

**Exploring Teachers' Knowledge and Beliefs About the Value of
Psychological Knowledge for Teaching**

by

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ABSTRACT

Educational psychology courses have long been part of teacher education programs, with the aim of helping teachers develop knowledge of learners and learning processes that can help them understand and manage teaching-learning situations. The combination of demands for increased teacher content knowledge and pedagogical content knowledge on the one hand, and limited curricular time on the other, makes it timely to re-examine the contribution of educational psychology to teacher education.

This dissertation aims to examine educators' psychological knowledge and their beliefs about its value for teaching. Participants consisted of three educator groups affiliated with one teacher education program. Pre-service teachers ($n = 30$) completed a survey measuring psychological knowledge and beliefs about how teaching can be informed by psychological knowledge in four domains: (1) learning/cognition, (2) individual/group differences, (3) human development and (4) motivation. They completed the survey at the beginning and end of the term, providing a measure of effects of taking an educational psychology course. To provide context for interpreting these results, in-service teachers ($n = 29$) took the same survey, and instructors who have taught educational psychology courses ($n = 10$) took the belief portion of the survey.

The first study examined changes in pre-service teachers' psychological knowledge and compared them to in-service teachers' psychological knowledge. Quantitative analysis showed a statistically significant interaction between respondent status (i.e., pre-service, in-service) and school level on the mean knowledge score.

The second study employed Q methodology to examine changes in pre-service teachers' beliefs about the value of psychological knowledge and compare them to in-service teachers and educational psychology instructors. Across the four domains, important similarities were found among the three educator groups in their identification of teaching practices where psychological knowledge would be particularly helpful: (1) determining and modifying appropriate means to present content and assess students'

understanding of the content for learning; (2) fostering classroom discourse and developing appropriate assessments for individual/group differences; (3) assessing student thinking, using instructional strategies to promote student learning, organizing classrooms to maximize learning, and building relationships with students for human development; and (4) attending and responding to student learning through feedback, promoting group work, building relationships with students and parents, and preparing instruction for motivation. Despite these similarities, there were variations in different educator groups' emphasis on the teaching practices they believed would be informed by their psychological knowledge of the four domains. These findings have implications for understanding the role of educational psychology courses, as well as for how they can be made more meaningful for prospective teachers.

CHAPTER 1

INTRODUCTION

What is Educational Psychology?

Educational psychology as a branch of psychology generally focuses on understanding how learners develop and acquire knowledge and skill, not only through instruction in a formal classroom setting but also throughout their entire lifespan. Educational psychologists often examine how various factors can impact teachers' instruction and/or student learning and development. Such factors include individuals' behaviors or mental processes (e.g., motivation, intellectual processes, memories, thoughts) as well as factors that reside within or outside of the school context (e.g., school community, peer relationships, parental involvement, cultural differences). Through applied research, the ultimate goal of the field is to consider how psychological theories, concepts, or principles related to teaching and learning could be applied to the classroom context; educational psychologists aim to communicate how we can effectively utilize theories or principles in ways that could enhance instruction and promote successful learning and development.

Domains in the field of educational psychology fall within the scope of various elements critical for effective teaching and learning (Anderson et al., 1995; Patrick, Anderman, Bruening, & Duffin, 2011; Darling-Hammond & Baratz-Snowden, 2005; Darling-Hammond & Bransford, 2005; NCATE, 2010; Peterson, Clark & Dickson, 1990; Poulou, 2005). They address important issues related to schooling, which among other areas include children and adolescent development, cognition and learning, individual and group differences, and motivation. Educational psychologists also study other areas such as gifted learners, learning disabilities, organizational learning, curriculum development, and educational technology. These in turn have important implications for teachers whose work is considered to be a critical factor in promoting students' academic, social and developmental success. Knowledge gained from educational psychology can

be a critical tool that facilitates teachers in their planning, implementation and evaluation of teaching and learning. The field's role in teacher education and teaching, however, continue to be questioned in the continual efforts to improve the quality of teacher preparation.

Problem Statement: The Role and Challenges of Educational Psychology in Teacher Education

...[E]ducational psychologists have in general heeded the call to make their content more relevant and meaningful [for teachers]...and to emphasize connections between theory and classroom application...[but], often not having a central role in teacher education, despite the relevance and significance of the field to educational psychology. (Patrick, Anderman, Bruening, & Duffin, 2011, p. 73)

Teaching is a complex and demanding practice (Cochran-Smith, 2003; Darling-Hammond & Bransford, 2005; Jackson, 1968; Lampert, 2001) that requires a combination of specialized knowledge and skills (Grossman, 1990; Hill, Ball & Schilling, 2008; Shulman, 1986, 1987) that are difficult to learn and challenging to teach in a time-restricted teacher education program. According to Darling-Hammond & Baratz-Snowden (2005), teachers' success with students depends on their development of knowledge in the following areas:

Knowledge of learners and how they learn and develop within social contexts...of the subject matter and skills to be taught in light of the social purposes of education...of teaching in light of the content and learners to be taught, as informed by assessment and supported by a productive classroom environment. (p. 5)

Different elements of what teachers need to know as outlined by Darling-Hammond & Baratz-Snowden (2005) highlight the interconnected relationship between the teacher, student and subject matter. Teachers' development of these different elements of teachers' knowledge however, is not sufficient; the knowledge they develop must effectively support teachers' ability to successfully carry out the various tasks entailed in the work of teaching. Teacher education programs have recognized this need for practice-based knowledge, which has led to shifts from building curriculum focused solely on building knowledge to a more practice-focused curriculum that attends to helping

teachers develop both knowledge as well as their ability to implement specific tasks that are essential for teachers to be effective in their work (Ball, Sleep, Boerst & Bass, 2009).

A part of what makes teaching complex is that it involves coordinating and carrying out a set of intricate tasks under uncertain conditions – uncertain in that students can be unpredictable in their thinking and behavior, which requires teachers then to use informed decisions in response to what their students know, think or do (Grossman, Compton, Igra, Ronfeldt, Shahan, Williamson, 2009). Many scholars (i.e., Ball et al., 2009; Grossman et al., 2009, Lampert & Graziani, 2009) have sought to decompose or unpack teaching to a set of learnable practices or activities considered to be fundamental for prospective teachers. Unpacking and defining these teaching practices have been critical in determining what prospective teachers must understand and master as they prepare to carry out the work of teaching. Ball et al. (2009), for example, have identified “high-leverage practices”, or teaching practices that “when done well, give teachers a lot of capacity in their work. They include activities of teaching that are essential to the work and that are used frequently, ones that have significant power for teachers’ effectiveness with pupils” (pp. 460-461). Ball et al. (2009) argue that they are necessary components of teaching across a broad range of contexts, subject areas, and grade levels. These practices are also “teachable” in that they can be articulated and modeled for beginning teachers and can be practiced *by* pre-service teachers during their fieldwork and refined as they continue their work in the classrooms as in-service teachers. This points to the important responsibility of teacher educators and instructors in actively helping teachers develop the knowledge and skills necessary for successful implementation of high-leverage practices in their teaching. At the same time, this also highlights the challenges of helping teachers develop such knowledge and a comprehensive set of skills in a time-limited teacher education program.

Educational psychology courses as a component of teacher education programs are intended to show how various psychological theories and principles related to learning and teaching mediate the interconnected relationship between the various elements of teachers’ knowledge and teachers’ ability to engage in instructional decision-making that support student learning. Applied research in educational psychology has advanced psychological knowledge that not only entails knowledge of theories and

principles of development (e.g., cognitive, emotional, social), learning processes (e.g., memory, metacognition), instruction, classroom management, motivation, and assessment, but also an understanding of how they could be applied in the classrooms to promote quality instruction and learning (Anderson et al., 1995; Patrick et al., 2011; Darling-Hammond & Baratz-Snowden, 2005; Darling-Hammond & Bransford, 2005; Peterson, Clark & Dickson, 1990; Poulou, 2005; Voss, Kunter & Baumert, 2011; Woolfolk Hoy, 2000). It serves to build conceptual tools with which teachers can interpret and respond to dilemmas and situations around learning and teaching (Grossman, Hammerness & McDonald, 2009). It provides teachers theories and principles with which they could think about students and their learning, make informed instructional decisions and use language with which they could effectively communicate and discuss their experiences and thinking around issues of learning and teaching.

Despite its potentially significant role in helping teachers develop knowledge considered to be important for supporting instructional activities that foster student learning and success, teachers are often left with the difficult task of linking the content of educational psychology to these high-leverage teaching practices. The limitations of educational psychology courses' ability to help pre-service teachers make these connections are evident, as pre-service teachers consider it to be too theoretical and thus unconcerned with its utility in the classrooms (Kiewra & Gubbels, 1997). Consequently, educational psychologists and instructors of educational psychology continue to face skepticism about the role of their courses in teacher education. This is an especially important time to address such skepticisms. Growing criticisms and increasing pressure to improve the quality and impact of teacher preparation has challenged university-based teacher programs to make changes that consist of replacing various courses with new ones given the time-limited nature of their curricula. Some teacher education programs, for instance, have replaced courses in general pedagogy (e.g., methods courses) with classes that focus on specific subject matters (Grossman, 2008; Patrick et al., 2011). Consequently, educational psychology courses, perceived as being further removed from teaching, can become easily superseded by other courses.

Re-Examining Educational Psychology in Teacher Education

In response to such skepticism, educational psychologists have re-considered different components of educational psychology courses to better understand how they align with teacher learning. First is the timing of the course. Teachers are traditionally required to learn educational psychology as a foundational course, often before entering K-12 classrooms for fieldwork or student teaching (Peterson et al., 1990; Shulman, 1990). Some are required to take such a course even earlier, as a prerequisite before formally entering their programs. The implicit assumption behind this approach is that teachers would develop a conceptual understanding of learning and development before transferring and applying the knowledge in their classrooms. However, learning requires new content to be situated in a meaningful context (Greeno, Collins & Resnick, 1996). Learning educational psychology through foundational courses, disconnected from classroom settings, leaves little opportunities to connect what teachers learn in light of what they do in classrooms (Anderson et al., 1995; Grossman et al., 2009; Peterson et al., 1990; Shulman, 1990).

Second, the core curriculum in teacher education programs is often designed around Shulman's (1986; 1987) conception of teachers' pedagogical content knowledge (PCK), which primarily consists of content courses, subject-specific methods courses, fieldwork, and student teaching. While PCK is only one element of knowledge teachers need to engage in their teaching, its representation of teachers' knowledge as specialized and unique to their work has led to it receiving the most attention both in research and teacher education programs. These courses and student teaching opportunities are focused on helping pre-service teachers develop a specialized knowledge of subject that enables them to organize and represent the subject in ways that make it more accessible to specific population of learners. The content-focused nature of the courses and teaching opportunities limits opportunities for instructors of educational psychology courses to help prospective teachers consider how their psychological knowledge gained from their course can be applied to and integrated with teachers' actual work of teaching.

The third component is the role of the instructors who are charged with teaching educational psychology content. They are given the task of not only presenting theories and principles of learning and development, but also showing how these theories can be

implemented in the classrooms. They must purposefully select concepts from an extensive range of issues and topics based on what they believe are the most relevant and useful for teachers. They must also be able to help teachers understand *how* the concepts are connected to teachers' practice. Past research, however, indicates that the pressure to cover a vast range of domains in a limited time often results in content being presented in a sweeping manner at the expense of developing a deeper knowledge of its applicability to their work (Woolfolk-Hoy, 2000). The instructors are further limited by the content of textbooks, which serve as a primary resource that drives their instruction. Recent review of educational psychology textbooks (Pomerance, Greenberg & Walsh, 2016) indicates that although textbooks attempt to emphasize the importance of strategies that support students' learning and mastery of content, they place a heavier emphasis on theories and research and less on how to carry out instructional strategies. Textbooks' emphasis on theories makes it challenging for instructors to help bridge together the different psychological theories and the work of teaching.

This is particularly problematic when considering the variations in the experiences and expertise instructors of educational psychology bring into their classes. Educational psychology instructors often range from graduate students to faculty members in psychology and/or education. Some bring direct teaching experience while others do not. These variations in their professional experience can influence what and how they present educational psychology content to pre-service teachers, how they effectively use and integrate textbooks with other instructional resources, and the degree to which they can help link knowledge to the practices of teaching (Patrick et al., 2001). Moreover, little consideration has gone into understanding how teacher educators' and instructors' own beliefs and instruction that often stem from their professional backgrounds can influence teachers' development of their psychological knowledge as it relates to the work of teaching as prospective teachers need to understand and master.

There have been productive discussions around how the current approaches and methods of presenting educational psychology might account for the potentially problematic role of these courses in teacher education. Educational psychologists have also begun to re-conceptualize the ways in which educational psychology can more effectively contribute to teacher learning and teaching (Anderson et al., 1995; Patrick et

al., 2001; Dembo, 2001, Peterson et al., 1990; Poulou, 2005; Woolfolk Hoy, 2000). These discussions, however, have been largely ideological; the existing research base showing how educational psychology enhances teachers' learning and instruction is weak.

An important step towards understanding the role of educational psychology in teacher preparation and considering how it can better support teacher learning and instruction is to gain insight from teachers themselves. That is, how do teachers personally identify the connection between educational psychology and their work of teaching? Some also call for the need to identify who is best qualified to serve as instructors teaching educational psychology to teachers (Patrick et al., 2011). Given pre-service teachers' specific learning needs in conjunction with the range of expertise educational psychology instructors bring (e.g., doctoral students, professors with K-12 teaching experience, professors solely with research experience), the degree to which *who* teaches educational psychology to preservice matters for teacher learning merits exploration (NCATE, 2010; Patrick et al., 2001).

Teacher education programs' current efforts to better support teachers' ability to recognize and respond to students' needs provide a great opportunity to explore how educational psychology can further enhance their efforts. Furthermore, the growing work around identifying specific teaching practices or strategies that are essential for quality teaching provides an opportunity to begin to consider how psychological theories and principles can be explicitly connected to the various teaching practices, and how various educators make these connections between psychological knowledge and the work of teaching. The dissertation responds to Patrick et al.'s (2011) call for developing a better base of evidence about educational psychology's contribution to teacher learning. More specifically, this dissertation addresses the first need to identify ways in which educators relate educational psychology to the work of teaching through their knowledge and beliefs about the connection between educational psychology and high-leverage teaching practices. It also begins to explore the latter point about the need to study instructors of educational psychology by examining their beliefs about the connection as well. Examining these different groups of educators is important because effective teacher learning and instruction is impacted by their knowledge and beliefs about the usefulness of educational psychology for their own learning and ultimately their teaching.

Purpose of Study

This dissertation aims to respond to calls for stronger research by exploring the ways in which different groups of educators make connections between educational psychology and the work of teaching. It is therefore an exploratory study that investigates the following questions: (1) Do pre-service teachers' psychological knowledge and beliefs about its value for teaching change after taking an educational psychology course? (2) Is there a difference between pre-service teachers and in-service teachers who have had formal experience in their classroom in their psychological knowledge? (3) Do pre-service teachers' beliefs about the value of psychological knowledge align with not only in-service teachers but also with what educational psychology instructors are trying to communicate as being important?

These questions were addressed through the use of a mixed methods approach to uncovering beliefs called "Q methodology", which employs quantitative technique to guide a qualitative exploration of pre-service teachers', in-service teachers' and educational psychology instructors' knowledge and belief structures with respect to the value of their psychological knowledge for their work of teaching. Q methodology requires respondents to prioritize, rank and organize teaching practices *in relation* to one another (rather than considering each teaching practice independently of each other), which corresponds to the complex and interrelated demands teachers face daily to identify priorities among a large set of desirable goals.

The pre-service teachers, in-service teachers and educational psychology instructors were affiliated with one university-based teacher education program. Both pre-service and in-service teachers were surveyed on their psychological knowledge and beliefs about its value for their work of teaching. A series of analyses comparing pre-service and in-service teachers explore the ways in which teachers' psychological knowledge and beliefs about its value might develop over time, particularly as they gain more formal experience in the classroom as they interact with a diverse group of students with specific learning and developmental needs. Educational psychology instructors were also surveyed on their beliefs about the value of educational psychology to consider the degree to which their beliefs about what are important for teachers to learn in an

educational psychology are aligned with how teachers actually believe their psychological knowledge could inform their teaching.

Through the exploration and comparison of the different educators, this dissertation seeks to facilitate a better understanding of the role of educational psychology in teacher learning and provide information about how teacher education programs and their instructors might need to amend and implement educational psychology courses to better meet the needs of teachers in their efforts to make sense of the complex demands of teaching. Furthermore, although the study is limited to one specific teacher education program, the program's particular focus on helping prospective teachers develop high-leverage teaching practices facilitates the effort to explore a common challenge teacher education programs face – the degree to which prospective teachers can connect the various theories related to students, learning, and teaching to the different demands entailed in the work of teaching.

Significance of Research

This dissertation has both conceptual and practical implications. At a conceptual level, this research seeks to support educational psychologists' efforts to re-conceptualize ways in which educational psychology facilitates teachers' development of knowledge and skills necessary to be effective in their work of teaching. More specifically, this dissertation aims to contribute to a better understanding of the knowledge the field of educational psychology has to offer to prospective teachers with respect to why and how gaining psychological knowledge can enhance teachers' ability to tackle the complexities of their work in the classrooms.

At a practical level, this work can inform how educational psychology can be taught in meaningful ways to prospective teachers. An exploration of not only teachers' psychological knowledge but also their beliefs about the ways in which they find educational psychology to be connected to their work of teaching can inform the design of courses in educational psychology designed specifically for pre-service teachers. Do teachers and their instructors align in their beliefs about how different domains in educational psychology inform different aspects of teaching practices? Any potential evidence of differences in their beliefs about the relationship between educational psychology and the work of teaching can help teacher education programs and

educational psychologists consider ways in which they can make the connections more explicit and meaningful to teachers.

Lastly, the dissertation can have implications for the potential need to help prepare instructors teaching educational psychology to teachers prepare them for their work of helping teachers make connections between their psychological knowledge and the work of teaching. Given the range of academic and professional expertise they may bring, it may be necessary to provide support, particularly to novice instructors, in their efforts to teach the content in ways that enable teachers to readily and effectively use their psychological knowledge to inform their teaching and interactions between their students. Identifying and comparing pre-service teachers', in-service teachers' and educational psychology instructors' beliefs about the value of their psychological knowledge for the practice of teaching can contribute to consideration for the ways in which instructors can not only anticipate, surface and challenge prospective teachers' beliefs about the role of educational psychology but to also challenge their own beliefs about how educational psychology can contribute to classroom teaching and learning. Given the increasing need to re-examine the contributions of educational psychology, as a field, to teacher learning and instruction, it is an important time to provide an empirical base that helps understand its value for teaching and teacher learning and informs how such value can be communicated more effectively to teachers.

Conclusion

Teachers must understand *who* they are teaching, *what* and *how* they should teach their students, and be able to articulate to the school, students, and parents *why* they select certain instructional and assessment approaches to meet their students' learning and developmental needs. Teachers' understanding of students' development and their diverse needs are critical in informing their instruction and efforts to help all students receive quality education and reach their potential. The different elements of educational psychology are closely intertwined with one another and address these complex elements of teaching. As Horowitz et al. (2005) state, student development, as well as teachers' knowledge of student development – could inform teachers' planning, selection and implementation of their instruction, organization of the lesson, quality of classroom organization and management, and assessment of student learning – and vice versa.

Further complexifying their work, teachers must consider these elements in light of the communities in which they schools are situation, as different communities bring specific standards, expectations, values, norms, resources, and opportunities. This complex, multidimensional nature of teaching transcends subject-specific teaching; all teachers, regardless of the subjects they teach, face challenges that require pedagogical knowledge (Shulman, 1986; 1987), to which educational psychology as a field can contribute (Voss, Kunter & Baumert, 2011). Educational psychology has helped shed light to issues central to the work of teaching as it provides useful theories, principles, and strategies with which teachers can make sense of the complex work they engage in.

Despite the critical link between educational psychology and teacher knowledge of students, teaching and learning, educational psychologists have lamented the lack of its emphasis in teacher education programs (Anderson et al., 1995; Berliner, 1992; Hanich & Deemer, 2005; Patrick et al., 2011; Peterson et al., 1990; Poulou, 2005; Shuell, 1996; Woolfolk-Hoy, 2000). Given the limited space in the teacher education curricula, combined with greater demands for teacher education reform and quality teacher preparation opportunities, there exists a sense of competition between different teacher preparation courses in trying to demonstrate its value and contributions to teacher learning. In response, the field of educational psychology, which has long been a foundational yet marginalized component of teacher education, has begun to conceptualize the ways in which psychological knowledge can mediate and enhance teachers' knowledge and ability to support their students' learning and development in the school contexts. However, we lack empirical research, particularly about how teachers make connection between educational psychology and their learning and teaching. Given the apparent limitation in educational psychology course's own ability to help make this connection clear, it is an important time to examine teachers' development of psychological knowledge and beliefs about how it supports their teaching practices. Such examination can inform both a further conceptualization of the role of educational psychology in teacher education and the instruction of educational psychology content for prospective teachers.

Organization of the Dissertation

To address the purposes discussed above, this dissertation is comprised of six chapters. Chapter 2 reviews the following: (a) teacher cognition with a focus on their knowledge and beliefs, (b) teacher cognition as a target for change in the context of teacher education, and (c) educational psychology instructors as models for teachers. Chapter 3 describes the research design and includes description of the sample of participants, procedures for collecting data, measures and analytic methods used. It also introduces Q methodology as an approach to exploring beliefs, in this case, about the value of psychological knowledge for teaching. Chapter 4 introduces the three groups of educators (pre-service teachers, in-service teachers and educational psychology instructors) who participated in the study before describing the result from the first study aimed to explore changes in pre-service teachers' psychological knowledge and its comparison to in-service teachers' psychological knowledge. Chapter 5 addresses beliefs about the value of psychological knowledge for teaching and is organized by the four domains of educational psychology examined in this study: learning/cognition (Study 2.1), individual/group differences (Study 2.2), human development (Study 2.3), and motivation (Study 2.4). Chapter 6 concludes the dissertation by discussing the findings of the research questions including limitations of the study, the implications of the findings for the role and design of educational psychology courses, and directions for future work.

CHAPTER 2

LITERATURE REVIEW

The first chapter introduced the challenges educational psychologists face in firmly establishing their role in teacher education. The ongoing skepticism about the significance of educational psychology and its impact on teachers' preparation and subsequent teaching points out the need for research that sheds light on the connection between educational psychology, teachers' learning, and the work of teaching. Moreover, the first chapter argues that one of the important steps is to explore how educators themselves perceive such connection with the goal of informing ways in which educational psychology courses can be effectively integrated into teacher education curricula. This chapter presents literature supporting the need to study educators' identification of the role of educational psychology in teaching and learning. More specifically, I focus on their cognition and its relationship to learning and teaching. Though the first chapter briefly introduced high-leverage teaching, this chapter begins by providing a more in-depth overview of the work of teaching organized around the idea of high-leverage practices. Identification of high-leverage teaching practices provides a useful way of thinking about core teaching practices considered essential for novice teachers to develop. Because these high-leverage teaching practices were extensively promoted in the teacher education program studied, it provides an opportunity to examine how teachers make connections between educational psychology and the teaching practices. This is followed by a review of the ways in which teacher cognition, specifically teacher knowledge and beliefs, has been conceptualized. It also considers its relation to the work of teaching. The next section discusses teacher cognition as a target for change in teacher education and course instructors as models for learning. The chapter concludes with research objectives and hypotheses.

High-Leverage Practices: Unpacking the Work of Teaching

As discussed in the introduction, educational researchers have highlighted the importance of unpacking and identifying what is entailed in the work of teaching with the goal of helping novice teachers build the skills and strategies essential for quality teaching and successful student learning. Ball & Forzani (2009) define these elements of teaching as “high-leverage”. They consist of fundamental tasks that teachers must carry out to help their students learn regardless of the subject they teach. These tasks take place both inside and outside of the classroom context and include “broad cultural competence and relational sensitivity, communication skills, and the combination of rigor and imagination fundamental to effective practice. Skillful teaching requires appropriately using and integrating specific moves and activities in particular cases and contexts, based on knowledge and understanding of one’s pupils and on the application of professional judgment” (p. 497). Teaching is shaped by how teachers readily attend to, interpret and respond to students’ experience and thinking. It also involves considering various resources and materials with respect to challenges and opportunities they provide with respect to what teachers can do and what or how students can learn. Taken together, the work of teaching entails various interactions between teachers and students around academic content. What makes teaching challenging is that these elements of teaching are not carried out in isolation. Teaching is a dynamic practice that must account for the unique population of students within a particular context.

The instructional triangle formed by bidirectional arrows, as illustrated by Cohen, Raudenbush and Ball (2003; Figure 2.1), depicts the complex and interactive nature of teaching and learning that entails multiple forms of interactions between teachers, a specific group of students and particular content situated in an environment (Hiebert & Grouws, 2007; Lampert, 2001), each of which has important implications for teaching. The student-content relationship is a central focus for teaching, to help students learn the content at hand. Teachers must attend to this relationship through their use of a range of assessments and subsequent implementation and modification of instructional strategies that help strengthen students’ quality of interaction with the content. The teacher-content relationship points to the importance of teachers’ understanding of the content in order for them to be effective in teaching the content. Strengthening this interaction involves

anticipating students' understanding or misconceptions and considering how different instructional strategies, curriculum and materials can aid students' learning.

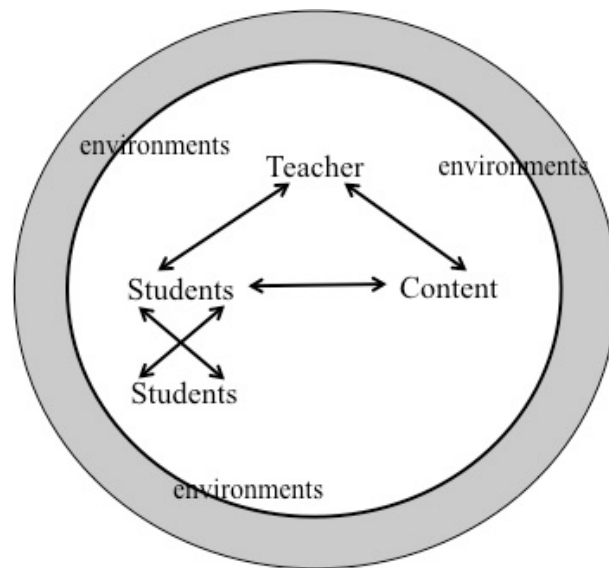


Figure 2.1 Instructional Triangle (Cohen, Raudenbush & Ball, 2003)

Teachers and students must also form a strong relationship with one another; developing interest, respect and trust in one another sets a stage for meaningful learning to take place. In addition to teacher-student relationship, teachers must help students build meaningful relationships with one another such that they can feel safe and comfortable to learn with and from one another. These various forms of interactions influence one another, further complexifying teaching and learning. Additionally, these interactions take place in environments that present unique challenges and opportunities, resources, policies and guidelines. Extending beyond the classrooms, the relationships are also embedded in various forms of culture, expectations, and parental concerns and support. Teaching practices, then, involves orchestrating these interactions within a particular environment, both inside and outside of the classrooms; as described by Cohen & Ball (2001), they include determining how they frame, implement and modify academic tasks, facilitate discourse, and negotiate the environment in which teaching and learning takes place and in turn impact opportunities students have to learn.

Various educational researchers have attempted to unpack and articulate a specific set of fundamental high-leverage teaching practices that mediate these interactions between teachers, students, and content within a specific environment. According to

Grossman, Hammerness & McDonald (2009), while researchers differed in their identification of what makes up high-leverage practices, they share the following characteristics: they are informed by research and foster student achievement; they are necessary components of teaching that occur frequently across a broad range of contexts, subject areas and grade levels that can be taught and mastered by novice teachers; and they address the complexity of teaching and enable teachers to learn more about students and learning. Examples of these teaching practices include, “Making content explicit through explanation, modeling, representations, and examples”, “Recognizing particular common patterns of student thinking in a subject-matter domain”, “Setting up and managing small group work”, “Eliciting and interpreting individual students’ thinking,” and “Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)”¹. Skillful implementation of these teaching practices, however, requires the ability to actively and purposefully attend to, interpret and respond to students’ behavior and learning.

In order for teachers to make sense of their students, their behavior and their learning, teachers must understand their students and consider how various factors influence them in their learning and development. Educational psychology, which specifically focuses on understanding how learners develop and acquire knowledge and skills, addresses this need. Important theories such as those that identify what learning looks like and how it takes place (e.g., constructivism), different factors that motivate students to engage in their learning, and various other internal and external factors that impact students as learners (i.e., personality, cultural, emotional, physical), serve as conceptual tools for teachers that guide their instructional decision-making. These tools enable teachers to not only better understand the students they interact with but to also make sense of their own teaching and development. Given this important connection between educational psychology and the work of teaching, however, the divide between theory and practice continues to exist (Kiewra & Gubbels, 1997). In an effort to bridge this gap between theory and practice, this study uses Ball et al.’s (2009) high-leverage

¹ A modified list of high-leverage practices is included in Appendix A. Please visit www.teachingworks.org/work-of-teaching/high-leverage-practices for an updated and complete list of high-leverage teaching practices.

teaching practices to frame this study's exploration of various educators' knowledge and beliefs about how educational psychology can inform these fundamental teaching practices. Although developing teaching practices is certainly at the core of teacher preparation, it is also important to recognize and understand how prospective teachers' knowledge and beliefs can influence the ways in which they understand and implement these practices to ensure they effectively engage in the work of teaching.

Teacher Cognition: Teacher Knowledge and Beliefs

At the center of the dissertation is teacher learning, or the development of teacher cognition as it relates to teachers' understanding of what is entailed in the work of teaching. Teacher research has been influenced by contributions from cognitive psychology, which as a field highlights the existence and importance of one's internal mental state as a determinant of external behavior and vice versa. This emphasis on cognition has resulted in a shift in teacher research from solely examining observable behaviors and skills to considering teacher cognition and its relationship to teachers' classroom instruction and student achievement. Such research often involves investigation of teachers' thought processes and reflection on their instruction, which acknowledges that teaching does not simply involve a mere enactment of pre-determined set of actions. Rather, teachers are active sense-makers of classroom situations who must make informed decisions in light of their understanding of the complex classroom situations in their efforts to ensure that meaningful learning takes place among their students.

Such emphasis on teacher cognition has had great scholarly and practical implications for understanding and supporting teacher learning and instruction. Cognitive psychology's idea of constructivism highlights the active role that learners play in building their own understanding of the world. In this sense, teachers, like students, use their own experiences, beliefs, and knowledge as filters through which they construct their understanding of teaching and learning (Borko & Putnam, 1996; Calderhead, 1996; Putnam & Borko, 1997). Guided by this idea, research on teacher cognition and practice has focused on the ways in which teachers' construction of the meaning of the work of teaching account for why or how they do what they do in their classrooms. Their thought processes serve as a primary source or filter through which teachers make instructional

decisions and develop the problem-solving skills that are necessary to address the complex nature of teaching that promote student learning (Clark & Peterson, 1986; Shavelson & Stern, 1981). The emphasis on the importance of teacher cognition, in turn, has influenced the evolution of teacher education curricula, from attempting to change teachers' behaviors to attending to and shaping how teachers understand the practice of teaching and decisions they make in light of their evaluation of students' experiences, interests, capabilities, and learning needs. This dissertation considers central elements of teachers' cognition that teacher research has actively sought to conceptualize: teacher knowledge and teacher beliefs. The following sections seek to distinguish between the two elements and understand how each element of teacher cognition relates to teacher learning and their work of teaching. This will be followed by consideration for what teacher learning entails within the context of prospective teachers engaging in teacher education.

It is worth noting that one's knowledge and beliefs are complex and closely interrelated. The distinction between the two components of teacher cognition is difficult to articulate. Many researchers who seek to study one component of teacher cognition (e.g., teacher knowledge) also consider the other component (e.g., teacher beliefs; Thompson, 1992). Others equate knowledge with beliefs, arguing that knowledge encompasses what a person believes to be true (e.g., Alexander, Schallert & Hare, 1991; Kagan, 1990). Still others contend that beliefs serve as a filter through which knowledge is constructed or modified and behaviors are carried out, and vice versa (Fennema & Franke, 1992; Hollingsworth, 1989; Kagan, 1992; Özgün-Koca & Şen, 2006; Powell, 1992). There is general agreement however, that knowledge is described as factual understanding, whereas belief is the more personal aspect of cognition that involves subjective evaluation and/or judgment (Abelson, 1979; Nespor, 1987; Pajares, 1992). This general description serves as a basis through which I review current understanding of the ways in which teachers' knowledge and beliefs matter for their teaching and learning.

Teacher Knowledge and its Relationship to Teaching

Research on teachers' knowledge has formed a basis for preparing teachers in teacher education programs: what knowledge and understanding do teachers need in

order to foster the development of skills that matter for teaching? Numerous literatures (e.g., Darling-Hammond & Baratz-Snowden, 2005) and standards outlined by teacher accreditation agencies such as the Teacher Education Accreditation Council (TEAC) and National Council of Accreditation of Teacher Education (NCATE) have attempted to address this question by characterizing the specialized and complex form of knowledge they believe teachers need in order to effectively carry out their work of teaching in ways that promote student learning and achievement. Research on teacher knowledge has helped map the knowledge base needed for teaching. Much of this research has focused primarily on how teachers' understanding of subject matters, student learning, and teaching impacts teaching and student learning.

Few would disagree that teachers need to know the content of their subjects in order to help students understand it. This need for teachers' content knowledge is reflected in teacher education curricula. In fact, teacher education programs commonly require prospective teachers to take various content courses and in some programs to earn a college degree in the content(s) they prepare to teach. However, reports of students' lack of proficiency in, for example, mathematics, indicates that content courses are insufficient for teacher preparation (Ball, Hill & Bass, 2005). Their understanding of content as it relates to classroom instruction transcends mastery of the content, as merely knowing the subject does not necessarily equate to teachers' ability to help their students develop a deep and rich understanding of the content at hand (Mewborn, 2001). Furthermore, evidence from research has shown that teachers' subject matter knowledge is often limited to facts and procedures, and lacks the in-depth knowledge of subjects necessary for student learning (e.g., Ball, 1990; 2002; Ma, 1999). In light of such evidence, there has been a growing body of research seeking to conceptualize teachers' knowledge that extends beyond simply knowing the content in the way that the general population of adults knows the content. Teachers need a more specialized form of knowledge of the content.

Shulman's (1986; 1987) work has been particularly influential in conceptualizing the distinct, complex, specialized nature of teachers' content knowledge. At a more general level, his work has generated an expansive growth in research on various elements of teacher knowledge and its link to teaching and student achievement, such as

general pedagogical knowledge, subject matter knowledge, and pedagogical content knowledge (e.g., Carpenter, Fennema, Peterson & Carey, 1988; Grossman, 1990; Hill, Ball, & Schilling, 2008; König, Blömeke, Paine, Schmidt, & Hsieh, 2011; Magnusson, Krajcik & Borko, 1999). However, his conceptualization of pedagogical content knowledge has been of particular interest for many educational researchers because it particularly highlights the specialized nature of knowledge that distinguishes teachers from other content specialists (e.g., scientists, mathematicians, historians) as well as from the general adult population. At its core, pedagogical content knowledge bridges teachers' knowledge of content and knowledge of the practice of teaching in ways that make their knowledge of subject matter unique to the work of teaching (Ball, Thames & Phelps, 2008). It enables teachers to represent content in ways that make it understandable for students, develop awareness of what makes particular content topics easy or difficult for specific groups of students, and anticipate students' misconceptions that could hinder their learning (Shulman, 1986). Teachers' knowledge of the content must include their ability to make sense of various representations of the same idea as presented by students, determine and select appropriate method(s) for responding to students' ideas in light of teachers' goals for student learning, and to continually reflect on the effectiveness of their instructional choices while simultaneously interacting with their students and content.

Numerous research findings indicate that teachers' pedagogical content knowledge influences teachers' instruction and students' learning in important ways. For instance, teachers' in-depth knowledge of different types of mathematical problems, students' mathematical thinking and problem-solving abilities, ways of providing mathematical explanations and representations to students, and ability to anticipate whether students can solve different types of problems have been positively associated with student learning in mathematics (e.g., Carpenter, Fennema, Peterson, & Carey, 1988; Hill, Rowan, & Ball, 2005). In science, teachers' knowledge of students' conceptions and potential misconceptions of particular topics has shown to enhance their ability to represent science content in ways that are understandable to their students, which in turn has shown to promote student learning (e.g., van Driel, Verloop & de Vos, 1998). Teachers' pedagogical content knowledge affects various aspects of teachers'

instruction: their identification of lesson goals in light of what students do or do not know, appropriate use of instructional and assessment strategies, selection of materials and resources, organization of content curriculum, and the quality of their focus on students' conceptual understanding (e.g., Grossman, 1990; Hill, Blunk, Charalambous, Lewis, Phelps, Sleep, & Ball, 2008; Magnusson et al., 1999; vanDriel et al., 1998). These findings indicating a strong positive relationship between teachers' pedagogical content knowledge, teachers' instruction and students' learning have formed a strong basis for developing and modifying teacher curriculum towards enhancing teachers' subject-specific knowledge.

Many have argued that, while content knowledge is certainly an important component of teacher knowledge, it does not ensure quality teaching if teachers do not know how to effectively organize their classrooms and manage their students in ways that establish an environment conducive to both individual and group learning. Simply put, teachers' instruction is not effective if students are not engaged with it. The multifaceted nature of teaching, which requires teachers to address various needs and behaviors that come with 20 to 30 students being placed in one classroom setting, can have a significant impact on teachers' efforts and ability to present and engage their students with the content at hand. Teachers must skillfully cater to the diverse needs and interests each student brings into the classrooms and create appropriate learning environment for each and every individual student. Concern for student engagement is especially prevalent among beginning teachers, who reportedly become daunted and preoccupied by the task of developing effective classroom routines and attending to student discipline and classroom management issues (Veenman, 1984). Such concerns have warranted the need to help teachers develop what Shulman (1987) identifies as general pedagogical knowledge, or knowledge of instructional and classroom management strategies that support positive learning environments. It primarily includes knowledge of classroom management that helps keep students on task and engaged in classroom activities, attend to student diversity and provide appropriate learning opportunities, and select from a repertoire of teaching strategies that meet the multiple demands of student learning. Teachers' knowledge of how to structure classroom activities, promote student engagement in their learning, and establish norms and routines for interacting with

students sets the stage for effective enactment of a more subject-specific set of instructional work that promote student learning (Leinhardt & Greeno, 1986).

Studies have suggested that general pedagogical knowledge is an important factor that distinguishes expert teachers from novice teachers. For example, expert teachers have demonstrated greater knowledge and ability to skillfully implement well-practiced routines and norms (e.g., students raising hands for attention, transitioning between lessons or activities) compared to novice teachers (e.g., Bloom, 1985). Furthermore, pedagogical knowledge has been related to teachers' ability to more readily interpret their observations of the classrooms with respect to student motivation and the types of activities occurring (e.g., Carter, Cushing, Sabers, Stein & Berliner, 1988; Carter, Sabers, Cushing, Pinnegar, & Berliner, 1987). Such routines for establishing norms and interpreting and responding to student behaviors enable teachers to make efficient use of time that could be committed to teaching more complex materials or attending to cues for student learning or engagement (Berliner, 1988; Borko & Putnam, 1996; Leinhardt & Greeno, 1986). General pedagogical knowledge thus supports not only teachers' ability to make informed and consistent interpretations of what occurs in the classrooms, but it also enables teachers to organize classroom activities and motivating and maintaining student engagement.

Despite its demonstrated importance for teaching, the role of pedagogical knowledge has been largely overshadowed by researchers' interest in pedagogical content knowledge. Given that pedagogical knowledge is a domain-general knowledge that is essential for all teachers of every subject matter, (Borko & Putnam, 1996; Shulman, 1987), there is a need to re-focus on the role of pedagogical knowledge in teachers' learning and practice of teaching *in light of* subject-specific knowledge that enables them to effectively help students understand the content at hand. I further argue for the need to not only consider teachers' understanding of *how to* develop pedagogy that promotes teaching and learning, but to also begin considering how teachers can learn to understand *why* and *how* certain instructional and learning strategies address specific challenges of teaching and learning. Such an understanding could enable teachers to become informed and reflective in their teaching and development throughout their professional lives. This dissertation focuses on an aspect of knowledge that extends on Shulman's (1987) original

delineation of general pedagogical knowledge – general pedagogical/psychological knowledge (PPK; Voss et al., 2011) – based on the premise that PPK enhances teachers’ understanding of how or why different teaching practices can impact student learning.

Teachers’ pedagogical/psychological knowledge and its domains

Voss et al.’s (2011) conceptualization of PPK aligns with Grossman & Richert’s (1988) characterization of general pedagogical knowledge: “knowledge of theories of learning and general principles of education, general knowledge about learners, and knowledge of the principles and techniques of classroom management” (p. 54). PPK expands upon this and encompasses knowledge of students’ individual developmental characteristics, cognition and learning processes, various classroom management and instructional strategies, and classroom assessment. It also includes an understanding of how to apply skills and ideas in the classroom. Altogether Voss et al. (2011) characterize PPK as, “the knowledge needed to create and optimize teaching-learning situations, including declarative and procedural generic knowledge of effective teaching that is potentially applicable in a wide variety of subjects” (pg. 953). Their notion of PPK explicitly highlights the integrative nature of psychological knowledge and pedagogical knowledge, suggesting the important role psychological knowledge plays in informing and supporting teachers’ ability to create and manage a classroom environment that fosters successful learning. PPK is considered to consist of the following domains: knowledge of classroom processes and knowledge of human heterogeneity (Voss et al., 2011; Voss & Kunter, 2013). Voss & Kunter (2013) expand upon these domains, which are briefly outlined.

Knowledge of classroom processes consists of teachers’ knowledge of classroom management, teaching methods and classroom assessment. Classroom management involves maximizing time for learning through the ability to navigate and coordinate the social setting of a classroom, which is often quite complex given that learning is embedded in an environment consisting of students with various learning needs and abilities (Voss & Kunter, 2013). Navigating and orchestrating a complex classroom setting thus requires teachers to prevent, anticipate, identify, and respond to potential disruptions without interrupting instruction. This is mainly addressed by two aspects of instruction: establishing and enforcing expectations, and maintaining momentum of

classroom activities. Teachers play a particularly important role in clearly defining and modeling expectations for the students regarding their social behavior. If disruptions occur, teachers must seamlessly respond to them without disrupting the flow of the classroom instruction and must be able to efficiently transition from one activity to another in ways that minimize distractions and maximize opportunities for all students to engage in learning activities.

While teachers' knowledge of classroom management is thought to help them maximize opportunities for learning by proactively minimizing distractions, their knowledge of teaching methods helps them make good use of the time available. Developing knowledge of teaching methods involves understanding strategies that range from direct instruction to more student-centered discovery learning. Teachers not only need to gain a repertoire of available teaching methods, but they must also consider how each teaching method caters to their students' diverse needs and abilities in light of educational goals they have set for their students. In addition to knowledge of teaching strategies, teachers' knowledge of various strategies for classroom assessment is important for their instruction. As Voss & Kunter (2013) state, evaluating student learning serves multiple purposes; it informs teachers about students' progress in their understanding of the content at hand in relation to learning goals, which in turn help provide helpful feedback to students and plan their future instruction. These two forms of knowledge, combined with teachers' knowledge of classroom management make up their understanding of classroom processes.

Given the increasing diversity in the student population, teachers' PPK must also include their understanding of student heterogeneity, as the diverse experiences, interests, abilities, and needs students bring to class complexifies the nature of learning and teaching. According to Voss and Kunter (2013), the knowledge of student heterogeneity comprises of knowledge of students' learning processes and knowledge of individual student characteristics. An understanding of student learning, a central component of educational psychology, involves understanding of the learning process as well as differences in these learning processes (Bransford, Brown, & Cocking, 2000), the latter of which could be facilitated by their understanding of individual student characteristics. It is important for teachers to increase their awareness of and sensitivity to differences in

student characteristics (e.g., special needs, various factors such as gender, culture, personality, etc. that can influence students' learning and behavior, etc.) that in turn can affect their learning.

Due to its recent conceptualization, the link between PPK and teaching and learning has not yet been empirically explored. However, a pilot test of PPK items developed by Voss et al. (2011) indicates a positive relationship between pre-service teachers' PPK and their students' ratings of pre-service teachers' instruction. Pre-service teachers with higher PPK scores received higher ratings from students in various areas of instruction, such as their ability to create a stimulating learning environment, adapt their instruction according to students' learning needs, and to minimize student misbehavior. This initial finding indicates that teachers' PPK matter for their instructional quality. However, more empirical work is necessary for a better understanding of the relationship between teachers' PPK and their instruction, and ultimately student learning. Additionally, given that the participants in the study were German teacher candidates, further studies must be replicated in other countries to draw generalized inferences. Finally, despite the link between psychological knowledge and pedagogical knowledge, research is needed to not only explore teachers' understanding of such link, but to also understand the impact of educational psychology courses on teachers' development of their knowledge of the relationship between psychological knowledge and pedagogical knowledge.

Teacher Beliefs and its Relationship to Teaching

Another component of teacher cognition that has generated great interest in teacher education research is teacher beliefs. Schön's (1987) work, for one, has been influential in understanding that professionals' personal beliefs about their work affect their performance. Based on a review of foundational literature on teacher beliefs, beliefs are generally considered to consist of the following characteristics: (1) they are based on personal judgment and subjective evaluation that neither requires supporting evidence nor expert evaluations, (2) they guide one's thinking and behavior, (3) they can be held unconsciously, and (4) they can facilitate or hinder one's ability to change teaching practice (Abelson, 1979; Borg, 2001; Clark & Peterson, 1986; Kagan, 1992; Nespor, 1987; Pajares, 1992; Richardson, 1996; 2003). Beliefs are an important component of

teachers and their teaching because, as Ernst (1989) posits, teachers with similar knowledge can teach differently if they hold different beliefs about their work, the content they teach, and the students they teach the content to. That is, knowledge by itself is inadequate in enabling teachers to carry out their work of teaching. Teachers' beliefs play a critical role in helping teachers make sense of and respond to the complex, ill-defined nature of teaching. They influence the types of goals teachers establish for their students and for themselves, and orient them to specific classroom events or problems; therefore, teachers who have the same level of knowledge but hold different beliefs may engage in their teaching differently with respect to the ways in which they prioritize their work, engage in their teaching, and make sense of classroom teaching and learning (Calderhead, 1996). In sum, teachers' beliefs determine what and how they develop and use their knowledge in their classrooms.

Different aspects of teacher beliefs have been investigated among researchers: beliefs about students, beliefs about learning, beliefs about teaching, and subject matter beliefs. These different components of beliefs influence various aspects of teaching: curriculum enactment, approaches to teaching the subject matter, reform efforts, and adoption of new instructional strategies (e.g., Calderhead, 1996; Clark & Peterson, 1986; Eccles & Wigfield, 1985; Ernst, 1989; Gregoire, 2003; Johnson, 1992; Nespor, 1987; Pajares, 1992; Peterson, Fennema, Carpenter, & Loef, 1989; Stipek, Givvin, Salmon & MacGyvers, 2001; Stodolsky & Grossman, 2000). Teachers' beliefs about student learning, for one, influence how teachers structure tasks for the students, how they interpret students' behaviors, and how they respond to and interact with students. For example, a study by Peterson et al. (1989) showed that teachers who believed students learn mathematics through their problem-solving abilities used more word problems in their instruction and emphasized on building problem-solving strategies before teaching mathematical facts. In another study by Anning (1988), various beliefs teachers held about students were shown to influence how they structured their learning tasks, such as providing opportunities for students' active participation or preparing and implementing activities that allowed students to explore and learn through trial-and-error. This indicates that the beliefs teachers hold about their students and their learning (e.g., that all students can learn) inform the teachers of the opportunities they provide in a particular learning

environment that could, in turn, either support or limit students' learning and development.

Teachers' beliefs about subject matter and teaching also impact their decision-making and instruction in the classrooms. Teachers hold a range of beliefs about subject matter, along with what is entailed in learning the subject matter (Calderhead, 1996). For example, some mathematics teachers believe the subject consists of a set of disconnected facts and procedures, leading them to enact instruction that primarily involves demonstrating rules and procedures to students without making connections at various levels. On the other hand, others believe that mathematics consists of interrelated topics and thus focus on helping students actively develop a conceptual understanding of how different topics they learn are connected with one another (e.g., Ball, 1990; Foss & Kleinsasser, 1996; Thompson, 1984; 1992). Subject matter beliefs in turn influence teachers' decisions with respect to what content to cover and how to cover such content (e.g., what aspect of the content to focus on, how much time students should devote to discussing the content, ordering of the different content topics)(Brickhouse, 1990; McDiarmid, Ball & Anderson, 1989; Woolfolk Hoy et al., 2006). Similarly, teachers' beliefs about teaching and what is entailed in their role as teacher have shown to impact their instruction. Teachers, especially novice teachers, generally believe their role is to transmit their knowledge to students (Anderson et al., 1995). In contrast, other teachers may believe their role is to support students in their own active development of their knowledge. These varying beliefs either guide or hinder their efforts to meet the challenges of adopting constructivist approaches to instruction wherein students' thinking and learning are surfaced, evaluated and challenged (Borko & Putnam, 1996; Pajares, 1992; Richardson, 1996). As noted by many, teacher beliefs impact various aspects of their work; they help define teachers' tasks and serve as filters through which they organize their knowledge to interpret and make decisions with respect to student learning, content teaching, as well as their interactions with their students.

Beliefs have been conceptualized in various ways: attitudes, conceptions, dispositions, perceptions, and values (Pajares, 1992; Richardson, 2003). This dissertation explores the beliefs held by pre-service teachers, in-service teachers and educational psychology instructors about the *value* of psychological knowledge for the work of

teaching. Rokeach (1979) broadly defines values as beliefs about one's desired end results. More specifically, the dissertation focuses on what Eccles et al. (1983) refers to as utility value, or one's beliefs about the usefulness of a given task, or how related a given task is to one's goals (Eccles et al., 1983; Eccles & Wigfield, 2002). An example of such a task in the context of this study is learning and using one's psychological knowledge to inform and support his or her goal of teaching effectively. Utility values are often represented by reasons for engaging in a task for the sake of reaching a desired end goal. How one values a task and sees its relevance to his or her future goals affects the individual's motivation, decisions, and ability to successfully engage in the task of gaining psychological knowledge for the purpose of using it successfully in practice (Eccles, 1983; Wigfield & Eccles, 1992; 2000). This dissertation explores various educators' beliefs about the *value* of psychological knowledge, or their beliefs about how their psychological knowledge informs their goals of effectively carrying out various components of their teaching practices.

Although research on utility value has generally focused on student learning, Hamman's (1998) research begins to uncover the potential effect of teachers' values on their instruction. Despite having learned how to implement strategy instruction, or a student-centered instruction approach that provides learners strategies they can use to process new information and integrate it with their existing knowledge, the likelihood of teaching the learning strategies to students was linked to their values for strategy instruction. Teachers' greater value for teaching content or learning strategies affected their willingness or ability to implement learning strategies that can enhance students' learning across different contexts. In the context of an educational psychology course, teachers' values for the course and the psychological knowledge they develop can influence their decision and ability to implement their understanding of psychological theories and principles in various aspects of their instruction (e.g., lesson planning, implementing lesson plans, evaluating student learning, reflecting on their instruction). Two teachers with the same level of psychological knowledge may vary in how they apply their knowledge in their teaching as a function of their utility value for their knowledge. In the context of their teacher preparation, their value for psychological knowledge can also impact the degree to which they engage with materials and content in

their educational psychology course. Research has shown that teachers' beliefs not only impact their learning but they also affect their learning.

Teacher Cognition as a Target for Change in Teacher Education

Cognitive perspectives posit that teachers' success in classroom teaching requires significant changes in their knowledge and beliefs that lead to improved quality of teaching and learning (Darling-Hammond, 1998; Putnam & Borko, 1997; Tatto & Coupland, 2003). Teacher education programs have sought to meet this demand by seeking to help teachers develop not only a deeper knowledge of subject matter, children and pedagogy, but also the ability to implement their knowledge in their instructional decision-making by placing them in classrooms under the supervision of in-service teachers as well as course instructors. Teacher learning, however, requires opportunities for an in-depth exploration of theories and practice *in light of* their existing knowledge, beliefs, and personal experiences (Ashton, 1992). According to constructivism, as previously discussed, teachers bring with them their own experiences, knowledge and beliefs about teaching that provide a lens through which they process and interpret new information and experiences. Given the impact of teachers' knowledge and beliefs on their practice and their learning, teachers' existing knowledge and beliefs both serve as factors that influence learning and as targets for change (Borko & Putnam, 1996; Calderhead & Robson, 1991; Richardson, 1996; 2003).

Research supports the idea that teachers' incoming knowledge and beliefs serve as powerful factors that shape their learning in teacher education programs. What makes pre-service teachers' experiences unique is that in contrast to those learning to become doctors, lawyers or other professionals, they learn about teaching long before entering their formal teacher education programs. During what Lortie (1975) calls their apprenticeship of observation, pre-service teachers observe numerous teachers as they progress from kindergarten to high school. Their teachers – and their teaching – serve as models from whom prospective teachers develop their knowledge of what is entailed in teaching and learning, focusing primarily on teaching strategies they found to be effective specifically for their learning, or what characterizes a good teacher. Their knowledge and beliefs are therefore deeply rooted in their firsthand experience as students. By the time they enter teacher education programs, prospective teachers believe they have sufficient

knowledge about teaching (Brookhart & Freeman, 1992; Calderhead, 1991; Joram & Gabriele, 1998). Their beliefs that they know what knowledge and skills are entailed in the work of teaching can impact the ways in which they engage in their learning within their teacher education programs. The knowledge and beliefs they have formed over the years, therefore, become critical targets for change that have proven to be difficult to change within a short span of time.

One of the reasons teachers' cognition is a target for change is that pre-service teachers often have simplistic conceptions of teaching, based solely on their exposure to their own or other teachers' observable behaviors (Whitbeck, 2000). As students, rarely do they have access to teachers' rationales behind the decisions made prior to, during and after instruction. Consequently, they focus on observable traits or behaviors when forming beliefs about what makes for good teaching. In fact, many emphasize the value of interpersonal aspect of teaching (rather than aspects of teaching that promotes learning), believing that good teachers are those who are warm and personable, and nurture or motivate students to achieve their goals (Brookhart & Freeman, 1992; Collins, Selinger & Pratt, 2003; Holt-Reynolds, 1992). They exhibit an underdeveloped awareness of the content or context of learning (Hammerness, Darling-Hammond, Bransford, Berliner, Cochran-Smith, McDonald, & Zeichner, 2005; Paine, 1990), leading to a lack of consideration for under what circumstances certain instructional moves would be more appropriate for and effective for student learning. Those who do account for content believe teaching primarily consists of transmitting their content knowledge to their students through lectures (Brookhart & Freeman, 1992; Feiman-Nemser, McDiarmid, Melnick, & Parker, 1987). Such knowledge and beliefs about teaching conflict with current reform efforts calling for learner-centered approach to teaching that requires teachers to attend to and support students' *active* process of learning rather than treating students as passive receivers of knowledge. This can translate to the need for teachers to effectively attend to and skillfully integrate the diverse set of skills, experiences, knowledge, and interests students bring to ensure each student is given equal opportunity to develop their knowledge and skills around academic content. In turn, teacher education programs are expected to help teachers be more reflective, analytical and critical in their efforts to develop teaching practices that address the complex,

multifaceted nature of classroom life. Given the strong relationship between teacher beliefs and practice, teacher education programs become critical sites in which pre-service teachers' initial knowledge and beliefs are surfaced, challenged, and become targets for change.

The need for a more concerted effort on the part of teacher education programs to target teachers' cognition is warranted by the argument that the long-held knowledge and beliefs teachers bring to teacher education are often difficult to change and become potential obstacles to teacher learning (Carter, 1990; Clark & Peterson, 1986; Kagan & Richardson, 1996). For example, Hold-Reynolds (1992) discovered that pre-service teachers who held traditional beliefs that knowledge is transferred from one person to another were less receptive to courses where professors promoted constructivist approaches to teaching. In Calderhead's (1998) study, what student teachers learned from their student teaching experiences varied depending on their subjective ideas about their roles in learning to teach; some appreciated the complexities of teaching and began to re-evaluate their practices and beliefs, while others grew more resistant, seeking instead information or experiences that confirm their pre-existing beliefs. Their existing knowledge and beliefs serve as criteria against which they interpret and evaluate the value of new ideas about teaching and learning. It is also often the case that pre-service teachers assimilate newly presented information to fit their existing knowledge and beliefs, further solidifying misconceptions about teaching and learning to teach (Anderson & Bird, 1995). Effects of teachers' personal schooling experience, which is the primary source through which they begin to build their understanding of teaching and learning, on their cognition therefore tend to be stronger than from formal education they later receive from teacher education programs; this, as a result, limits pre-service teachers' ability to recognize the importance of making purposeful decisions based on evidence and sound reason, rather than a mere replication of what they had observed their teachers doing in the past (Richardson, 1996).

In addition to believing that they already have the knowledge that enables them to teach, many teachers believe that meaningful learning occurs in the field and underestimate the value of teacher preparation courses (Book, Byers & Freeman, 1983). The degree to which teachers believe courses provide meaningful learning experiences

impacts what and how they choose to engage in their learning in their courses. Calderhead & Robson's (1991) study, for instance, found that pre-service teachers' varying beliefs about teaching as well as their own learning affect how they interpret their courses as being useful for their learning. This particularly has important implications for educational psychology courses, which are commonly perceived by teachers as being disconnected and irrelevant to teaching practice (Kiewra & Gubbels, 1997). Their lack of value for educational psychology courses can negatively impact their engagement in such courses and consequently the likelihood of implementing their psychological knowledge once they formally enter classrooms.

Despite these concerns, changes in teachers' cognition as a result of their participation in various aspects of teacher education programs are possible (e.g., Bramald, Hardman & Leat, 1995; Dunkin, Precians & Nettle, 1994; Nettle, 1998; Richardson, 2003). In Bramald et al.'s (1995) study, for example, pre-service teachers shifted from traditional, "teacher-centered" orientation to "student-centered" orientation depending on the courses taken prior to entering student teaching. Additionally, Joram & Gabriele's (1998) study shows potential for educational psychology courses based on their results demonstrating that educational psychology courses can promote positive changes in teachers' beliefs about learning and teaching. They contend that uncovering and targeting teachers' incoming knowledge is particularly critical in fostering cognitive changes in teachers. This dissertation further argues that teachers' values for educational psychology must be addressed prior to and during instruction to increase teachers' receptiveness to ideas and perspectives that potentially conflict with their own.

Educational psychologists efforts to challenge the notion that educational psychology is disconnected from teaching and teacher learning have gained momentum. However, there is a need to explore the experiences of teachers who develop their psychological knowledge in relation to their goals of developing the knowledge and skills they believe are necessary for their work of teaching. If teachers do not believe what they learn in their educational psychology course align with other courses, or if they find psychological theories and principles to be unhelpful in informing their teaching and learning, they would be less likely to expend their efforts on learning the content, much less applying their knowledge to their own teaching. Research is thus needed to

understand to what extent teachers value educational psychology for the purpose of developing and applying the knowledge and skills they need for their teaching. While studies such as that by Kiewra & Gubbels (1997) suggest that teachers find educational psychology content to be too theoretical and abstract, examining *how* they make connections between central domains in educational psychology and different teaching skills seem to be of greater conceptual and practice value and is thus warranted. Understanding how teachers believe educational psychology is connected to the work of teaching can help scholars and instructors of educational psychology consider ways in which theories, principles and research can be made more readily accessible and of value to teachers.

Just as important is the need to consider the ways in which instructors teaching educational psychology impact changes in teachers' beliefs about the value of educational psychology. Sociocultural perspective, which will be discussed later in the chapter, places a great emphasis on the role of the 'more knowledgeable other' in creating learning experience powerful enough to transform teachers' knowledge and beliefs. Given this emphasis on the teacher educators' role, however, relatively little consideration has been given to teacher educators and their role as models of teaching and learning. The following section reviews emerging literature on the experiences of teacher educators given the role of promoting and fostering changes in teacher cognition.

Teacher Educators and Instructors as Models

Educational research has made much progress in examining and understanding the knowledge and beliefs teachers need to promote student learning. In contrast, how the cognition of those who teach teachers affects their ability to help teachers develop a strong foundation for knowledge and skills needed for teaching and ongoing professional development has more often been overlooked (Grossman, 2005). Teacher educators include course instructors and cooperating teachers, or practicing teachers, who supervise and mentor pre-service teachers during their student teaching. They provide instruction in courses in the higher education institutions (e.g., instructors who teach or have taught educational psychology to pre-service teachers) whose goal is to help teachers learning about teaching and learning. Adapting Cohen, Raudenbush & Ball's (2003) instructional triangle Ghouseini & Sleep's (2011) model helps to see that the interaction between

teacher educators (the “teacher”) and pre-service teachers (the “students”) around teaching practices (the “content”) is important in helping promote pre-service teachers’ learning (see Figure 2.2).

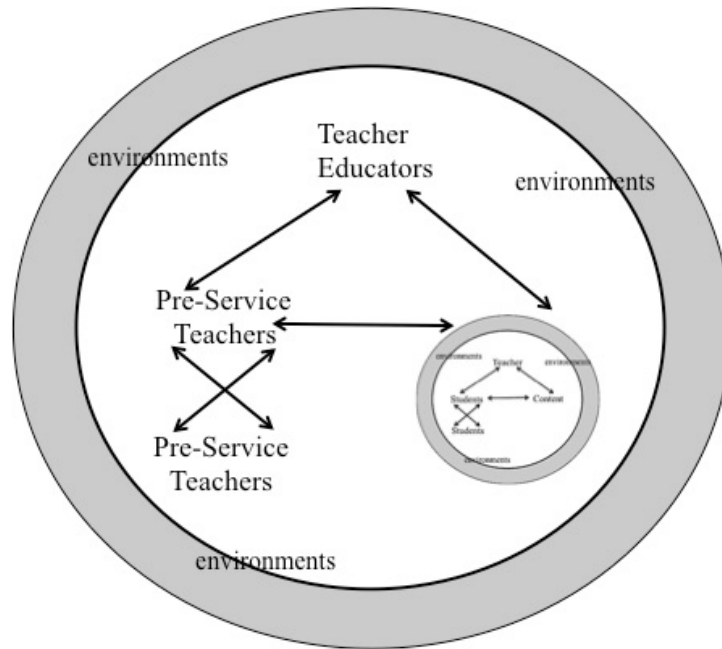


Figure 2.2 Elements of a learning system as applied to teacher education (Ghousseini & Sleep, 2011)

Instructors who work with prospective teachers play a critical role in uncovering the complexities of teaching by unpacking and critically analyzing various aspects of teaching, often as informed by theories or principles related to teaching and learning. Furthermore, they must do so while attending to the knowledge and beliefs teachers bring with them. Promoting changes in teachers’ cognition about teaching and learning requires teacher educators to make explicit the knowledge and beliefs held by pre-service teachers and to understand how their cognition affects their learning (Berry, 2007). Not only must they talk about their ideas or knowledge about good teaching, but they must also make this explicit through their actions (Bullock, 2009; Loughran & Berry, 2005; Smith, 2005). According to sociocultural theory, teacher educators and instructors are role models who, as novice teachers have insisted, should “practice what they preach” (Smith, 2005, p. 185). Organizations such as Association of Teacher Educators (ATE, 2003) identify one of the roles of teacher educators as modeling teaching in ways that demonstrate content and professional knowledge and behaviors proven to be effective for student learning.

They must model behaviors to help pre-service teachers learn and apply their learning in their classrooms. As teacher research and cognitive psychology indicate, however, we must consider how instructors' ability to model such behavior is rooted in their own cognition.

Given the important role of instructors in providing prospective teachers opportunities to adequately prepare for their profession, however, efforts to explore and understand the experiences of teacher educators has only recently begun to grow. Existing literature on teacher educators begins to shed light on the role of their cognition in their learning to teach teachers. Teacher educators have conducted self-studies to document the challenges they face in transitioning from the role of teachers to teacher educators (e.g., Berry, 2007a, b; Dinkelman, Margolis & Sikkenga, 2006; Russell & Korthagen, 1995). Self-studies² involve using one's own knowledge and beliefs to reflect on one's practice in teaching pre-service teachers. Many, like Berry (2007a, b), discuss the conflicts they experience between their intentions for instruction and instruction in practice. Much of these tensions arise from the lack of preparation they receive upon being given the task of preparing pre-service teachers for their profession. Without a clear understanding of the task entailed in teaching prospective teachers, teacher educators rely on their personal experiences to form their beliefs about what it means to teach teachers, which in turn influence decisions they made and actions they take when teaching teachers (Chin, 1997). Based on self-studies of teacher educators who have had K-12 teaching experience (Berry, 2007; Myers, 2002), their initial conceptions of their roles have consisted of "showing and telling", or sharing the experiences and resources they had accumulated over the years of their teaching and expecting pre-service teachers to reproduce it in their classrooms. Such findings, in conjunction with past research examining the relationships between cooperating teachers' beliefs and student teachers' learning (e.g., Borko & Mayfield, 1995) indicate that teacher educators' beliefs influence their decisions and teaching in ways that can affect teachers' cognition about teaching and learning.

² Self-study is a methodology used by teacher educator researchers wherein they engage in critical reflection of their practice, identify dilemmas they face in their practice, and articulate shifts in their roles and practices.

Histories from which teacher educators develop understandings about learning and teaching can influence their intentions and purposes for teaching teachers. In turn, they form images of who they aim to be as teacher educators. A study of four beginning teacher educators documents how their reflections of memories as teachers and images they form of themselves as a result of their past not only impact their initial work of teaching teachers, but also their approaches to learning to teach teachers (Guilfoyle, Hamilton, Pinnegar & Placier, 1995). Guilfoyle et al. (1995) argue that “biography were important precursors and contributors to the process of our development as teacher educators...Our past experiences gave us insight into our current experiences...and this brought new understanding, an enrichment of the meaning of being a teacher educator and greater commitment to the development of teachers” (pp. 44-45).

The idea of teacher educators’ beliefs and images as shaped by their histories raises the question of how *who* teaches prospective teachers matter. A potential limitation of existing self-studies is that these studies are produced by teacher educators who have had teaching experience. They primarily document challenges they face as they transition from teachers of children to teachers of prospective teachers. Though many instructors of teacher education courses (e.g., methods courses) have had K-12 teaching experiences, this is not necessarily the case for all courses. Instructors teaching educational psychology, in particular, come from a range of background both academically and professionally.

Because professional routes or experiences through which instructors enter their role of teaching teachers vary, it is important to consider how their diverse histories impact their cognition and instruction. On one hand, for example, those with classroom experience can be more inclined to ‘share’ or ‘pass down’ their wisdom and experience that pre-service teachers could apply directly to their everyday work in the classrooms. While this may be more appealing to students for its immediate utility, such an approach would come at the cost of helping student teachers establish a rich, theoretical understanding about learning and instruction, which is an essential form of conceptual tool through which teachers make instructional decisions during class and reflect on their practice. On the other hand, those who come solely with research experience may be able to provide theoretical framework that can inform teachers’ roles and teaching practices.

The lack of classroom experience, however, may limit their ability to make connections between the theories and actual work of teaching. This may lead pre-service teachers to perceive theoretical instruction as being unhelpful and disconnected from teaching, leading to potential disengagement from their learning. Either type of experience can bring considerable limitation that in turn affect what and how pre-service teachers learn and experience in their teacher education programs.

This dissertation aims to address the identified limitation of existing research examining instructors who teach teachers by studying the beliefs of educational psychology instructors who range in their experiences. Education psychology course as a context for study provides a unique opportunity to explore instructors who often come with various academic and professional backgrounds and examine how their beliefs might compare or contrast with pre-service teachers who take the courses, as well as with in-service teachers who have had the opportunity to formally teach in the classrooms.

Bringing it All Together: Bridging Psychological Knowledge and the Work of Teaching through the Eyes of Educators

In conclusion, the field of cognitive psychology has helped recognize the learners' (and instructors') active role in constructing their own knowledge and beliefs. Teachers, like their students, draw on their own experiences, beliefs, and knowledge as filters through which they develop their understanding of and beliefs about teaching and learning (Borko & Putnam, 1996; Calderhead, 1996; Putnam & Borko, 1997). These knowledge and beliefs, in turn, impact how they make sense of and engage in learning and teaching. These cognitive factors drive their action with respect to decisions they make and skills they develop to address the complex nature of teaching in ways that foster successful learning in their classrooms (Clark & Peterson, 1986). While education research has focused on elements of teacher cognition by examining teachers' content knowledge, pedagogical knowledge, and pedagogical content knowledge, educational psychologists have begun to conceptualize pedagogical/psychological knowledge (Voss et al., 2011) and its relationship to teaching. Voss et al.'s (2011) preliminary study shows a positive relationship between prospective teachers' PPK and quality of instruction as indicated by their students. This is thus an important opportunity to extend on their study and further understand how teachers' psychological knowledge is connected to the work

of teaching. Understanding how psychological knowledge aligns with other components of teacher cognition considered to be essential in supporting teachers' ability to engage in the work of teaching can have important implications for how teacher education program can effectively integrate educational psychology courses into their curricula.

Extending on constructivism, I argue that sociocultural theory can help frame the way in which teachers' psychological knowledge can support their understanding of high-leverage teaching practices. The theory emphasizes language as an important part of learning; it is central in establishing and maintaining purposeful interactions between pre-service teachers, teacher educators and instructors, and content around the work of teaching. Teacher educators and instructors play an important role in helping develop what Shulman (1987) calls pedagogical reasoning skills. Such skills enable teachers to think and talk about their practice using warrants to justify their pedagogical decisions based on standards, principles, or past experiences of learning or teaching. Building these skills is an important goal for teacher education programs because, as Fenstermacher (1978; 1986) argues, teachers should not only be able to skillfully engage in teaching, but to also talk about and make sound explanations about their teaching. Their ability to do this both with instructors and peers can help critically analyze and refine their teaching practices. Good teaching should be grounded in theoretical or empirical principles supported by educational communities and teachers must be able to soundly articulate what guides their actions (Ball, 1988; Fenstermacher, 1986; Shulman, 1987). Shulman further suggests that pedagogical reasoning is an element of pedagogical content knowledge wherein teachers' articulation of their teaching includes relating subject matter to pedagogy. I argue that educational psychology especially plays a significant role in developing teachers' pedagogical reasoning abilities; it provides fundamental theories and principles teachers can use as a lens through which they make sense of students' learning and development, as well as their own instruction, and personal and professional development.

Instructors teaching educational psychology serve as role models who play an important role in bridging and integrating theory into practice by transforming language as used in the field of educational psychology into one that can readily be taken up by pre-service teachers in their efforts to develop professional language and conceptual tool

with which they can engage in pedagogical reasoning as they observe, learn and talk about teaching. Pre-service teachers and methods course instructors, for example, use a specific set of language – one that is more closely tied to the subject matter – that enable teachers to readily implement, reflect on, and talk about and construct their knowledge of practices of representing subject matter to students. On the other hand, educational psychology has its own specialized set of language with which theories, concepts and principles of teaching and learning are explored and discussed in light of teachers’ teaching and learning experiences. If pedagogical reasoning involves teachers justifying their pedagogical decisions based on theoretical and empirical principles, and psychological theories and principles can provide a basis for pedagogical reasoning, it is important for educational psychology courses to consider how language used in the field of educational psychology to discuss theoretical and empirical principles can be translated into language used to talk about teaching.

Recent articulation of high-leverage teaching practices (Ball et al., 2009) combined with greater calls to make these practices central to teacher education curriculum has important implications for educational psychology instructors’ ability to help pre-service teachers find value in their psychological knowledge for their work of teaching. These high-leverage teaching practices allows for an exploration of teachers’ beliefs about the utility of their psychological knowledge for their teaching by examining how they relate these teaching practices to their understanding of foundational domains in educational psychology. Furthermore, given the important responsibility of educational psychology instructors as role models for teachers, my dissertation seeks to consider the degree to which educational psychology instructors’ beliefs about the value of psychological knowledge align with those of pre-service teachers as well as in-service teachers who have had experience teaching in the classrooms. Extending beyond the context of educational psychology courses, examining how teachers connect believe their psychological knowledge specifically informs high-leverage teaching practices addresses a more universal question of how prospective teachers, as well as practicing teachers, build a connection between the various theories and principles they learn around students, learning and teaching with the more practical challenges of effectively engaging in the

work of teaching. Current understanding of the aspects of teacher learning as discussed in this chapter thus serves as a foundation for this study.

Dissertation Questions and Hypotheses

Research Objective 1. Pre-Service Teachers' Development of Psychological Knowledge

The following research questions guide my consideration of growth in pre-service teachers' psychological knowledge over time:

- 1a. What happens to pre-service teachers' psychological knowledge after taking an educational psychology course in their teacher education program?
- 1b. Does pre-service teachers' psychological knowledge differ from in-service teachers who have entered their teaching profession?

The purpose of the first question is to determine whether there are changes in pre-service teachers' psychological knowledge after having taken a course in educational psychology as part of their requirement toward completion of teacher education. I hypothesize that taking an educational psychology course will lead to changes in their psychological knowledge, as they will have been exposed to theories and principles related to central domains in educational psychology. I also compare the psychological knowledge of pre-service teachers at the end of the course to psychological knowledge of in-service teachers who have graduated from the same program and have entered their teaching profession. This allows for a better understanding of how teachers' psychological knowledge might differ as a function of their opportunity to apply their psychological knowledge in the classrooms. Compared to pre-service teachers, in-service teachers will have had extensive interactions with students and faced issues related to learning and teaching that could be informed and addressed by psychological theories and principles. Given these opportunities, in-service teachers could develop a greater understanding of how their psychological knowledge about students, learning and teaching can inform various elements of their teaching compared to pre-service teachers. As a result, I hypothesize that in-service teachers may hold greater psychological knowledge compared to pre-service teachers. The comparison of pre-service teachers and in-service teachers

allow us to consider how their psychological knowledge might potentially vary as a function of different opportunities to develop knowledge and expertise.

Research Objective 2. An exploration of Teachers' Value of their Psychological Knowledge For the Work of Teaching

The second research objective, which explores teachers' beliefs about the value of psychological knowledge for teaching, is at the center of this dissertation, as it is one's beliefs that determine whether and to what degree teachers are likely to apply their knowledge to their instruction. The following research questions guide my exploration of various educators' value of their psychological knowledge:

- 2a. What happens to pre-service teachers' beliefs about the value of their psychological knowledge after their educational psychology coursework?
- 2b. Are pre-service teachers' beliefs aligned with what educational psychology instructors are trying to communicate as important and are they aligned with the beliefs of in-service teachers who have entered their teaching practice?

The second set of research questions are addressed by exploring how educators believe their knowledge of four domains in educational psychology would inform various aspects of teaching practices and will thus be organized into four sections by the domains they consider in their beliefs about how their knowledge can inform their teaching: 1) learning, 2) individual/group differences, 3) human development, and 4) motivation. The first sub-question explores the degree to which pre-service teachers' beliefs about the value of their psychological knowledge change after taking an educational psychology course. While I hypothesize that taking an educational psychology course will lead to changes in their psychological knowledge, it is hypothesized that their beliefs about the value of their psychological knowledge will be more resistant to change. Research on teacher beliefs in teacher education has indicated that teachers' beliefs are difficult to change (e.g., Clark & Peterson, 1986; Kagan, 1992; Richardson, 1996). Given the relatively stable nature of beliefs, it is predicted that the value they assign to their psychological knowledge will remain relatively unchanged despite changes in their psychological knowledge.

I proceed to compare pre-service teachers' beliefs at the end of the course to those of two different educator groups: in-service teachers and educational psychology instructors.

Given in-service teachers' greater opportunities to integrate their psychological knowledge into their teaching, I hypothesize that their beliefs about the value of educational psychology may look different from those held by pre-service teachers. In addition to comparing the beliefs of pre-service teachers' beliefs to in-service teachers' beliefs, the study also explores and compares the beliefs of instructors who have taught the same educational psychology course for the same teacher education program. As stated in the introduction, the range of personnel who teach educational psychology courses consists of both graduate students and faculty members who vary in their professional experiences and interests. Whereas the norm for subject-area methods courses is to use teacher educators who bring with them K-12 teaching experiences, this is not necessarily the case for those teaching educational psychology courses. This variation in backgrounds and expertise may influence their beliefs about how psychological knowledge can inform teachers' learning and development of teaching practices. Given their varying expertise and experiences, I hypothesize that their beliefs about the value of psychological knowledge will look different from those held by both pre-service teachers and in-service teachers.

CHAPTER 3

METHODS

Introduction

As outlined in the previous chapter, the current study is centered around exploring educators' beliefs about the value of psychological knowledge for teacher learning and teaching. The research questions are designed to examine three specific groups of educators, all affiliated with the same university-based teacher education program, as participants. First, it examined *pre-service teachers'* psychological knowledge and beliefs about its value, and explored the degree to which they changed after taking an educational psychology course. Second, it examined and compared the psychological knowledge and beliefs of pre-service teachers to *in-service teachers* who graduated from the same teacher education program and had entered into the teaching profession. Finally, it studied the beliefs of *instructors* who had designed and taught educational psychology courses to pre-service teachers at various time points. Each group's beliefs, the central component of their cognition under investigation, was measured employing a mixed methods approach to uncovering beliefs called the "Q methodology", wherein qualitative exploration of each participant's beliefs structures is facilitated through quantitative methods. This approach, which has been increasingly used in the field of psychology to study subjective viewpoints, is reviewed more extensively in the next section. This is then followed by description of procedures taken to carry out the study.

Q Methodology: A Mixed Methods Approach for Studying Beliefs

Studies examining pre-service teachers' beliefs have often been conducted using surveys, interviews, or a combination of both. Surveys employed to tap into teachers' beliefs have often consisted of Likert-scale items, such as Chan & Elliot's (2004) epistemological beliefs questionnaire and teaching and learning conceptions questionnaire, asking respondents to determine the degree to which they agree or disagree

with each item's statement (1=strongly disagree, 5=strongly agree). Others have sought to use open-ended questionnaires to gain a more extensive understanding of teachers' beliefs, for example, about mathematics and students' learning of mathematics (e.g., Ambrose, Clement, Philipp & Chauvot, 2004). Similarly, research seeking to specifically study pre-service teachers' beliefs about the role of educational psychology in their learning, though few, has involved the use of questionnaires and/or interviews (e.g., Joram & Gabriele, 1997; Kiewra & Gubbels, 1997; Lohse-Bossenz, Kunina-Habenicht & Kunter, 2013). Responses to questionnaires, however, are limited in gaining an in-depth understanding of teachers' beliefs. Furthermore, surveys such as those used by Kiewra & Gubbels (1997) and Lohse-Bossenz, Kunina-Habenicht & Kunter (2013) ask educators to select or identify the degree to which they believe different topics in educational psychology are important for teachers and their teaching. While these provide some insight into how different educational psychology topics are the most closely relevant to teaching as identified those who engage in the work of teaching, there still exists a lack of connection between educational psychology topics and the actual teaching practices. Surveys can be supplemented with interviews. However, interviews require time commitments, which could be a challenge particularly for pre-service teachers whose schedules consist of attending schools for their fieldwork or student teaching in addition to their classes on campus.

The current study's primary aim to explore participants' beliefs about the value of their psychological knowledge for teacher learning and teaching was addressed through the implementation of Q methodology, a methodology developed within the field of psychology. Q methodology is considered a mixed methods approach that involves the use of quantitative statistical analyses (i.e., correlational analysis and factor analysis) to facilitate a more qualitative interpretation of the data that represent various beliefs within a group about a specific topic or issue (e.g., Brown, 1996; Newman & Ramlo, 2010; Ramlo & Newman, 2011; Shemmings, 2006; Shinebourne, 2009; Watts & Stenner, 2005). This is accomplished by using multivariate data reduction techniques to group people based on their profiles with respect to their beliefs about the topic (Newman & Ramlo, 2010). These profiles are then subject to qualitative interpretation to determine

the range of views held by the participants. It thus helps identify commonalities and differences in participants' beliefs across sample group.

Various fields, including education and psychology, have employed Q methodology to explore and identify distinct patterns of beliefs about a particular topic (Ernest, 2001; McKeown & Thomas, 1988; Ramlo, 2008a). Educational research studies have used Q methodology to uncover beliefs of various stakeholders in education about issues around learning and teaching. Ramlo (2006/2007; 2008b), for one, used Q methodology to explore physics students' epistemological beliefs and views about learning after taking a physics course and to compare students' beliefs to their instructor's beliefs. Ernest (2011) also used the methodology to explore prospective teachers', practicing teachers' and parents' beliefs about developmentally appropriate practices. Q methodology has been increasingly used and adapted in the field of psychology to assess, identify, understand and conceptualize personalities and social relationships. For example, John & Halliburton (2010) argue that Q methodology can help strengthen the understanding of child-father attachment such as through identifying fathers' beliefs about their relationship with children and its role in building a secure relationship. Q sorting, Q methodology's mean for collecting data, has also been used to understand, evaluate and characterize individual's personality (Block, 1961). Q methodology's focus on uncovering and identifying the complexities of beliefs, perspectives and attitudes has led to its increasing use in a greater range of fields.

Given that Q methodology's goal is to identify and understand people's points of view, it was employed in this dissertation to explore and uncover the beliefs held by a specific group of people (i.e., pre-service teachers, in-service teachers, educational psychology instructors) about the value of their psychological knowledge specifically for teaching practices. Employing Q methodology for this study allows for a greater understanding of the ways in which pre-service teachers, in-service teachers and educational psychology instructors view various domains of their psychological knowledge as being helpful for informing different aspects of their teaching in relation to other aspects of their teaching. The rest of this section provides an overview of Q methodology and steps involved using Q methodology to explore pre-service teachers',

in-service teachers', and educational psychology instructors' beliefs about the ways in which their psychological knowledge could enhance their teaching practices.

Overview of Q Methodology

Q methodology involves the systematic, scientific study of human subjectivity, or “a person’s communication of his or her point of view” (McKeown & Thomas, 1988, p. 12). This methodology was developed by William Stephenson (1935), who was interested in designing a means to examine and understand people’s personal experiences as experienced from the standpoint of the person experiencing it. In his effort to study subjectivity in an objective manner, Stephenson adapted and expanded on traditional factor analysis (also known as R method), which was founded by his mentor, Charles Spearman (Stephenson, Brown, & Brenner, 1972). However whereas the traditional statistical method focuses on comparisons and correlations between variables across a sample of participants, Q methodology explores correlations between participants across a sample of variables with the goals of facilitating and uncovering personal viewpoints. It is more concerned with exploring the meaning and quality and less interested in generalizing to the greater population. The results of Q methodological studies are therefore helpful in describing a population of viewpoints as constructed by participants rather than a population of people, or the constructors. Q methodology has become more widely used in various fields of social science, including psychology, whose studies are often concerned with perceptions, opinions or attitudes (Brown, 1997; Cross, 2005).

Subjectivity, which is at the center of this methodology, was addressed by Stephenson in two ways: method for data collection and analysis of the data. Q methodology involves collecting data through Q sorting tasks, which ask participants to rank-order a set of stimuli in the form of multiple items or statements along a continuum according to a specific set of instructions (McKeown & Thomas, 1988). Oftentimes these instructions ask participants to rank-order items or statements based on the degree to which they agree or disagree with the statements (e.g., “Sort the items according to those with which you most disagree to most agree”), or are least to most representative of them or their views (e.g., “Sort the items according to what is most like or most unlike your point of view.”). The tasks therefore involve expressing their points of view about a topic. Such tasks of rank-ordering a set of items or statements based on such subjective

criterion allow the sorters to give their own personal meaning to the statements, rather than researchers imposing meaning on the statements, by making specific self-referential judgment about each item or statement in relation to the other items or statements (van Exel & de Graaf, 2005). Each completed Q-sort therefore suggests that the sort-ranked items are valued differently by the sorter based on the task's criterion.

These Q sort rankings are subsequently analyzed by conducting *by-person* correlation and factor analysis of the Q sorts, the latter of which will be discussed in subsequent sections (Stenner, Watts & Worrell, 2008). Stephenson (1935) likened Q methodology as an inversion of R methodological technique in the sense that its analysis correlates persons instead of test items; variables become the people who performed the Q sorts whereby those who are significantly associated with a factor that emerges from analysis share a common perspective or, in this case, beliefs. Such analysis enables the comparison of each participant's *overall* configuration of his or her Q sorts, rather than by individual items ranked by the participants. Preserving the overall configuration of the items helps "identify *groups of participants* who make sense of (and who hence Q 'sort') a pool of items in comparable ways" (Watts & Stenner, 2005, p. 68). The analysis yields descriptive outputs that can then be interpreted qualitatively to explore people's beliefs or perspectives. More specifically, the analysis provides information about the similarities and differences in the participants' beliefs; participants clustered together and loaded onto the same factor show similarities in their beliefs through the ways in which they sort items in relation to one another.

A Note on Sample Size

Given that the overall aim of Q methodology is to reveal and elaborate on the main perspectives favored by a specific population, there is less of a need for a large group of participants. Q methodologists such as Stainton Rogers (1995) emphasize that the focus of Q methodology is on the range of the different beliefs, not the people representing those beliefs (Stainton Rogers, 1995). Thus unlike traditional quantitative methodology, Q methodology does not require a large number of participants. It instead calls for a "structured sample of respondents who are relevant to the problem under consideration...[and are] expected to have a clear and distinct viewpoint regarding the problem" (van Exel & de Graaf, 2005, p. 6). Q methodology primarily aims to explore

the existence of, understand, explain, and compare particular viewpoints and not to make claims about the prevalence of occurrence throughout the greater general population (Stenner, Watts, & Worrell, 2008; Watts & Stenner, 2012). As van Exel & de Graaf (2005) note, “the number of persons associated with a factor is of less importance than who they are” (p. 6). While a large sample of participants may uncover new or a wider range of beliefs, Watts & Stenner (2005) suggest that using a large number of participants could potentially be a limitation in Q methodology because it can mask the subtle complexities, differences, or qualities comprised in the data. Although generally 40 to 60 participants have been recommended, having far fewer participants for Q studies have shown to be just as effective (e.g., Ramlo, 2012; Watts & Stenner, 2005; Wilson, 2006/2007). One might argue that the small purposive sample of participants in this study could limit its generalizability. Generalizations in Q methodology however do not refer to demographics. Rather, they refer to the diversity and range of beliefs or viewpoints; Q methodology seeks to identify and explore the range of viewpoints that could then be generalized back to the phenomenon being studied (rather than the population of people; Ward, 2009). As Ward (2009) notes, the demographics or individual participants who construct the Q sort is not of direct interest because the same viewpoints could be acquired through others. The ways in which the representative Q sorts differ are of main interest. Thus having a small number of participants through purposive or selective sampling can be particularly beneficial in exploratory studies, such as this dissertation, as a way to provide initial empirical support for demonstrating the existence of certain beliefs or perceptions within and/or among specific groups of people – in this case, educators. Given this issue of sample size and the resulting factors that emerge, however, the results that emerge from studies can be used to inform further research.

Performing Q Methodology

Steps for conducting Q methodology to measure participants’ subjectivity is essentially divided into two steps: (1) collecting data through Q sorting tasks and (2) analyzing data by means of by-person factor analysis. There have been many researchers who often employ only one aspect of these two procedures (e.g., use Q sorting tasks that are then analyzed using traditional R techniques). However, Q methodologists stress the importance of using *both* steps to effectively measure subjectivity; the use of Q sorts to

collect data enables the valid application of by-person factor analysis. Qualitative interpretation of the results follows quantitative analysis of the Q sorts. These steps are discussed in more detail.

Collecting Data: Developing and Conducting Q-Sorting Tasks

Q methodology entails collecting data through Q sorting tasks, an approach that has been increasingly used by the field of psychology and social sciences as a means for scientific assessment of participants' beliefs about a central topic (Brown, 1980; 1993; van Exel & de Graaf, 2005). Participants receive a set of statements, also known as a Q set and are asked to rank the statements according to their beliefs or point of view based on a set of a given continuum (e.g., ranging from "most disagree" to "most agree"). By asking participants to evaluate each item relative to one another and assign it a ranking by placing it into a distribution based on this set of continuum, Q sorting enables them to give their own subjective meaning to the statements rather than researchers imposing meaning on the statements (van Exel & de Graaf, 2005). This process thus makes the sorting tasks subjective.

Prior to carrying out the Q sorting task, a Q set that sufficiently represents the issue under investigation needs to be generated. This Q set is considered to be the *sampling* task in Q methodology, whereby its items serve as an estimate, or broad representation of the domain at issue (Stenner et al., 2008; Watts & Stenner, 2005). Generation of these items can be theoretically driven and drawn by key texts in academic literature. However, it can also be gained in other ways, such as through other forms of popular texts (e.g., magazines, television, etc.), formal and/or informal interviews, and pilot studies, among other numerous methods (Watts & Stenner, 2005). The development of this study's Q set was both informed by academic literature and refined through interviews.

This study's generation of Q-set was informed by Ball, Sleep, Boerst & Bass's (2009) identification of "high-leverage practices", which, as described in Chapter 2, are considered to be teaching practices that "when done well, give teachers a lot of capacity in their work. They include activities of teaching that are essential to the work and that are used frequently, ones that have significant power for teachers' effectiveness with pupils" (pp. 460-461). The survey items represented the nineteen high-leverage teaching

practices. Given that the primary aim of the study was to explore pre-service teachers' beliefs about the value of their psychological knowledge, interviews were conducted with previous pre-service teachers to revise and refine the items. Pre-service teachers were asked to perform the Q-sorting tasks in person with the initial set of high-leverage teaching practices and to verbalize their thinking by providing reasons for their evaluation and ranking of each item. Additional questions asked participants to read and explain what they thought each item meant and to evaluate whether the nineteen items represented the work entailed in the classroom. Based on their responses, one item, "Teaching a lesson or segment of instruction", was taken out of the Q-set as participants agreed that this aspect of teaching practice was too broad and was addressed through the other items. As a result, the final Q set consisted of 18 items. Items used for the Q sorting tasks are included in Appendix A.1.

In this study, participants were asked to compare each item and determine where to place each item *in relation* to one another in ways that best represented his/her own values of the different domains of their psychological knowledge (Watts & Stenner, 2005). They were asked to sort these items into one of five scales, from 'least helpful' to most helpful' based on their own beliefs about how helpful their psychological knowledge of each of four specific domains (i.e., learning/cognition, individual/group differences, human development, motivation) might be in informing their ability to carry out specific teaching practices.

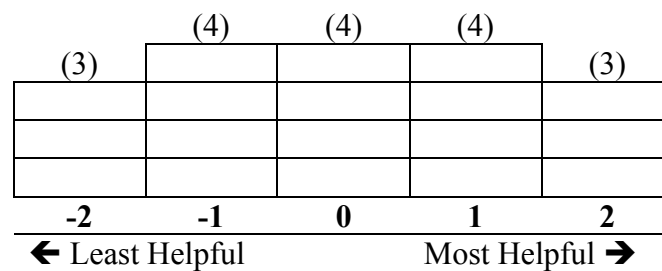


Figure 3.1 Illustration of Fixed Quasi-Normal Distribution. Ranking values range from -2 to +2. Numbers in parentheses indicate the number of items participants were asked to assign to a specific rank, for a total of 18 items.

As shown in Figure 3.1, respondents assigned each statement a ranking position in a fixed quasi-normal distribution, wherein participants were asked to assign a fixed number of items to each ranking position (e.g., Brown, 1993; van Exel & de Graaf, 2005; Watts &

Stenner, 2005; 2012). Along a five-scale continuum, participants were asked to sort each item by placing three statements at each extreme end of the continuum (i.e., ‘least helpful’, ‘most helpful’), and four statements at the center of the continuum (‘not very helpful’, ‘neither helpful nor unhelpful’ and ‘somewhat helpful’). This method of ‘forced distribution’ is considered to be beneficial in reducing response bias and facilitating participants’ ranking of the statements without having a statistical effect on factors that emerge from the data (Brown, 1980; van Exel & de Graaf, 2005; Watts & Stenner, 2005). Q sorts were then analyzed.

Analyzing Data: Analyzing Q Sorts Through By-Person Factor Analysis

Q sorting as a means to collect data is only one part of Q methodology. Factor analysis is central to the methodology, as it consists of statistical means through which participants are grouped based on their beliefs as represented by their Q-sort configurations. Similar to R method, analyses of the Q sorts provided by participants involve correlation, factor analysis, and calculation of factor scores. Q methodology, however, is unique for its application of a by-person factor analysis, which contrasts with R methodology’s employment of by-item factor analysis (Watts & Stenner, 2005). By-person factor analysis involves intercorrelation and factor analysis of the *overall configurations* produced by participants, as shown in Figure 3.2.

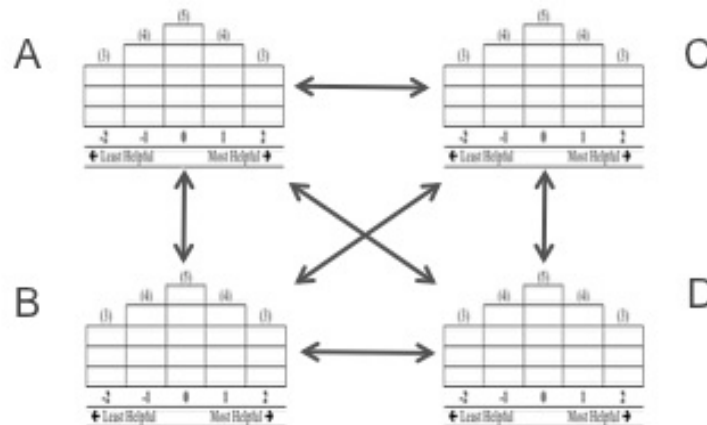


Figure 3.2 Illustration of intercorrelation of Q sort configurations of Participants A-D

This differs from traditional correlation that examines the relationship of a single item with other items. Intercorrelating and factor analyzing the overall configuration of Q sorts

ultimately yields a set of factors onto which participants load onto based on the whole Q sort configuration they provide. Each factor represents a different set of item configurations shared by multiple participants, which indicate that participants loading onto the factor share similar configurations, or different patterns of belief about the topic. Analysis of Q methods is accomplished through software designed specifically for Q methodology. PQ Method software is the most commonly used and was employed for this study.

The analysis of Q sorts is generally conducted in several steps. The first step of the analysis is to assign each item a numerical score that corresponds to the ranking given by each participant. For example, in this study an item was assigned a “2” if it was placed under “Most helpful”, “-2” if placed under “Most unhelpful”, etc. (see Figure 3.1). The next step is to calculate the correlation matrix of all Q sort configurations provided by the participants as illustrated in Figure 3.2. The correlation compares each Q sort to one another, indicating the degree of similarity between two sets of beliefs represented by the Q sorts. More specifically, finding correlations between participants based on their overall rankings provides useful information about similarities and/or differences in their beliefs about a particular topic (i.e., teaching practices for which they believe their psychological knowledge would be more or less helpful). In the case of this study, such analysis enables one to see how different groups of educators might hold different views about the utility of their psychological knowledge. The resulting correlation matrix represents all of the relationship between the different Q sort configurations (Brown, 1980; 1993; van Exel & de Graaf, 2005; Watts & Stenner, 2005).

The correlation matrix is then subject to statistical analysis that yields a set of factors representing different sets of beliefs shared by groups of participants. First, factor extraction resulting from by-person factor analysis produces an initial set of factor loadings that “express the extent to which each Q sort is associated with each factor” (Brown, 1993, p. 111, see Table 3.1). These factor loadings are expressed as correlations that show the degree to which each Q sort is associated with each of the extracted factors. How each participant loads onto the factors depends on their configuration of the Q-sort items, with each factor representing different beliefs about the topic (van Exel & de Graaf, 2005; Watts & Stenner, 2005).

Table 3.1 Example of Correlation and Factor Matrix

Q Sort	Correlations ^a				Factors ^b		
	1	2	3	4	I	II	III
1 Participant A	--	-30	20	-18		X	
2 Participant B	-30	--	31	73	X		
3 Participant C	20	31	--	-12			X
4 Participant D	-18	73	-12	--	X		

^aNumbers represent correlations with decimals to two places omitted

^b'X' indicates significant factor loadings

Participants' Q sorts that load onto the same factor indicate that they share similar item configuration, and thus similar beliefs about the topic. As the example from Table 3.1 shows, Participant B's Q-sort configuration is highly correlated with Participant D's Q-sort configuration, indicating that they hold similar points of views. Consequently, they load onto the same factor, Factor I.

This process of factor extraction can be conducted in one of two common ways: centroid method or principal components analysis (PCA). The centroid method is the most traditional, common method for factor extraction in Q methodology. It has been the most preferred because it offers an indeterminate number of potential solutions (Brown, 1980). This appeals to Q methodologists as it enables them to consider the data from various perspectives before choosing the rotated solution they consider to be appropriate and informative (Watts & Stenner, 2005). PCA on the other hand decides on a single, mathematically best solution. Despite the differences, the structures of the factors that result from using centroid method or PCA have shown to have no significant difference; both methods produce similar results (McKeown & Thomas, 1988; Watts & Stenner, 2012). This study employed principal components analysis because of its mathematical ability to best provide simple solution.

Factor extraction yields a table of factor loadings that show each Q sort's initial correlation with each of the factors in the form of correlation coefficient. Analysis of Q sorts requires careful consideration of how many factors to extract and interpret. This decision depends on satisfying several standard requirements (Watts & Stenner, 2005).

First, it is common to select factors with an eigenvalue greater than 1.00³, which suggests statistical strength and explanatory power; an eigenvalue of less than 1.00 accounts for less variance than one single Q-sort (Watts & Stenner, 2012). Second, an interpretable factor must have at least two Q-sorts that load significantly upon it. Such Q sorts are considered to be “factor exemplars” that characterize the pattern of configuration representative of the factor. The level of significance at $p < .01$ can be calculated as follows: $2.58 \times (1/\sqrt{\text{number of statements}})$. In the context of the study, the level of significance was initially calculated as 0.61 ($2.58 \times (1/\sqrt{18}) = 0.61$). However, upon further examining the data, in order to allow as many number of Q-sorts as possible, I took a more conservative approach by including Q-sorts that loaded significantly onto a factor at $p < .05$, or 0.46 ($1.96 \times (1/\sqrt{18}) = 0.46$). Changing the level of significance is considered appropriate in Q methodology to minimize the number of non-significant and/or confounding Q-sorts (or Q-sorts that load significantly onto two or more factors) and therefore maximize the amount of Q-sorts loading onto one single factor (McKeown & Thomas, 1988; Watts & Stenner, 2005; 2012). Altogether, factors should capture as much of the study variance as possible (variance indicates range and variability of viewpoints). A variance of 35-40% or above is considered a sound solution (Watts & Stenner, 2005; 2012).

Initial factor extraction yields a raw source of information and provides a basis for further analysis and probing of the data (Brown, 1993). Further examination and analysis is often accomplished through factor rotation wherein one examines information from various perspectives before arriving at a final set of factors that can be interpreted (Brown, 1993; van Exel & de Graaf, 2005; Watts & Stenner, 2005). Factor rotation helps to better illustrate the range of beliefs expressed by participant groups and more clearly distinguish the interaction between the different Q sorts while preserving the underlying response patterns (Brown, 1980; Stephenson, 1993/1994; Watts & Stenner, 2005). In statistical terms, factor rotations can increase the factor loadings of Q-sorts that are representative of each factor while decreasing their loadings on other factors, which ultimately facilitates the qualitative interpretation of the factors (Watts & Stenner, 2012).

³ Eigenvalue represents the amount of variation explained by a factor. An eigenvalue of 1.00 represents considerable variation.

Factor rotations may be conducted either theoretically (by-hand technique) or objectively through statistical methods.

Traditionally, Q methodologists have used theoretical, or by-hand, techniques. This involves the investigator rotating the factors driven by theoretical concerns or ideas that may have been raised during the study (e.g., based on salient themes observed from Q sorts or follow up interviews). Hand rotation can also be the method of choice if the researcher has reasons to believe a particular Q sort represents a target belief and is interested in exploring how others' perceptions align with the target belief (Watts & Stenner, 2012). Still other investigators might decide to focus on a particular Q sort(s) if they know in advance that certain participants have particular influence over the population of interest. Theoretical rotations conducted through such knowledge can produce factor solution(s) that might more accurately represent the reality. Thus hand rotation is often a method of choice if one is aware of or confident in what to look for.

Given the exploratory nature of the study, the second method of factor rotation, the varimax rotation, was employed. Varimax rotation is a commonly preferred objective and reliable method of factor rotation for its prioritization of participant groups' inputs as emerged by the initial factor analysis and for its ability to maximize the variance of the factor loadings (Abdi, 2003; Watts & Stenner, 2005). It focuses on the most prevalent viewpoints that exist within the group. It is also used for studies that involve a greater number of participants. A possible weakness of this method is that a focus on beliefs that are shared by a greater number of participants may not necessarily represent beliefs that are in reality the most influential (Watts & Stenner, 2012). However, this is not an issue for this dissertation, where the aim is to explore the majority viewpoints across three different educator groups.

It is important to note that factor rotation, regardless of its method, preserves the relationship between the different Q sorts and merely changes the angles or perspectives through which the data is observed (van Exel & de Graaf, 2005; Watts & Stenner, 2012). In other words, if a Q sort has a low factor loading, no amount of factor rotating would change the degree to which they have common variance. Rather, factor rotation primarily helps interpret the data by redistributing the explained variance without changing the amount of variance accounted for. As Watts and Stenner (2012) note, factor rotation

“does not and cannot change the viewpoint or perspective of any Q sort, but it can, and must, change *our* perspective,” as it enables researchers’ view of the topic matter to become “more focused, more specific and more faithful to the actual viewpoints of the participants” (p. 129).

Once factor rotation has been accomplished, a factor estimate or factor score, or an estimate of each factor’s viewpoint, is generated with the goal of assigning a factor score (ranging from -2 to +2 in the case of this study) to each item in ways that exemplify each factor’s Q-sort configuration. This is first done by identifying Q-sorts that load significantly onto *one* factor, which are considered to exemplify or define the viewpoint of that factor. Q-sorts that load significantly onto more than one factor, or confounding Q sorts, are not used for factor estimates. Factor estimates are based on weighted average, wherein Q sorts with higher loading (or higher correlation coefficient) contribute more to the estimate than those with lower factor loadings (Watts & Stenner, 2012). By doing this, Q sorts that load significantly onto each factor combine to produce a single Q sort configuration considered to be the best estimate of the belief pattern representing the factor (Watts & Stenner, 2005).

These initial factor scores are not comparable because different number of Q sorts load onto each factor. To account for this and make each statement’s factor score comparable across factors, each score is standardized by normalizing weighted average statement score of participants and converting them into z scores. Z-score value indicates the degree to which each item characterizes each of the factors. These z-scores are rounded to the array of the discrete values (e.g., the three highest z-scores are assigned +2, the three lowest z-scores are assigned -2, and so on) and serve as a basis for which final set of factor arrays are constructed. Statistical analysis is complete once this final Q sort, also called the factor array, is generated for all of the factors. Identification of the final set of factors and their factor arrays is followed with an in-depth qualitative interpretation of the Q sorts that load onto those factors.

Interpretation involves discussing salient characteristics of statements that describe each of the identified factors. Statements selected for interpretation of the factors is largely determined by the factor scores that show the degree to which each of the statements or items characterizes each factor (Brown, 1996; van Exel & de Graaf, 2005).

Statements will be considered characteristic of a factor if its z score is less than -1 or greater than 1. Once factor scores are computed, one can determine the degree to which each Q sort is a defining variable of each factor by examining whether each participant's factor loading satisfies a particular condition (commonly $p < 0.01$).

A table with the identified significant factors, along with the ranking their corresponding participants assign to each item (from -2 to 2) serves as a basis for factor interpretation (Brown, 1996; Shinebourne, 2009; see Table 3.2 for an example). These interpretations will yield narrative accounts of the factors and account for the entire configuration of each factor. To facilitate this process, one can first attend to what is known as consensus statements and distinguishing statements. Consensus statements consist of items whose rankings do not distinguish significantly between any of the factors, indicating that participants' Q-sorts loading onto these factor have ranked the statements in the same way. On the other hand, distinguishing statements are items that a specific factor has ranked in a significantly different way compared to other factors (this is represented by a difference in z-scores, both at $p < .05$ and $p < .01$). These distinguishing statements help begin to consider how each factor is distinct from one another in their beliefs.

Table 3.2 Example of Table for Factor Interpretation

Statement #	Statement	Factor 1 Item Scores	Factor 2 Item Scores	Factor 3 Item Scores
1	Making content explicit through explanation, modeling, representations, and examples	-2	1	2
2	Leading a whole-class discussion	1	-1	0
3	Eliciting and interpreting individual students' thinking	-1	2	1
4	Establishing norms and routines for classroom discourse central to subject-matter domain	0	1	2
5	Recognizing common patterns of student thinking in subject-matter domain	2	-1	0

While looking at these distinguishing statements is helpful, solely making cross-factor item comparisons is not sufficient in interpreting each factor; rather, interpretation of

each factor must be driven by the interrelationship of the items within each factor (Watts & Stenner, 2012). Any open-ended comments (through open-ended survey response or follow-up interviews) can also be integrated into the interpretations to provide a more in-depth understanding of different beliefs expressed by the participants. These steps in conducting Q methodology serve as a basis for addressing much of the dissertation's research questions.

Using Q Methodology to Test and Compare Differences

Watts and Stenner (2012) note that Q methodology is not designed or intended to test differences, as many previous studies have shown that group memberships don't necessarily determine or influence one's Q sorting. That said, however, Q methodology affords research questions, such as those of this study, that aim to make comparisons within a group across time as well as comparisons across different groups. As outlined by Plummer (2012), there exist three possible approaches to analyzing differences.

The first approach involves analyzing all Q-sorts together and treating them as one data set. Although doing so yields overall shared viewpoints, a big disadvantage of this approach is that it does not allow us to appreciate the viewpoints of the groups in their own rights, as all the viewpoints are intercorrelated (Plummer, 2012; Watts & Stenner, 2012). Watts & Stenner (2012) likens the mixing of these separate data sets to what might result when mistakenly mixing experimental and control groups in an experimental design, while Plummer (2012) likens it to mixing two colors, such as red and blue to produce the color purple, making data difficult to extrapolate and untangle the views. In the case of this study, given that the different groups of educators bring different experiences, the aim of this study was to investigate shared views from within each independent group in their own right before exploring and determining whether these views were similar or different between each groups.

A second approach involves conducting a second-order factor analysis wherein factor arrays that emerge from initial independent analysis for each group or each time point is employed as data in a new Q study (Watts & Stenner, 2012). This produces a secondary set of factors that capture shared viewpoints or differences across the range of existing shared viewpoints within the original groups or within a group across different time points. However, this gives rise to a larger study and extends beyond the scope of

this study. The third approach, the one used for this study, analyzes and compares the separate data qualitatively. Each data set produces shared viewpoints within each time point or within each group, and also enables a qualitative comparison of the factor arrays at a manageable option. With this in mind, the next section introduces the specific groups of people who participated in the study.

Study Context and Participants

As previously discussed, Q methodology calls for a structured sample of participants relevant to the problem at hand (van Excel & de Graaf, 2005). For this study, a purposive sample of pre-service teachers, in-service teachers and educational psychology instructors affiliated with one university-based teacher education program from a mid-western public university were invited to participate. Both elementary and secondary pre-service teachers enrolled in an educational psychology course during the Fall 2012 term were invited to study. Pre-service teachers formally enter the program during their junior year and receive their certification upon their graduation. At least 170 pre-service teachers receive their teacher certification each year.

Although from the same institution, elementary and secondary teacher education programs differ in their design and curriculum. The elementary teacher education program consists of a two-year curriculum (four terms), while the secondary teacher program consists of a one-and-a-half year curriculum (three terms). Each term focuses on course works combined with field experiences wherein pre-service teachers spend several hours each week in formal classroom settings to observe, gather data on learning and teaching, tutor students, and work with their cooperating teachers on lesson planning and co-teaching. Pre-service teachers then enter student thinking during their last term as they become fully engaged in all aspects of instruction in classrooms for five days a week.

Both elementary and secondary pre-service teachers are required to take one educational psychology course. This contrasts with other programs that require pre-service teachers to take similar course(s) as a pre-requisite for entrance into their programs. The required educational psychology course is offered within the School of Education, which differs from other programs that might require their pre-service teachers to take educational psychology or similar courses offered by their schools'

psychology departments (NCATE, 2010). This is important to note because while courses from psychology departments are often designed for psychology majors, similar courses offered within schools of education might be more specifically catered to the needs of students interested in the field of education.

Although educational psychology is integrated within the teacher education program's curriculum for both elementary and secondary pre-service teachers, *when* the course is offered differs for each group of teachers in the program. Elementary pre-service teachers take the course during their first term of the program (third year in college) in conjunction with courses on contemporary issues in elementary teaching and literacy, as well as their first practicum experience. They are thus exposed to educational psychology content concurrently with their initial placement in classrooms as prospective teachers. Secondary pre-service teachers, on the other hand, take the educational psychology course during their second term in the program (fourth year in college) in conjunction with a course in methods. They enter the course having had a term's worth of practicum experience during which they have interacted with students and teachers in a classroom setting. The teacher education program thus situates the educational psychology content in teacher education curricula.

In addition to the timing of the course, pre-service teachers take various courses that integrate different psychological theories and principles to address different aspects of teaching practices thus reinforcing some of the foundational theories and principles addressed in the educational psychology course. For elementary pre-service teachers, these courses included the following: Children as Sensemakers; Culturally Responsive Pedagogy; Managing to Teach; Teaching Students with Exceptionalities; Working with Families; Teaching with Digital Technologies; and Problems and Principles of Elementary Education. In the case of elementary pre-service teachers, they were required to take the Educational Psychology course in conjunction with Children as Sensemakers; Children as Sensemakers course was taught during the first four weeks in the fall, followed by the Educational Psychology course which was taught until the end of the same academic term. Different instructors taught the two courses. For secondary pre-service teachers, required courses that integrated principles of educational psychology included: Educational Foundations in a Multicultural Society; Teaching with Digital

Technologies; Students with Exceptionalities; and Problems and Principles of Secondary School.

Six educational psychology sections were offered during the fall term in which data collection took place. Each section was taught by a different instructor and was designed for different cohorts of pre-service teachers. Despite the cohort-specific division of the course, all sections were designed around a common goal of helping pre-service teachers understand classroom practices and students behaviors through the lens of educational psychology. According to the general syllabus, the objectives for the course included developing prospective teachers’ ability to (a) apply theories and research from educational psychology to understand the social and emotional development of students in the classroom, (b) identify the psychological principles of education that lay behind commonly used models and strategies of teaching at the elementary or secondary level, (c) critique lessons, classroom materials and assessment tools for their implementation based on educational psychology principles, (d) develop lessons and assessments that implement the principles of educational psychology and that support all learners, (e) use psychological principles as a means to develop more equitable learning activities for students from diverse backgrounds, including English language learners and traditionally underrepresented groups, and (f) develop strategies to promote student motivation and engagement in their own learning.

Of the 122 pre-service teachers who were enrolled in the educational psychology courses, 25% of them (N = 30) completed the surveys both at the beginning and end of the course and were thus included in this study (see Table 3.3).

Table 3.3 Pre-Service Teacher Participant Information

Cohort	# of Pre-service Teachers Enrolled in Course	# of Pre-Service Teachers Who Participated
Elementary	28	7
Elementary	28	7
English	17	3
Math & Science	17	3
Social Studies	16	5
World Language, Science & Music Education	16	5

There were others who either completed the survey at only one time point or started but did not complete the survey. In addition to the 30 pre-service teachers, 29 in-service teachers completed both knowledge and beliefs surveys, and ten educational psychology instructors completed the beliefs survey. The participants who completed the survey are described in more detail in Chapter 4.

Measures

An online survey was used to measure pre-service teachers, in-service teachers and educational psychology instructors' beliefs, which was accessed through an e-mail invitation that included the survey link (a copy of the belief survey is included in Appendix A, A.2).

Beliefs About the Value of Psychological Knowledge

The beliefs survey consisted of several Q sorting tasks to explore participants' beliefs about the usefulness of developing psychological knowledge for their work of teaching (see Figure 3.2). In employing this method, this section consisted of four Q sorting tasks, each representing a foundational domain in educational psychology for which the participants considered its usefulness in relation to different aspects of their teaching practices: learning/cognition, individual/group differences, human development, and motivation. Each of these tasks included a brief description of the domains they were asked to consider in relation to the teaching practices along with a set of items, or statements representing the various elements of teaching practices. For each domain, or Q sorting task, they were presented with a set of statements describing various aspects of teaching practices identified as being important for quality teaching.

Respondents were asked to sort these items into five scales, from 'least helpful' to most helpful' based on their own beliefs about how useful psychological knowledge of each domain might be in informing their ability to carry out specific teaching practices. The instructions also provided a summary of major issues covered within each of the domains to ensure participants had a standardized understanding of what each domain entails. The following section provides an overview of these domains of educational psychology which participants were asked to consider in connecting their psychological knowledge to teaching practices.

DIRECTIONS: Drag each statement into the category that best matches your beliefs in response to the question below (You must have **THREE** statements under "Most helpful" and "Least Helpful", and **FOUR** statements under "Somewhat Helpful", "Neither Helpful Nor Unhelpful" and "Not Very Helpful" categories):

"How helpful do you believe knowing psychological principles and theories of COGNITION/LEARNING PROCESSES might be in supporting your ability to carry out the following teaching practices?"

NOTE: Major issues around the topic of cognition or learning processes include (but are not limited to) students' construction of knowledge, memory, attention, student perception, how misconceptions develop, higher-level thinking, and organizing knowledge.

Items	I believe knowledge of COGNITION/LEARNING PROCESSES will be the MOST HELPFUL in supporting: (drag 3 statements from the left-hand column to this box)
Developing and selecting appropriate assessments (i.e., quizzes, tests, projects), and interpreting results of the assessment to inform future instruction.	
Recognizing common patterns of student thinking in a particular subject.	
Leading a whole-class discussion about academic content that encourages students to listen and respond to one another.	I believe knowledge of COGNITION/LEARNING PROCESSES will be SOMEWHAT HELPFUL in supporting: (drag 4 statements from the left-hand column to this box)
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content.	
Setting up and managing small group work to promote individual and group learning.	I believe knowledge of COGNITION/LEARNING PROCESSES will be NEITHER HELPFUL NOR UNHELPFUL in supporting: (drag 4 statements from the left-hand column to this box)
Reflecting on and analyzing my instruction in order to improve its effectiveness.	
Providing verbal and written feedback to students to help them improve their academic work.	I believe knowledge of COGNITION/LEARNING PROCESSES will be NOT VERY HELPFUL in supporting: (drag 4 statements from the left-hand column to this box)
Making academic content clear through the use of explanation, demonstrations, illustrations, and examples.	
Establishing norms and routines for how students should talk and work with each other to build knowledge of academic content.	I believe knowledge of COGNITION/LEARNING PROCESSES will be the LEAST HELPFUL in supporting: (drag 3 statements from the left-hand column to this box)
Setting long- and short-term learning goals for students that are appropriately sequenced and aligned with district standards.	
Using appropriate methods to check for student understanding and monitor student learning.	
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking.	
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists).	
Establishing organizational routines, procedures and strategies to maximize time available for student learning.	
Evaluating, choosing, and modifying curriculum materials and learning tasks to accomplish a specific learning goal.	
Purposefully engaging in non-academic conversations with individual students to build relationships.	
Designing a sequence of lessons toward a specific learning goal.	
Communicating with parents or guardians to promote their child's success in and out of school.	

Figure 3.3 Example of Q sort ranking task

Learning and Cognition

Given teachers' likely primary goal of helping students learn, they must understand *how* students learn to ensure that successful learning takes place in their classrooms. Educational psychology provides an understanding of cognition and learning processes and covers content around memory, attention, transfer of knowledge from one context to another, self-regulated learning, and metacognition (Darling-Hammond & Baratz-Snowden, 2005; NAE, 2005). Jean Piaget's (1952) work in cognition has helped recognize that learners actively make sense of new information based on their existing background knowledge, beliefs, and experiences with the content to be learned. This idea of students as active learners and not passive receivers of knowledge has led educators to think more deeply about how they can make connections between the content to students' incoming knowledge in ways that make it comprehensible to their students.

Knowledge of memory, attention and metacognition brings awareness to how students attend to their classwork or information presented to them, how they remember and retrieve what they had learned in the past, and how they can monitor their own learning and effectiveness of strategies used to learn certain topics (NAE, 2005). This is important because teachers must consider how students process and make sense of new information in light of what they already know or do not know, how various approaches to instruction impact students' attention to the information, why students might have trouble remembering what they had previously learned, and how teachers can help students remember a newly learned or complex idea(s). Additionally, different theories of learning help teachers determine what it means for students to have learned and mastered something, and select from various evaluation approaches to appropriately determine whether students had achieved their learning goals.

Vygotsky's (1978) idea that learning is not isolated but social and that culture plays an important role in one's learning also has implications for teachers' role in student learning. Learning is mediated through interactions with peers and teachers within a learning community that brings a certain set of norms and tools (e.g., language, manipulatives and other learning or instructional materials) with which they interact. Teachers, as experts of the content, play an especially important role in promoting learning through proper forms of support. Vygotsky's (1978) concept of the zone of

proximal development has defined what it means for teachers to *scaffold* their students, or to guide students in their learning of a challenging topic to the point in which they can engage with the topic independently. Taken together, teachers' knowledge of learners and learning can have an impact on their approaches to understanding what and how students learn in light of their prior learning experiences and knowledge, designing instruction in ways that students feel motivated to attend to, engage in, and process new information, establishing a learning environment that provides the support necessary to create an engaged community of learners, and properly monitoring and evaluating students' learning to inform their future instruction.

Individual/Group Differences

Any two students can receive the same instruction and resources for learning yet show different learning outcomes and achievements. Classrooms consist of students with various abilities, from exceptionally gifted students to those with disabilities such as communication disorders, physical and health impairments, learning disorders, behavioral or emotional disorders, and sensory handicaps. Additionally, growing diversity in student population necessitates teachers' understanding and ability to address issues around students' individual and group differences, as learning is influenced by cultural contexts and values along with individual traits (Patrick et al., 2011). Educational psychology reveals the complexity of learning due to individual and group differences as it accounts for various traits of each student, such as one's personality, mental abilities, willingness or motivation to learn, previous knowledge and experience, and preference for how one learns (Jonassen & Grabowski, 2011). In addition to helping one understand that successful learning is maximized when students' differences are addressed, educational psychology informs and enables teachers to attend to and account for these differences as they seek to provide all students equal opportunity for positive learning and development. Awareness of how cultural contexts combined with individual traits affect students' development enhances their knowledge of and appreciation for how their students' various experiences impact their learning and ultimately help students perceive their experiences as strengths that could lead to successful learning (Bransford, Darling-Hammond, & LePage, 2005; Horowitz et al., 2005).

For teachers, understanding individual and group differences has important implications for their instruction and student learning. For one, the understanding that all students do not necessarily benefit from one particular method of instruction or a rigid set of curriculum or learning materials implies that teachers must consider various instructional strategies and resources that are appropriate for particular sets of goals identified for their students. Teachers must also prepare, attend to and respond to students' variations in their thinking, attitude, and interests by having prepared methods to modify their instruction during instruction. In addition to preparing and modifying their instruction, teachers must be equipped with various methods for assessing and evaluating their students to ensure that they are properly and fairly assessed in their learning in light of their differences and in turn provide appropriate feedback and instructional response to their students' progress in their learning.

Human Development

A deeper knowledge of students involves not only knowing what students know about a subject, but also how their development at various levels (e.g., cognitive, social, identity, language, and moral development) affects their classroom behavior and learning, and vice versa. Research indicates that creating a successful learning environment entails attending to students' various facets of development: physical, cognitive, social, emotional, and linguistic (Elias et al., 1997; Horowitz et al., 2005; Zins, Weissberg, Wang, & Walberg, 2004). Emphasis on the need for "developmentally appropriate practice" in schools suggests teachers' understanding of their students' development as being a critical factor in teachers' ability to design appropriate lessons that are challenging yet engaging for their students (Horowitz et al., 2005). This is even more important in classrooms whose student population continue to become diverse, with each student bringing unique understandings and beliefs, goals, interests, needs, and forms of behavior (Doyle, 1977).

Developmentally appropriate practice allows teachers to design instruction in light of their students' own experience and needs and provide materials that support students' learning needs (Horowitz et al., 2005). It also informs teachers' approaches to observing and evaluating what and how students learn. For example, when students encounter difficulty with a task, a teachers' understanding of development might allow

them to consider developmental factors that explain why or in what ways students struggle (rather than concluding that students are simply not learning) and provide proper support to help them not only engage in the task but to also successfully complete the task. Educational psychology aids in developing such forms of practice that promote not only students' learning of the academic content, but their development as well.

Similarly, knowledge of development helps understand how children learn and develop within a particular social context. Students are placed in a social environment that places them not only with a teacher, but also with twenty or more peers. Teachers thus interact with students both at the individual and group level, and moderate students' interactions with their peers (Cohen et al., 2003). Teachers' understanding of social development allows them to create a safe learning environment that fosters a development of positive peer relationships and students' prosocial behavior by helping them learn to respect their peers and to make decisions that benefit the learning community as a whole. Teachers' awareness of students' emotional development helps promote students' sense of self and a safe environment in which students could take risks in their learning (e.g., volunteering to provide answers to questions, engaging in classrooms discussions, asking questions). Knowledge of development, then, not only informs teachers' pedagogy, but also helps teachers consider how their instruction can further enhance their students' development. Schools' and teachers' ability to foster different aspects of student development has led to various benefits that contribute to academic success: decreased problem behavior, improved prosocial and responsible behavior, ability to regulate emotions, positive sense of self, greater value for schooling and peers' diverse experiences, and motivation for learning (Durlak, Weissberg, Dymnicki, Taylor and Schellinger, 2011; Elias et al., 1997; Lemerise & Arsenio, 2000; Zins, Weissberg, Wang, & Walberg, 2004).

Motivation

Teachers often think about how to keep their students motivated to participate and engage in their learning. While it is commonly believed that motivation is something that students bring into their classrooms, teachers' instruction can shape students' motivation to learn. Motivation theories have been influential in helping understand how teachers can impact student motivation. For example, teachers use rewards, such as prizes, praises,

or grades, to motivate students to participate and successfully complete their tasks. However, research has demonstrated that excessive use of praise or praising students on irrelevant aspects of the task could either become ineffective (Ames, 1990; Brophy, 1983), or eventually drive students to perform well for the sake of receiving rewards (or extrinsic motivation), rather than to satisfy their inherent desire to learn and master the material at hand (or intrinsic motivation). Stipek (1996) argues that teachers must create a learning environment and design tasks that provide students opportunities to develop intrinsic motivation (e.g., increase self-efficacy, or belief that they have the ability to influence their own success in learning, Bandura, 1994) rather than extrinsic motivation (e.g., doing a task to receive good grades), with the end goal of helping students believe they are capable of being successful learners and thus be able to take control of their learning. According to the expectancy-value theory (Eccles & Wigfield, 2002; Wigfield & Eccles, 2000), one way of increasing students' intrinsic motivation is to help students see the value of learning a content (e.g., because it will be useful when I enter college) and to increase their expectations of mastering the content by providing multiple opportunities to succeed in similar tasks.

Other motivation theories have been influential in understanding how teachers and their instruction can positively affect student motivation, which in turn have delineated strategies teachers can use to promote motivation. Designing tasks that are challenging yet solvable, making connections between the material and students' lives and experiences, placing an emphasis on intrinsic motivation by downplaying the importance of grades or other external forms of rewards, offering choices of tasks students can engage in, and provide tasks that lead to concrete accomplishments, helping students set goals that are achievable have shown to relate to student motivation (Ames, 1990; Brophy, 1987; Lepper, 1988; Newby, 1991). Teachers' effective implementation of these strategies require their ability to assess why students might be disengaged and unmotivated to learn. Is the task too challenging or uninteresting for the students? Does the environment not properly support their ability to engage in successful learning? Is the teacher providing proper feedback that helps students toward making progress on their work? Do students perceive their success or failure as being outside of their own control, or do they understand that increased effort can lead to productive learning? Teachers'

familiarity with theories of motivation could help increase their awareness of motivational issues and aid in their efforts to increase and maintain student interest and engagement in their learning.

Psychological Knowledge

Teachers' psychological knowledge was measured using items adapted from *Praxis II: Principles of Learning and Teaching (PLT)*, which is developed by Educational Testing Service (ETS). Praxis is an assessment used by many states to measure knowledge of beginning teachers as part of their licensing and certification process. *Praxis II: PLT* measures test-takers' knowledge of pedagogy which is often expected to be developed from courses in educational psychology or similar fields that address topics around human growth and development, learning processes, diverse learners, classroom management, instruction and assessment, and professional development. The test consists of multiple-choice questions and short-answer questions related to case histories that describe a teaching situation. Permission was obtained by ETS to use items that were publicly available for this dissertation research.

The original test, consisting of 70 multiple-choice questions and four short-answer questions related to two case histories, is expected to take a total of two hours to complete. However, the number of available items used for the study was reduced to 17 multiple-choice questions and three short-answer questions following one case history to decrease the amount of time participants needed to spend to complete the survey. Different versions of the measures were administered to the teachers according to the grade level teachers were teaching or were expected to teach (K-6 for primary, 7-12 for secondary pre-service teachers). Although different versions were used, much of the items were similar and different questions addressed similar topics. The topics were primarily centered around students as learners, instruction and assessment, all of which require application and incorporation of the test-takers' psychological knowledge.

Participant Background

The last section asked participants to provide background information. A copy of this portion of the survey is included in Appendix A.3. In addition to basic information such as major/minor and year in college, participants were asked to provide additional

information that could potentially have had an impact on their knowledge and beliefs about the value of educational psychology. For example, participants were asked to list other psychology courses they had taken prior to or concurrently with educational psychology. Educational psychology instructors were also asked to provide additional information with respect to their professional background such as any K-12 teaching experiences as well as research background and interests.

Procedure

The knowledge and beliefs survey was administered online through Qualtrics. The link to this online survey was provided through a formal invitation to participate via e-mail. The first page of the survey was an assent form ensuring anonymity, which participants were required to ‘sign’ before proceeding and completing the survey.

Pre-service teachers, in-service teachers and educational psychology instructors were invited to participate during the Fall 2012 term. Pre-service teachers were invited to participate at the beginning of the Fall 2012 term for PRE-survey and again at the end of the term for POST-survey. They were invited both in-person and via e-mail wherein they received a link to the online survey that included consent forms to participate in the study. They were given up to three weeks to complete their surveys at each time-point to ensure they had sufficient time to complete them. Multiple measures were taken to ensure as many pre-service teachers as possible participated in the study and completed the survey at both time-points. In addition to providing monetary incentives (through Amazon gift cards) upon their completion of both surveys, educational psychology instructors invited me to distribute paper version of the surveys for them to complete after class. During the classroom visits, they were offered pizza and other snacks – in addition to the Amazon gift cards – upon their completion and submission of their paper surveys.

In-service teachers were invited to participate in the knowledge and beliefs survey only once and were allowed to complete at any time throughout the term, at their convenience. In-service teachers also received monetary rewards for their participation. Previous and practicing educational psychology instructors were also invited to participate in the beliefs survey once throughout the term. Reminder e-mails were sent to all three groups to increase the number of participants. All names and identifying

information was replaced with code numbers and data were securely stored in accordance with IRB regulations.

Summary

This study employed a form of mixed-methods approach, Q methodology, to address the central aim of better understanding different educators' beliefs about the value of their psychological knowledge for teaching. The study primarily used surveys from multiple groups of educators (i.e., pre-service teachers, in-service teachers, educational psychology instructors) affiliated with one university-based teacher education program to explore and compare their beliefs about how their understanding of various psychological domains – human development, learning and cognition, individual/group differences and motivation – can inform different aspects of teaching practices. The following five chapters report the data analysis and results in response to each of the research questions.

CHAPTER 4
STUDY 1 FINDINGS: EXAMINING TEACHERS’
PSYCHOLOGICAL KNOWLEDGE

Overview

An exploration of pre-service teachers’ psychological knowledge and beliefs about its value for their teaching lies at the center of this dissertation, with the goal of better understanding how the field of educational psychology can effectively contribute to teacher education. Two overarching research questions address two components of pre-service teachers’ cognition –psychological knowledge and beliefs about its value for their teaching practices – and the ways in which those beliefs change after taking a teacher education course in educational psychology. Chapter four addresses the first study’s research questions, which examine the first element of teachers’ cognition: psychological knowledge. The first study’s research questions ask: 1a) What happens to pre-service teachers’ (PS) psychological knowledge after taking an educational psychology course? 1b) Do pre-service teachers’ psychological knowledge differ from in-service teachers (IS) who have entered their teaching profession? Thus this chapter looks at 1) changes in pre-service teachers’ psychological knowledge from beginning to the end of the term and 2) comparisons between pre-service teachers and in-service teachers in their psychological knowledge as measured by the knowledge survey. In order to provide context for these results, the chapter begins with a summary of the analysis plan, followed by descriptive statistics for the educator groups who participated in the study.

Analysis Plan

The survey administered to measure participants’ psychological knowledge consisted of 17 multiple-choice questions and three open-ended questions. The answer to each multiple choice was assigned a score of ‘1’ if correct and ‘0’ if incorrect. *Praxis II: Principles of Learning and Teaching (PLT)*’s open-ended questions are scored on a 0-2-

point scale (see Figure 4.1 for a general framework for scoring the responses); blank responses were assigned a score of 0. The framework provided by *Praxis II: PLT* was implemented to score participants' response to the three open-ended questions, for a total possible score of six for this section.

<p>A response that earns a score of 2:</p> <ul style="list-style-type: none">• Demonstrates complete understanding of the parts of the case that are relevant to the question• Responds appropriately to all parts of the question• When an explanation is required, provides a thorough explanation that is well supported by relevant examples• Demonstrates a strong knowledge of pedagogical concepts, theories, facts, procedures, or methods relevant to the question <p>A response that earns a score of 1:</p> <ul style="list-style-type: none">• Demonstrates a basic understanding of the parts of the case that are relevant to the questions• Responds appropriately to one portion of the question• When an explanation is required, provides a weak explanation supported by relevant evidence• Demonstrates some knowledge of pedagogical concepts, theories, facts, procedures, or methods relevant to the question <p>A response that earns a score of 0:</p> <ul style="list-style-type: none">• Demonstrates misunderstanding of the parts of the case that are relevant to the question• Does not respond appropriately to the question• Is not supported by relevant evidence• Demonstrates little knowledge of pedagogical concepts, theories, facts, procedures, or methods relevant to the question <p>No credit is given for blank or off-topic responses.</p>

Figure 4.1 Framework for scoring constructed response

Two raters (one of which included the author) scored the participants' responses. To establish initial reliability, raters selected model responses from a subset of participants' open-ended answers and discussed components of the responses that call for a specific score to ensure same level of understanding of what the different scores entail. The raters then independently scored another set of responses before reconvening to compare scores. Disagreements were discussed before jointly deciding on a final score. This

process was repeated for the rest of the open-ended responses. Weighted Cohen’s Kappa was run to determine the degree of agreement between the two raters. There was good agreement between the two raters’ judgment, $\kappa = .70$ (95% CI (.61 to .79)), $p < .0001$.

Once the total score was calculated (e.g., 17 total possible points from multiple choice questions and 6 total possible points from open-ended responses, for a possible sum total of 23 points), paired samples t-test were used to explore changes in pre-service teachers’ psychological knowledge, and whether such changes were significant. Independent samples t-test was then used to compare pre-service teachers’ POST knowledge score to in-service teachers’ knowledge score. An alpha level of .05 was used for all statistical tests.

Descriptive Statistics for Educator Participants

To provide a context for the study, this section explores the three educator groups and provides descriptives of their background. The survey asked about each teacher participant’s background, including basic demographic information, major/minor, and psychology courses they had taken prior to or concurrently with the educational psychology course offered in their teacher education program (see Table 4.1).

Table 4.1 Demographic Characteristics of Educator Groups

Characteristics	Pre-Service Teachers (<i>n</i> = 30)		In-service Teachers (<i>n</i> = 29)	
	No.	%	No.	%
Level				
Elementary	14	46.7	9	31.0
Secondary	16	53.3	20	69.0
Gender				
Male	4	13.3	10	34.5
Female	26	86.7	19	65.6
Ethnicity				
White	27	90.0	28	96.6
Black	0	0.0	0	0.0
Hispanic	0	0.0	0	0.0
Asian	2	6.7	1	3.4
Other	1	3.3	0	0.0
Education				
Bachelor’s Only			15	51.7
Master’s & Bachelors			14	48.3
Doctorate			0	0.0
Avg. Years of K-12 Teaching			2.97	

A purposive sample of pre-service teachers ($n = 30$) and in-service teachers ($n = 29$), all affiliated with the same university-based teacher education program, completed the knowledge survey. The participants were predominantly white female participants, which is fairly representative of the teachers in the US. Table 4.2 shows that most of the elementary pre-service teachers, with the exception of one, were in the third year of their college; one other elementary pre-service teacher was in her fifth year.

Table 4.2 Pre-Service Teacher Demographics

Gender	Ethnicity	College Level	Major	Minor	Certification
F	White	3 rd year	Elementary Math Education		Elementary
F	White	3 rd year	Mathematics		Elementary
F	White	3 rd year	Education-Language Arts		Elementary
F	White	4 th year	Language Arts		Elementary
F	White	3 rd year	Elementary Education		Elementary
F	White	3 rd year	Language Arts		Elementary
F	White	3 rd year	Mathematics		Elementary
F	White	3 rd year	Mathematics, Integrated Science		Elementary
F	White	3 rd year	Language Arts		Elementary
F	White	3 rd year	Language Arts		Elementary
F	White	3 rd year	Language Arts & Mathematics		Elementary
F	White	3 rd year	Social Studies		Elementary
F	White	3 rd year	Language Arts		Elementary
F	White	3 rd year	Language Arts		Elementary
F	White	4 th year	Social Studies	Psychology	Secondary
M	Other	4 th year	Social studies & History		Secondary
M	White	4 th year	History	French	Secondary
F	White	5 th year	History	Health	Secondary
M	White	4 th year	Political Science	Psychology	Secondary
F	White	4 th year	Mathematics	Psychology	Secondary
F	White	4 th year	Secondary Mathematics Education	Secondary Spanish Education	Secondary
F	White	4 th year	Mathematics	English	Secondary
F	White	4 th year	English	Spanish	Secondary
F	White	4 th year	Psychology & English		Secondary
F	Asian	4 th year	English	Political Science	Secondary
M	White	Master's	Vocal Performance	Biblical Studies	K-12
F	White	4 th year	Spanish, English		Secondary
F	White	Master's	Latin	History	Secondary
F	Asian	Master's	Music Performance, Foreign Language certification		K-12
F	White	4 th year	Arabic, English		Secondary

Most of the secondary pre-service teachers were in the fourth year of their college. One secondary pre-service teacher was in her fifth year, and three were seeking to obtain a Master's degree in addition to certification to teach.

In-service teachers who participated in the study reported an average of 2.97 years in teaching experience, but ranged in the number of years they had taught (from zero to six years, see Table 4.3). 13 of the 29 participants reported having obtained a Master's degree and one had been working towards a Master's degree at the time of their participation.

Table 4.3 In-Service Teacher Demographics

Gender	Ethnicity	Major	Minor	Certification	Years taught
F	White	Integrated Science	Mathematics	Elementary	2
F	White	Mathematics	Language Arts	K-8	1
F	White	Education, Mathematics	Fine Arts	Elementary/ Middle Math	2
F	White	English	Spanish	Secondary	6
F	White	Elementary Education		Elementary	3
F	White	Spanish	Mathematics	K-12	1
M	White	English		Elementary	3
F	White	Elementary Education, Language Arts	Social Studies	K-8	5
F	White	Popular Culture	History of Art, History	K-12	2
F	White	Mathematics	Psychology	Secondary	4
F	White	Chemistry	Mathematics	Secondary	0
M	White	Integrated Science	Mathematics	Secondary	1
M	White	Biology	Music, Spanish	Secondary	2
F	White	Music Education		Secondary	6
M	White	Electrical Engineering		Secondary	4
M	White	Instrumental Music Education		PreK-12	6
F	White	Secondary Education, Social Studies	History	Secondary	0 (5 as sub)
F	Asian	Biology	Music, Spanish	Secondary	2
F	White	Mathematics	Psychology	Secondary	4
F	White	History	Political Science	Secondary	5
M	White	Social Studies	History, Psychology	Secondary	2
M	White	Spanish, Social Studies	Political Science	Secondary	4
F	White	English Literature		K-12	4
M	White	English	Mathematics	Secondary	2
M	White	Mathematics	Psychology	Secondary	2
M	White	English, History		Secondary	2
F	White	French	English	Secondary	4
F	White	English; Education	Spanish	Secondary	5
F	White	English	Psychology	Secondary	2

As can be seen in Table 4.2 and 4.3, there were pre-service teachers ($n = 3$) and in-service teachers ($n = 5$) who minored in Psychology. Interestingly, those who minored in Psychology were teaching or preparing to teach at the secondary level. Thus both prospective and practicing teachers indicated that they had some form of background knowledge of psychology. In fact, pre-service teachers and in-service teachers, many of them at the secondary level, reported having taken psychology courses even though they did not necessarily minor in psychology. Table 4.4 shows the different undergraduate psychology courses they reported having taken.

Table 4.4 Psychology Courses Taken by Pre-Service and In-Service Teachers

Psychology Courses	Pre-Service Teachers		In-Service Teachers		Total	%
	Elementary	Secondary	Elementary	Secondary		
Introduction to Psychology	9	12	7	15	43	72.9
Developmental Psychology	3	5	2	5	15	25.4
Cognitive Psychology	0	6	0	4	10	16.9
Abnormal Psychology	1	3	0	4	8	13.6
Social Psychology	0	2	0	4	6	10.2
Personality Psychology	1	2	0	0	3	5.1
Psychopathology	0	1	0	2	3	5.1
Educational Psychology	0	1	0	1	2	3.4
Political Psychology	1	1	0	0	2	3.4
Gender Psychology	1	0	1	0	2	3.4
Language and Thought	1	0	0	0	1	1.7
Human Behavior	0	0	0	1	1	1.7
Physiological Psychology	0	0	0	1	1	1.7
Child Psychology	0	0	0	1	1	1.7
High School AP Psychology	6	2	1	3	12	20.3

The largest percentage of pre-service and in-service teachers reported having taken an introduction to psychology, followed by developmental psychology, cognitive psychology, abnormal psychology and social psychology. At least 20% of pre-service and in-service teachers had also taken Advanced Placement Psychology in high school. With the exception of a few educators (one pre-service teachers and three in-service teachers), the educator participants had begun to develop their psychological knowledge prior to taking the educational psychology course offered by the teacher education program.

Educational psychology instructors were also asked to provide background information. In addition to demographic information, the survey sought additional information with respect to their professional background, specifically with respect to their experience, if any, in teaching at the K-12 and college level. Table 4.5 provides demographic information for the instructors.

Table 4.5 Educational Psychology Instructor Demographics

Gender	Ethnicity	Major (Minor)	Master's Degree	Certified To Teach K-12?	Years taught K-12	Years taught Ed Psych
F	White	Psychology	Psychology	Yes	3	3
F	Black	Psychology	Psychology	No	0	1
M	Hispanic	Psychology	Developmental Psychology	No	0	1
F	White	Psychology (Special Ed)	Psychology	No	0	1
F	White	Elementary Ed; Child Development	Developmental Psychology; Cognitive Psychology; Curriculum and Instruction	Yes	7	1
M	Black	Psychology	Urban Education	Yes	5	10
F	Other	Psychology (Music)	Developmental Psychology	No	0	27
F	White	Psychology (Education)	Psychology	No	0	1
F	White	Elementary Education and Psychology	Developmental Psychology	No	0	15
M	White	Physics	Science Education	No	0	2

Educational psychology instructors who partook in the study were also predominantly white female participants. Three of the ten instructors were doctoral candidates at the time they completed the survey, while the rest had obtained their doctoral degrees. Furthermore, three instructors reported having had at least three years of K-12 teaching. Across the group, they ranged in their years of experience teaching educational psychology courses, from one year to 27 years.

Findings 1a: Comparing Changes in Pre-Service Teachers' Psychological Knowledge

Comparison of changes in pre-service teachers' ($N = 30$) mean scores by the education level they were preparing to teach is shown in Table 4.6.

Table 4.6 Independent Samples T-Tests Results to Compare Pre-Service Teachers' Changes in Psychological Knowledge by Education Level

	Elementary		Secondary		t-value
	Mean Score	SD	Mean Score	SD	
PRE-Survey	13.79	3.95	15.81	3.47	-1.50
POST-Survey	14.14	3.68	16.81	3.39	-2.07*

Note. Negative value in change of mean indicates an increase in variable. An * indicates significance at $p < .05$.

Even though significance was not detected when comparing pre-service teachers' overall mean scores on their PRE and POST psychological knowledge survey, there was a significant difference when comparing elementary pre-service teachers' mean scores to secondary pre-service teachers' mean scores. Independent samples t-test showed that secondary pre-service teachers had a higher mean score at the beginning and at the end of the term. Significance was detected when comparing secondary pre-service teachers' ($N = 16$) mean score ($M = 16.81$, $SD = 3.39$) to elementary pre-service teachers ($N = 14$; $M = 14.14$, $SD = 3.68$) at the end of the term, $t(28) = -2.07$, $p < .05$.

Findings 1b: Comparing Pre-Service Teachers' and In-Service Teachers' Psychological Knowledge

The average mean scores of pre-service teachers and in-service teachers by the school level they were preparing to teach (or were teaching) are shown in Table 4.7.

Table 4.7 Comparison of Pre-Service Teachers' and In-Service Teachers' Mean Scores

Teacher Status	School Level	N	Mean Score	SD
Pre-Service Teachers	Elementary	14	14.14	3.68
	Secondary	16	16.81	3.39
	Total	30	15.57	3.72
In-service Teachers	Elementary	9	17.56	3.09
	Secondary	20	15.90	3.24
	Total	29	16.41	3.24

Two-way ANOVA was conducted to examine the effect of teacher status (pre-service vs. in-service) and school level (elementary vs. secondary) on participants' mean psychological score. There was a statistically significant interaction between the effect of status and school level on the mean score of knowledge survey, $F(1, 55) = 5.59, p = .02$ (see Figure 4.2).

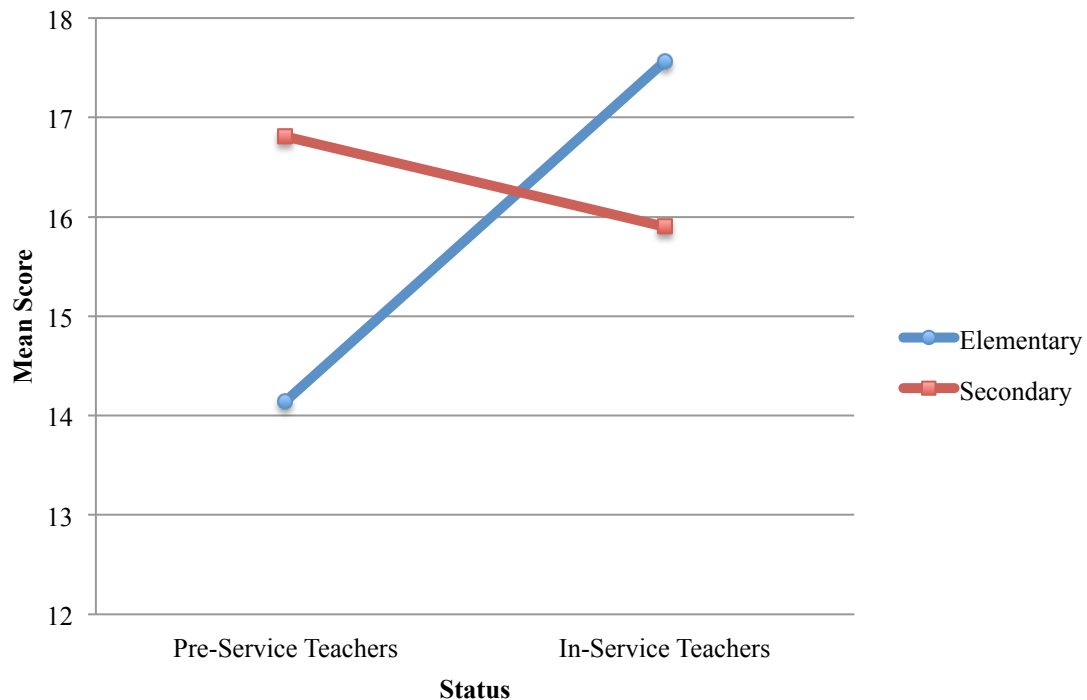


Figure 4.2 Mean scores between pre-service and in-service teachers by school level

Simple main effects analysis showed that in-service elementary teachers ($M = 17.56$) showed higher mean score than pre-service elementary teachers ($M = 14.14$), and this difference was significant $F(1,55) = 5.62, p < .05$.

Summary and Discussion

This chapter sought to describe characteristics of educator participants and analyzed pre-service teachers' and in-service teachers' psychological knowledge to better understand the context in which the study took place. Participants were predominantly white and female, which is representative of educators in the US. The three educator groups (pre-service teachers, in-service teachers and educational psychology instructors)

also showed variation in their academic backgrounds and certification. Interesting to note is that more pre-service teachers and in-service teachers at the secondary level reported having minored in psychology and indicated to have taken more psychology courses than elementary pre-service teachers and in-service teachers.

Analysis of changes in pre-service teachers' mean scores and differences between pre-service teachers' and in-service teachers' mean scores from the psychological knowledge survey indicated significant differences from pre-to-post. This was particularly the case when comparing mean scores by school level (elementary vs. secondary). Comparison of elementary and secondary pre-service teachers' mean scores at both time points shows that secondary pre-service teachers' mean score continued to be higher than elementary pre-service teachers' mean score. This difference was statistically significant at the end of the term. In examining teacher participants' background, a greater number of secondary pre-service teachers reported having minored in Psychology. A greater number of secondary pre-service teachers also took more psychology courses. Their greater exposure to psychology could have attributed to a higher mean score compared to elementary pre-service teachers. Comparison of pre-service teachers' mean score to in-service teachers' mean score while taking into account the school level they were teaching showed that while secondary pre-service teachers scored higher than secondary in-service teachers, elementary in-service teachers scored higher than elementary pre-service teachers, the latter of which was statistically significant.

Although results suggested an increase in pre-service teachers' knowledge score after taking an educational psychology course, the mean scores were relatively low and the difference was not significant. In light of these results, it is worth considering the nature of the survey items used to assess teachers' psychological knowledge. As discussed in Chapter 3, items were adapted from *Praxis II: Principles of Learning and Teaching (PLT)*, which consists of 70 multiple-choice questions and four constructed-response questions. The knowledge survey used for this study included 17 multiple-choice questions and three constructed-response, which is a small percentage and may not have been sufficient providing participants the opportunity to showcase their knowledge. Increasing efforts are being made to develop assessments that more validly

and reliably measure teachers' PPK (Voss et al., 2011), which could be used in future studies to better capture teachers' development of their psychological knowledge.

Experience in the classrooms can also possibly influence psychological knowledge. This particularly appears to have been the case for elementary teachers, as indicated by significant differences in scores between elementary pre-service and elementary in-service teachers. Even though the difference was not statistically significant for secondary in-service teachers, their lower mean score compared to secondary pre-service teachers' mean score could possibly be attributed to the more content-focused nature of teaching at the secondary level. Whereas elementary teachers generally teach the same group of students throughout the day, secondary teachers spend significantly less time with a larger number of students. This often leads to secondary teachers attending more to the content that needs to be taught to the students in the limited time they have. This may lead to a decreased opportunity to apply psychological knowledge to their work of teaching. However, longitudinal studies exploring teachers' transition from teacher education programs to formal classroom settings would further our understanding of their development of psychological knowledge. It is also worth considering the relatively small sample size when examining the results. Further studies with a greater number of participants could strengthen our understanding of how pre-service teachers' development of their psychological knowledge as a result of taking educational psychology courses catered to their needs and how they compare to in-service teachers who have had more opportunity to apply their psychological knowledge in the classrooms.

CHAPTER 5

STUDY 2 FINDINGS: EXPLORING BELIEFS ABOUT THE VALUE OF PSYCHOLOGICAL KNOWLEDGE FOR THE WORK OF TEACHING

Overview

The second study explored beliefs about the value of psychological knowledge. In addition to comparing pre-service teachers' beliefs to those of in-service teachers, the study also compared the beliefs of instructors who have taught educational psychology to pre-service teachers – though not necessarily to those who participated in the study. The research questions for this portion of the study are: 2a) What happens to pre-service teachers' beliefs about the value of their psychological knowledge after their educational psychology coursework? 2b) Are pre-service teachers' beliefs aligned with what educational psychology instructors are trying to communicate as important and are they aligned with the beliefs of in-service teachers who have entered their teaching practice? This chapter explores the three educator groups' beliefs in the ways in their psychological knowledge of the four principal domains – learning/cognition, individual/group differences, human development and motivation – would inform or influence their work of teaching. The chapter begins by reviewing the analysis plan, followed by a summary of findings. A more extensive discussion of findings for individual educator groups and similarities within and between these groups are included in Appendices B through E.

Analysis Plan

Addressing the second study's research questions primarily involved the exploration of participants' Q sorts representing their beliefs about the role of educational psychology to teacher learning and teaching. As discussed in Chapter 3, Q analysis helps to compare each participant's overall configuration of his or her Q sorts, rather than by individual items. Such analysis provides information about the similarities and differences in participants' *beliefs structure* at a more holistic level; participants clustered

together and located on the same factor show similarities in their beliefs through the ways in which they sorted items in relation to one another.

Study 2 used the same survey with four Q sorting tasks. Study 2a explored how pre-service teachers' beliefs about the value of psychological knowledge changed across time. Study 2b studied how pre-service teachers' beliefs after taking an educational psychology course compared to those of educational psychology instructors and in-service teachers. The completed Q sorts for each domain were entered and analyzed using PQ Method software (freeware, Schmolck, 2002). Q sorts for each participant group (i.e., pre-service teachers, in-service teachers, educational psychology instructors) were analyzed independently; pre-service teachers' Q sorts from the beginning of the term were analyzed separately from pre-service teachers' Q sorts from the end of the term, which was also analyzed separately from in-service teachers' Q sorts, and separately from educational psychology instructors' Q sorts. Analysis of Q sorts involved generating correlation matrix, with each Q sort, rather than individual statements, having been correlated with the other Q sorts. The correlation matrix was then submitted to principal components analysis with varimax rotation to find the simplest structure in the data that can explain the greatest amount of variance (Brown, 1980). Each Q sort was then flagged based on its significant loading (or lack thereof) onto one of the factors emerged from analysis. The set of factors that emerged from analysis of each time point (for pre-service teachers) and each educator group was then compared through qualitative exploration.

Q sort analysis yields an overall configuration of each participants' Q sorts, which includes both negative and positive ranking of items as they relate to participants' beliefs about the degree to which their psychological knowledge would be more (indicated by positive ranking) or less (indicated by negative ranking) helpful in relation to one another. The final step of Q methodology involves a qualitative summary and interpretation of the overall configuration representative of each factor that emerged from analysis. Interpretation of each factor includes a more holistic account of the Q sort and discusses both the positive and negative rankings in ways that distinguish each factor from one another. For this study, comparisons of factors across PRE and POST-surveys and between the groups of educators focus on patterns that emerged with respect to their beliefs about the specific teaching practices for which their psychological knowledge of

different domains would be *more* helpful (as indicated by positive rankings). Through this, the goal is to highlight what might be of greater interest and importance in trying to compare the beliefs about ways in which psychological knowledge of the different domains are perceived to be more useful. The findings, along with an in-depth explanation and discussion of the findings are included in Appendices B through E. This chapter uses the instructional triangle (see Table 5.1; Cohen, Raudenbush & Ball, 2003) as a framework to summarize and organize the findings.

Table 5.1 Mapping High-Leverage Teaching Practice Onto Instructional Triangle

High-Leverage Teaching Practice	Instructional Triangle
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	Teacher-Content
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	Teacher-Content
Evaluating, choosing and modifying curriculum materials and learning tasks to accomplish a specific learning goal	Teacher-Content
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	Teacher-Content
<u>Reflecting on & analyzing instruction in order to improve its effectiveness</u>	Teacher-Content
Encouraging students to share their thinking and using that using that information to evaluate their understanding of academic content	Student-Content
Recognizing common patterns of student thinking in a particular subject	Student-Content
Using appropriate methods to check for student understanding and monitor student learning	Student-Content
Developing and selecting appropriate assessments (i.e., quizzes, tests, projects), and interpreting results of the assessment to inform future instruction	Student-Content
Setting long- and short-term learning goals for students that are appropriately sequenced and aligned with district standards	Student-Content
<u>Designing a sequence of lessons toward specific goals</u>	Student-Content
Leading a whole-class discussion about academic content that encourages students to listen and respond to one another	Student-Student
Setting up and managing small group work to promote individual and group learning	Student-Student
Purposefully engaging in non-academic conversations with individual students to build relationships	Teacher-Student
Providing verbal and written feedback to students to help them improve their academic work	Teacher-Student
Establishing norms and routines for how students should talk and work with each other to build knowledge of academic content	Environment (inner circle)
Establishing organizational routines, procedures and strategies to maximize time available for student learning	Environment (inner circle)
Communicating with parents or guardians to promote their child's success in and out of school	Environment (outer circle)

The instructional triangle, as discussed in the first two chapters, helps map out the similarities and differences in educators' beliefs about how their psychological knowledge of each of the four domains can help teachers address one or more of the interactions between teachers, a specific group of students and particular content situated in a particular environment, each of which has important implications for teaching. It is important to note that the high-leverage teaching practices are not exclusive to one particular interaction. Each teaching practice can influence more than one interaction at any given time under various contexts or situations. Mapping out the teaching practices is an attempt to make sense of the complex sets of beliefs that emerged from analyses of the educator participants' Q sorts.

Findings 2.1a: Changes in Pre-Service Teachers' Beliefs about the Value of their Psychological Knowledge of Learning/Cognition

Preview

Three factors representing common sets of pre-service teachers' beliefs emerged at the beginning of the term, with twelve items that were positively ranked across the three factors. At the end of the term, four factors emerged and fourteen items were positively ranked across the factors. Of these, factors of pre-service teachers from both time points positively ranked nine of the items. Given that each factor represents a common set of beliefs with respect to their values of their psychological knowledge of learning for their teaching, the increase in number of factors indicates a more diverse range in common viewpoints about teaching practices for which pre-service teachers believed their understanding of learning/cognition would be helpful.

While the number of factors increased from PRE- to POST-term, comparison of positive ranking of items from beginning to end of the term indicate that pre-service generally continued to value their psychological knowledge of learning/cognition for ensuring students build a clear understanding of content by planning and preparing their instruction and resources, effectively using explanation, modeling, representations and examples, and evaluating student thinking to ensure they make progress toward learning goals. However, other shifts indicate that whereas some of the pre-service teachers

emphasized value of their knowledge for communicating about student learning with their students and for analyzing and communicating about their instruction with other professionals in education at the beginning of the term, by the end of the term more pre-service teachers showed emphasis of their value on providing opportunities for students to share and respond to one another's thinking and, to a lesser degree, on designing a sequence of lessons toward specific learning goals and communicating effectively with parents or guardians about student learning.

Exploring Changes in Pre-Service Teachers' Beliefs

Mapping the positively ranked items onto the instructional triangle shows that pre-service teachers continued to believe their psychological knowledge of learning/cognition would help strengthen teacher-content relationship and student-content relationship (as shown by boldfaced black arrows in Figure 5.1). The following teaching practices were positively ranked at both time points:

- Making academic content clear through the use of explanation, demonstrations, illustrations and examples
- Using appropriate instructional strategies to support, extend, or change common patterns of student thinking
- Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal
- Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction
- Recognizing common patterns of student thinking in a particular subject
- Using appropriate methods to check for student understanding and monitor student learning
- Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards

Based on the ranking, their understanding of how students learn was perceived to help determine what their aims for their students should be with respect to setting learning goals for their students and sequencing lessons to ensure students reach those goals, evaluating what appropriate approaches, strategies and materials for presenting content would best help students understand the topic at hand, and assessing whether students successfully understood what was taught.

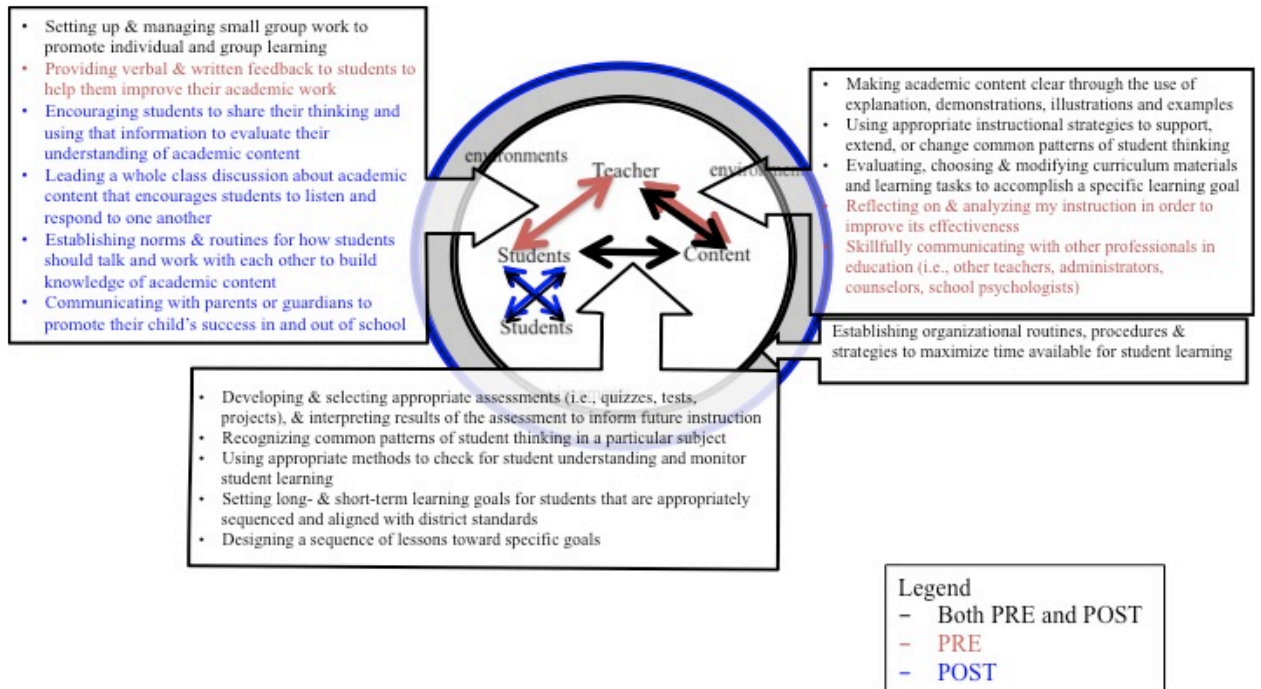


Figure 5.1 Mapping pre-service teachers' value of psychological knowledge of learning/cognition to the instructional triangle

To a lesser degree, pre-service teachers at both time points also believed this knowledge would enhance their ability to create a classroom environment that fosters student learning (as shown by the boldfaced black inner circle) and to strengthen student-student relationship, though more so at the small group level.

- Setting up & managing small group work to promote individual and group learning
- Establishing organizational routines, procedures & strategies to maximize time available for student learning

Thus according to pre-service teachers' positive rankings at the beginning and end of the term, psychological knowledge of learning was perceived to serve as a framework with which they can consider where they want their students to be by the end of a lesson/term/etc., where their students currently are in relation to where they want them to be, how they can help students reach their identified potential by establishing an environment and opportunities conducive to learning, etc. These practices can in turn strengthen the student-content and teacher-content relationship, both of which are vital to strengthening one another (e.g., understanding how students are interacting with the content, as informed by their knowledge, can help develop their relationship with content

with respect to their awareness of how curriculum and various instructional strategies can influence students' understanding of the content).

Differences in pre-service teachers' positive ranking of items from beginning to the end of the term showed distinct patterns in the ways their beliefs about the value of their understanding of learning/cognition shifted across the two time points. At the beginning of the term, pre-service teachers considered the role of their knowledge of learning in further enhancing the teacher-content relationship, particularly with respect to their professional development:

- Reflecting on & analyzing my instruction in order to improve its effectiveness
- Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)

They also showed value of knowledge for strengthening teacher-student relationship in terms of their ability to clearly communicate with students in ways that help them understand their progress in their learning and how they can advance in their understanding of the content:

- Providing verbal & written feedback to students to help them improve their academic work

By the end of the term, pre-service teachers placed a greater emphasis on the role of their knowledge in further strengthening their ability to facilitate student-student relationship as well as their own teacher-student relationship, as represented by the following items:

- Encouraging students to share their thinking and using that information to evaluate their understanding of academic content
- Leading a whole class discussion about academic content that encourages students to listen and respond to one another
- Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content
- Designing a sequence of lessons toward specific goals
- Communicating with parents or guardians to promote their child's success in and out of school

These rankings indicate a shift in pre-service teachers' focus on the role of their psychological knowledge in fostering not only individual learning, but also collective learning (Vygotsky, 1978). In addition to facilitating students' discourse with one another, few pre-service teachers showed greater value of knowledge for the ability to communicate effectively with students' parents about issues around their learning. Not

only can teachers serve as resources for students' parents with respect to providing accurate information about issues related to students' learning, but parents can also be resources for teachers by obtaining information about students' culture, experiences and interests, all of which have important implications for students' learning. Understanding what entails successful learning can help teachers meaningfully attend to important environmental factors (e.g., home environment, culture, etc.) that impact student learning through their interactions with both students and parents. Thus by the end of the term, pre-service teachers had begun to consider learning as not only an individual process but also as a social process which in turn could support their efforts to facilitate both individual and social learning.

Summary of Findings 2.1a

Analysis of pre-service teachers' Q sorts yielded an increase in factors representing common patterns of beliefs about the value of psychological knowledge of learning/cognition, representing a wider array of teaching practices for which pre-service teachers believed their understanding of knowledge would be more or less helpful. Despite the increase in factors from three to four factors, value of knowledge specifically for strengthening teacher-content and student-content relationships continued to exist as they positively ranked teaching practices around preparing, implementing and modifying instructional strategies and resources to build students' understanding of content. They also continued to believe their knowledge would be helpful for evaluating student thinking to ensure they continue to make progress in their learning.

Examination of differences in positive rankings across the factors indicate that at the beginning of the term, there was a greater emphasis on the value of knowledge for addressing teacher-student relationship by communicating effectively with their students about their learning as well as for their own relationship with content by reflecting on, analyzing, and communicating about teaching and learning with other professionals in education. By the end of the term, however, positive value of knowledge shifted to teaching practices around facilitating opportunities for students to work collectively both at the small-group and whole-class level, designing well-sequenced lessons, and communicating effectively with students' parents in their joint efforts to promote successful student learning.

Findings 2.1b: Comparing Pre-Service Teachers' Beliefs About the Value of Psychological Knowledge of Learning/Cognition to Educational Psychology Instructors and In-Service Teachers

Preview

One factor emerged from analysis of educational psychology instructors' Q sorts, with all ten instructors' Q sorts loading onto the factor. Three factors emerged from analysis of in-service teachers' Q sorts. In comparing the three educator groups – pre-service teachers, in-service teachers and educational psychology instructors – they generally shared in their beliefs that their psychological knowledge of learning would be more helpful for determining and modifying appropriate means to present content to students and attend to students' progress in the development of their understanding of the content. Some pre-service teachers however emphasized the value of knowledge for promoting and facilitating opportunities for students to contribute to one another's learning whereas some in-service teachers emphasized the value of knowledge for their own ability to interact with students by providing appropriate feedback about their learning as well as engaging in non-academic conversations to gain understanding of and integrate students' personal experiences and goals.

Comparing Pre-Service Teachers', In-Service Teachers' and Educational Psychology Instructors' Beliefs

In-service teachers and educational psychology instructors positively ranked six of the teaching practices that were positively ranked by pre-service teachers (as indicated by black boldfaced arrows; see Figure 5.2). These teaching practices include:

- Making academic content clear through the use of explanation, demonstrations, illustrations and examples
- Using appropriate instructional strategies to support, extend, or change common patterns of student thinking
- Using appropriate methods to check for student understanding and monitor student learning
- Recognizing common patterns of student thinking in a particular subject
- Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction
- Designing a sequence of lessons toward specific goals

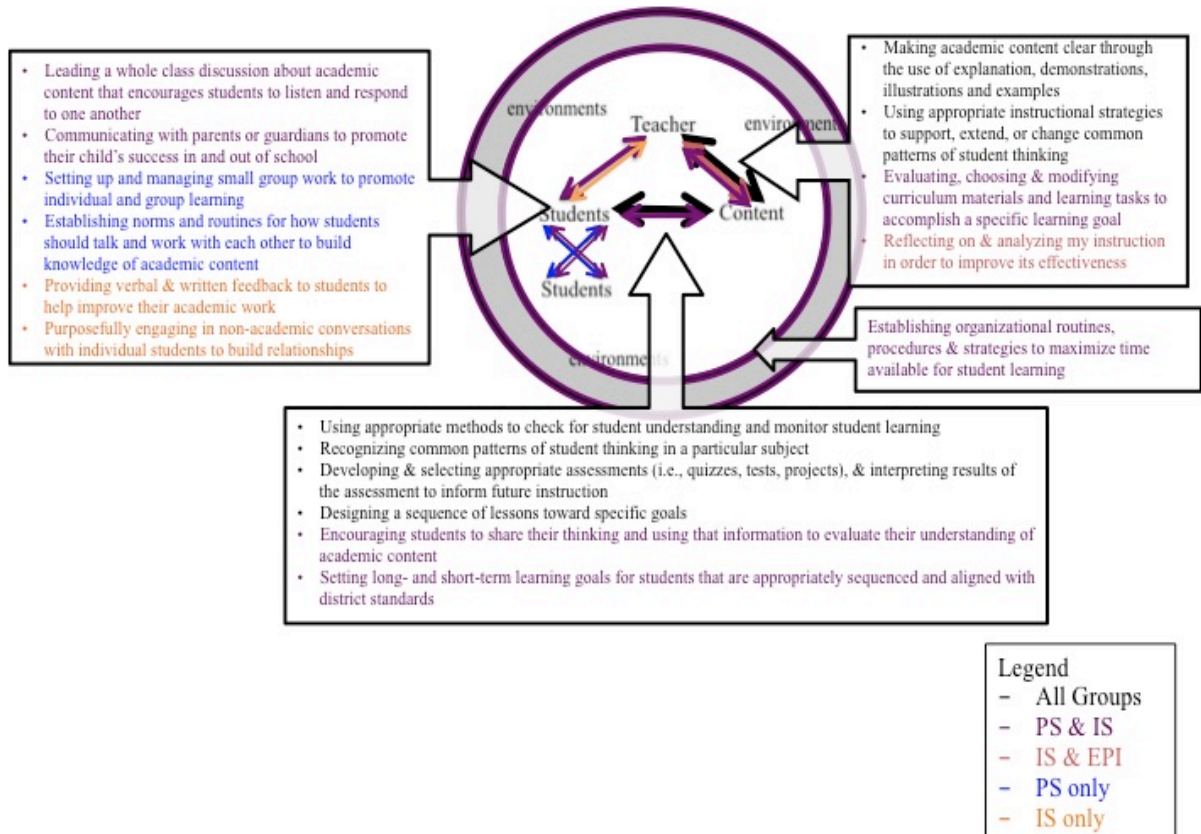


Figure 5.2 Mapping educators' value of psychological knowledge of learning/cognition to the instructional triangle

These reinforce pre-service teachers' beliefs that their understanding of knowledge would strengthen teacher-content and student-content relationships. Mainly, their understanding of student learning was identified as more helpful for teaching practices that involve designing, selecting, and modifying strategies for promoting and evaluating students' progress in their learning. Pre-service teachers and in-service teachers expanded on the role of their knowledge in enhancing these relationships:

- Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal
- Encouraging students to share their thinking and using that information to evaluate their understanding of academic content
- Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards

In-service teachers, along with educational psychology instructors, further showed value of knowledge of learning for supporting teacher-content relationship, believing their

knowledge would enhance their efforts to effectively reflect on and analyzing their instruction.

In addition to elaborating on these practices around using appropriate instructional strategies and methods for evaluating student learning, pre-service teachers and in-service teacher shared in their beliefs that the same knowledge would also be helpful for supporting student-student and teacher-student relationships:

- Leading a whole class discussion about academic content that encourages students to listen and respond to one another
- Communicating with parents or guardians to promote their child's success in and out of school

Connecting knowledge of learning to these teaching practices, combined with establishing organizational norms and routines to maximize student learning, point to pre-service and in-service teachers' consideration for ways in which their understanding can effectively help them recognize and address the important role of various environments, both in and outside of the classroom context, in fostering student learning.

However, while pre-service teachers elaborated on their value of knowledge for promoting collaborative work (setting up & managing small group work to promote individual and group learning and establishing norms & routines for how students should talk and work with each other to build knowledge of academic content) in-service teachers focused on teaching practices around their interaction with students by communicating with them around both academic and non-academic. Altogether, psychological knowledge of learning/cognition was identified by all educator groups as particularly helpful for teaching practices around fostering and evaluating students' learning. On the other hand, the value of knowledge for fostering collective learning (student-student and teacher-student relationships) was recognized by in-service teachers and to a greater degree pre-service teachers; this sheds light to their recognition of learning as not only an individual process, but also as a social process wherein students can be valuable resources for one another's learning.

Summary of Findings 2.1b

Pre-service teachers' and in-service teachers' Q sorts positively ranked a greater number of the same items compared to educational psychology instructors' Q sorts. Comparison of the factors that emerged from analyses of all educator groups' factors

however shows that the educator groups shared in their value of their psychological knowledge of learning/cognition for teaching practices that strengthen student-content and teacher-content relationships: evaluating, selecting and modifying appropriate strategies to present content to students and to evaluate and determine students' progress in their learning. Pre-service teachers' and in-service teachers' Q sorts positively ranked teaching practices that elaborated on these relationships while also considering those that foster student-student relationship around academic content and creating a supportive learning environment: setting appropriate short- and long-term learning goals, encouraging students to share and respond to one another's thinking during whole class discussion, and establishing organizational norms and routines to maximize opportunities for learning. Despite these similarities, pre-service teachers and in-service teachers identified different teaching practices for which they believed their knowledge would also be particularly helpful. In the case of pre-service teachers, their Q sorts identified value of knowledge for managing students' relationship with one another around academic content, particularly at the small group level. In contrast, in-service teachers emphasized on the value of their knowledge for their own relationship with students by engaging in both academic and non-academic conversations to attend to and integrate students' personal experiences and goals to maximize opportunities for successful learning.

Summary of Study 2.1

Understanding how students learn has significantly evolved from perceiving learners as passive receivers of knowledge to active constructors of meaning and knowledge. Students' learning is made more complex by the fact that it is influenced by the context in which learning takes place. This shift in how learning is defined has had great implications for teachers and the range of decisions they must make to support their students' learning. Supporting students' learning requires teachers to make complex decisions around what they believe students would want to and need to learn, how to help students' transfer and apply new knowledge and skills, what ideas or concepts might be particularly difficult, the degree to which students' previous experience or knowledge could facilitate or hinder their understanding of new ideas, how to integrate the curriculum with students' personal backgrounds, how to communicate to students why

what they learn is important, how to determine whether students understand what is being taught, etc. Addressing these important issues entails understanding students as learners.

The perceived applicability of one's psychological knowledge of learning/cognition appeared to have been fairly consistent both across time for pre-service teachers and between pre-service teachers, in-service teachers and educational psychology instructors. From the beginning to the end of the term, pre-service teachers in general showed value of their knowledge for teaching practices that involve ensuring students build a clear understanding of the content through strategies for presenting content and integrating curriculum materials as well as for evaluating student learning. Comparison of shifts in positive rankings of items from beginning to the end of the term shows that whereas greater emphasis on the value of knowledge was placed on effectively communicating with students about their learning and for discussing their teaching with other professional teachers at the beginning of the term, by the end of the term greater emphasis was placed on a more diverse range of teaching practices that include providing opportunities for students to share and respond to one another's thinking, designing a sequence of lessons toward specific learning goals, and communicating with parents or guardians about student learning.

One finding of note is the single factor that emerged from analysis of educational psychology instructor Q sorts, with all ten instructors' Q sorts loading onto the factor. The single factor suggests a consensus among all instructors in their beliefs about how one's knowledge of learning would be particularly helpful. This consensus is noteworthy because analyses of educational psychology instructors' Q sorts in relation to other domains of educational psychology yielded multiple factors representing a more varied set of beliefs about how psychological knowledge could inform teaching practices. This suggests that compared to other domains of educational psychology, educational psychology instructors shared a more focused set of teaching practices for which they believed teachers' understanding of learning would be particularly helpful. These teaching practices centered around designing, planning, implementing, and evaluating instruction and learning. Although the existence of a single factor among educational psychology instructors is interesting, further studies exploring a wider population of educational psychology instructors from various teacher education programs would be

beneficial. Doing so would help determine whether this common set of beliefs is representative of how all instructors' value psychological knowledge of learning, or is more specific to a group of instructors who are prepared within a specific program to teach a particular educational psychology course within that teacher education program.

Although there wasn't a single factor related to teaching practice that each educator group believed would be enhanced by knowledge of learning, multiple pre-service teacher factors and in-service teacher factors, like the single educational psychology instructor, showed value of knowledge for supporting and evaluating students' development of understanding of academic content. Pre-service teacher factors and in-service teacher factors elaborated on these practices by also showing value of knowledge for fostering student interaction with one another, their own interaction with students' parents and guardians, as well as for designing instruction with respect to setting learning goals and sequencing their lessons accordingly. Despite these shared beliefs, pre-service teacher factors' Q sorts placed additional emphasis on the value of knowledge for facilitating and managing opportunities for students to engage with one another while in-service teacher factors' Q-sorts placed a greater emphasis on their value of knowledge for their own interaction with their students. These differences shed light on pre-service teachers' and in-service teachers' beliefs that extend beyond making connections between psychological knowledge of learning and teaching practices around supporting and evaluating students' interaction with the content; the factors that emerged suggest their consideration of learning as a social process, wherein students' interaction with one another as well as their interaction with teachers within a particular context impact their construction of understanding of the content at hand. The extent to which educational psychology courses and/or experiences in the classroom have an impact in framing learning as a social process merits further examination. Relatedly, future studies can consider the extent to which psychological principles around learning can help provide teachers a framework within which they can support students' engagement with one another in ways that foster each others' learning.

Findings 2.2a: Changes in Pre-Service Teachers' Beliefs about the Value of their Psychological Knowledge of Individual/Group Differences

Preview

Three factors emerged both at the beginning and end of the term. While thirteen teaching practices were positively ranked across the three factors at the beginning of the term, fourteen were positively ranked across the three factors at the end of the term. Factors from both time points positively ranked eleven of these teaching practices. Comparison of these factors indicate that all factors at the beginning and end of the term valued psychological knowledge of individual/group differences for aspects of teaching practices that involve establishing an environment and strategies conducive to students' interaction with one another around academic content, assessing student learning, and communicating with students and parents.

Differences in positively ranked items show that at the beginning of the term, pre-service teachers placed a greater emphasis on the value of knowledge for considering how they can enhance students' interaction with the content through their ability to select appropriate instructional strategies, and curriculum materials and learning tasks to challenge students towards their learning goal. By the end of the term, pre-service teachers' beliefs not only expanded on students' relationship with the content but also considered their relationship with the content and the greater learning environment, as they emphasized on the value of their knowledge for sequencing lessons, reflecting on and analyzing their instruction, and establishing organizational routines and strategies that help maximize opportunities for student learning.

Exploring Changes in Pre-Service Teachers' Beliefs

Pre-service teachers' positive ranking of items from pre- and post-survey shows an emphasis on the value of their psychological knowledge of individual/group differences for strengthening teacher-student and student-student interactions (see Figure 5.3):

- Encouraging students to share their thinking and using that information to evaluate their understanding of academic content
- Providing verbal & written feedback to students to help them improve their academic work

- Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content
- Purposefully engaging in non-academic conversations with individual students to build relationships
- Setting up & managing small group work to promote individual and group learning
- Communicating with parents or guardians to promote their child's success in and out of school
- Leading a whole class discussion about academic content that encourages students to listen and respond to one another

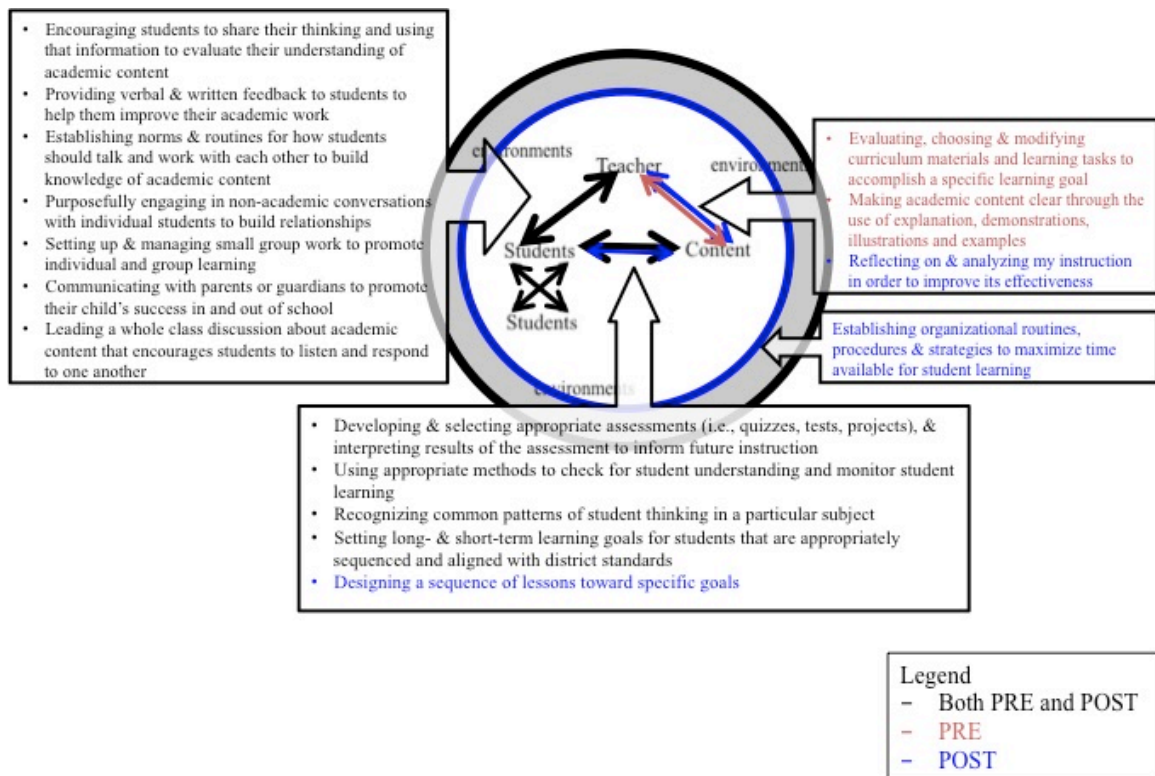


Figure 5.3 Mapping pre-service teachers' value of psychological knowledge of individual/group differences to the instructional triangle

These positive rankings suggest the belief that understanding individual and group differences would enable teachers to attend to aspects of teaching that involve building meaningful relationships among and with students in ways that help build a respectful and collaborative environment. Learning about individual and group differences and how these differences impact their behaviors and approaches to learning may have reinforced the initial beliefs that such psychological knowledge can help establish a productive means to communicate with students and parents; it could guide them in initiating and

maintaining purposeful interactions through which they can gain access to the different experiences, meanings, and strengths each students bring to the class. At the same time, it can enable teachers to effectively communicate care and interest such that students feel valued as members of the learning community.

In addition to these teaching practices, pre-service teachers at both time points considered the value of their knowledge for attending to students' relationship with the content through their use of both summative and formative assessments:

- Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction
- Using appropriate methods to check for student understanding and monitor student learning
- Recognizing common patterns of student thinking in a particular subject
- Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards

The different forms of diversity students bring to class (e.g., cultural, gender, learning styles, motivation) call for the ability to assess students in various way to ensure all students attain their learning goals. Thus the positive ranking of these items indicates their belief that sensitivity to diversity can help provide various and equal opportunities for students to showcase their learning which in turn ensures teachers have sufficient evidence to determine quality of students' interaction with the content.

Differences in positively ranked items from pre to post showed a small shift in teaching practices for which they believed their knowledge of individual/group differences would be helpful. At the beginning of the term, at least one factor at the beginning of the term showed value of knowledge for supporting student learning, as they positively ranked the following:

- Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal
- Making academic content clear through the use of explanation, demonstrations, illustrations and examples

This indicates the belief that understanding issues around diversity can enhance their ability to consider each students' progress, interests and needs in conjunction with questions or ideas a particular method or material would raise. Thus their psychological knowledge of individual/group differences could help incorporate various strategies and

materials that ensure students have ample opportunities and resources to learn and contribute to one another's learning.

By the end of the term, pre-service teachers believed their knowledge of individual/group differences could address a greater range of relationships: teacher-content relationship, student-content relationship, and their relationship with the classroom environment:

- Designing a sequence of lessons toward specific goals
- Establishing organizational routines, procedures & strategies to maximize time available for student learning
- Reflecting on & analyzing my instruction in order to improve its effectiveness

This shows an expansion in pre-service teachers' beliefs about the ways in which their understanding and sensitivity to individual and group differences could positively influence their teaching. For one, attending to individual and group differences could help appropriately sequence lessons, which is critical in ensuring students experience success in their learning and focus on their longer-term learning goals. Pre-service teachers' positive ranking also suggests this knowledge would help create a learning environment that recognizes students' social and cultural perspectives that can lead to a sense of belonging that contributes to active engagement and learning (e.g., Willms, Friesen & Milton, 2009). Lastly, their awareness of individual/group differences and its impact on students' response to instruction and learning could influence the ways in which they examine their own beliefs, attitudes and assumptions of different students in ways that could inform their instruction.

Summary of Findings 2.2a

Analysis of Q sorts from the beginning to the end of the term showed continued emphasis on the role of knowledge of individual/group differences in fostering and facilitating students' academic discourse and collective work with one another, building and maintaining their own relationships with students and parents, and attending to student learning through appropriate forms of assessment. Differences in PRE- and POST-term's Q sorts' positive rankings on the other hand point to a greater emphasis placed at the beginning of the term on the value of knowledge for evaluating, selecting and modifying appropriate strategies for presenting content and curriculum materials to support students' progress toward learning goals. By the end of the term, this emphasis

shifted to greater consideration of the connection between knowledge and more overarching aspects of teaching practices, which included sequencing lessons appropriately, reflecting on and analyzing instruction, and developing and implementing establishing organizational routines and strategies to maximize their ability to provide various opportunities for students to learn and attain success in the classrooms.

Findings 2.2b: Comparing Pre-Service Teachers' Beliefs About the Value of Psychological Knowledge of Individual/Group Differences to Educational Psychology Instructors and In-Service Teachers

Preview

Two educational psychology instructor factors and four in-service teacher factors emerged from analysis. The three educator groups shared in the beliefs that an understanding of individual/group differences would help inform them in fostering classroom discourse through establishment of norms and implementation of instructional strategies and group learning tasks, and developing appropriate summative and informal assessments. Despite the general agreement in their beliefs that their knowledge would be helpful for practices that involve collective learning, comparisons of positive rankings showed slight variations in their beliefs across the educator groups. Few pre-service teachers positively ranked anticipating and identifying common patterns of student thinking, which was not positively ranked by any of the in-service teacher or educational psychology instructor factors. Several in-service teachers positively valued the same knowledge for ensuring they could make academic content explicit for their students whereas no pre-service teachers or educational psychology instructor factors did so. Lastly, some educational psychology instructors valued knowledge for preparing, implementing and modifying instructional resources and learning tasks, a practice that was not positively ranked by any of the pre-service teacher or in-service teacher factors.

Comparing Pre-Service Teachers', In-Service Teachers' and Educational Psychology Instructors' Beliefs

All educator groups positively ranked seven of the teaching practices that were positively ranked by pre-service teachers emphasizing students' relationship with their peers and with their content (see Figure 5.4):

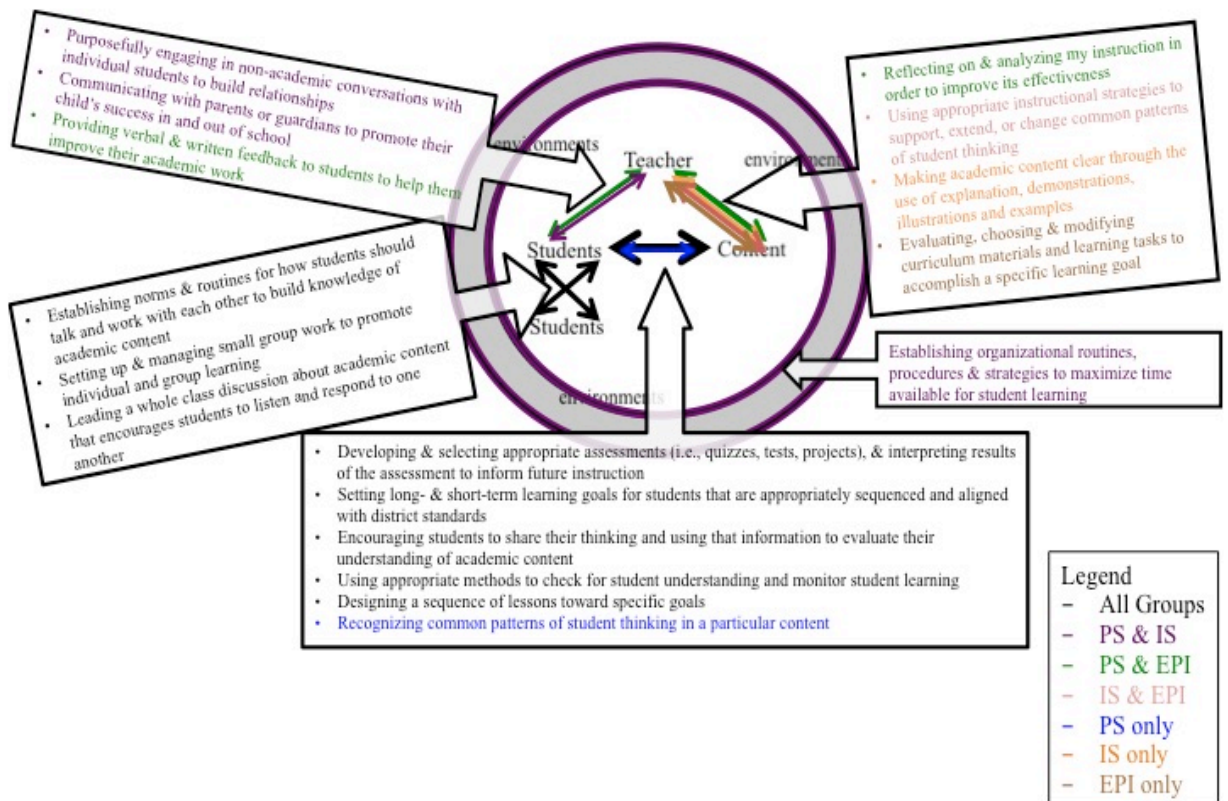


Figure 5.4 Mapping educator groups' value of psychological knowledge of individual/group differences to the instructional triangle

- Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content
- Setting up & managing small group work to promote individual and group learning
- Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction
- Leading a whole class discussion about academic content that encourages students to listen and respond to one another
- Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards
- Encouraging students to share their thinking and using that information to evaluate their understanding of academic content
- Using appropriate methods to check for student understanding and monitor student learning

Altogether, these positive rankings point to all groups' consideration for using their knowledge of individual/group differences to create ample opportunities for students to engage in discourse that not only support students' relationship with one another but also

lead to their own cognitive growth. Furthermore, understanding of individual/group differences was considered to be essential in effectively evaluating students so that they can build pedagogy that is responsive to students' needs (e.g., Villegas & Lucas, 2002).

Pre-service teachers and in-service teachers also emphasized the value of knowledge for their efforts to strengthen the teacher-student relationship by building meaningful relationships with individual students and their parents:

- Purposefully engaging in non-academic conversations with individual students to build relationships
- Communicating with parents or guardians to promote their child's success in and out of school

These positive rankings point to pre-service teachers and in-service teachers' identification of their knowledge of individual/group differences as important in guiding their efforts to gain and connect students' experiences, knowledge and values to their teaching in ways that benefit everyone's learning (Banks et al., 2005). Also, positive ranking of these items suggest their recognition of the role of their knowledge in serving as a bridge between students' lives in the classroom and their community, which can positively impact their academic achievement (Banks et al., 2005). In contrast to in-service teachers who focused on the role of knowledge in building personal relationships with students, educational psychology instructors along with pre-service teachers believed their knowledge of individual/group differences would be helpful for engaging in academic interaction with students by using various forms of feedback that effectively communicate students' strengths and articulate where and how students can improve.

Different educators also considered ways in which their knowledge can help strengthen teachers' relationship with the content. For one, in-service teachers and the instructors showed value of knowledge for modifying instructional strategies and approaches for making academic content clear for their students. In addition, in-service teachers believed knowledge would inform them in preparing their instruction before class by designing and preparing methods to clearly represent content, while educational psychology instructors believed knowledge would be more helpful for selecting appropriate curriculum materials and learning tasks to further support students' learning. In-service teachers and educational psychology instructors also showed consideration of ways in which their understanding of diversity can be used to readily recognize, celebrate

and incorporate different and unique experiences students bring into their instruction and resources for learning. Teachers must not only know a set of instructional strategies, but they must effectively determine when and how to implement them. They must also be able to select curriculum materials and learning tasks that integrate perspectives, values and contributions of different groups. Such ability to decide what strategies or materials to use and how to use them requires knowledge of students' unique interests and needs, which could also be obtained through appropriate assessment of their students.

On the other hand, pre-service teachers (as well as educational psychology instructors) focused on the role of their knowledge in enhancing their ability to reflect on and analyze the effectiveness of their instruction. As Banks et al. (2005) note, teachers' knowledge of subject matter and how to teach the subject matter isn't sufficient when teaching a diverse group of students. Teachers must be able to reflect on their own underlying attitudes and expectations for their students as they relate to the experiences and opportunities they provide their students in the classrooms. Pre-service teachers' positive ranking of this item suggests their recognition that their understanding of individual/group differences can enable them to reflect on these attitudes and their efforts to integrate their students' interests, knowledge, experiences, and needs in ways that affect quality of students' learning opportunities. Taken together, positive rankings across the three educator groups placed the greatest emphasis on the value of knowledge of individual/group differences for encouraging and facilitating students' relationship with one another around academic content and for effectively evaluating students' learning through appropriate assessments that provide equal opportunities for students to showcase their knowledge and skills. While they also addressed the impact of knowledge for addressing teacher-content relationship, the specific teaching practices they connected to their knowledge varied by educator groups.

Summary of Findings 2.2b

Comparison of factors that emerged from analyses of pre-service teachers', in-service teachers' and educational psychology instructors' Q sorts indicates shared the belief that teachers' psychological knowledge of individual/group differences would be helpful for teaching practices that involve facilitating students' discourse and work with one another, attending to student learning, and establishing learning goals that ensure

every student can experience success in achieving learning goals. Pre-service teachers' Q sorts and in-service teachers' Q sorts shared further similarities. In particular, they focused on the value of knowledge for aspects of teaching practices that involve building meaningful relationships with students and parents by engaging in conversations that sometimes extend beyond issues around academic learning as well as implementing organizational norms and routines to ensure opportunities for learning are maximized. Pre-service teachers' and educational psychology instructors' Q sorts on the other hand showed value of knowledge for teaching practices around providing students feedback about their learning and reflecting on and analyzing their own instruction. Despite these similarities, each educator showed differences from each other in their beliefs. One pre-service teacher factor considered the value of knowledge for recognizing common patterns of student thinking. Two in-service teacher Q sorts showed value for preparing and implementing pedagogical strategies for making academic content understandable for their students, while one educational psychology instructor Q sort placed greater value of knowledge for modifying instructional strategies *during* instruction.

Summary of Study 2.2

An increase in the diversity of student population in schools has led to a greater need for culturally responsive teaching that entails teachers' awareness and understanding of different cultural systems in addition to various forms of diversity that impact their students' engagement and success in the classrooms (e.g., gender, socioeconomic status, special needs and exceptionalities). Culturally responsive and inclusive classrooms are supportive of all children and accepting of differences; children's strengths are emphasized and differences are recognized and considered a positive part of a learning environment because they allow children to share and experience diverse perspectives. One of the many complexities of teaching then includes serving as a bridge to establish connections between the different cultures and experiences students bring to facilitate their instructional process. Numerous studies have shown that effective teachers of a diverse group of students develop and maintain connections with students within their social contexts and incorporate elements of their culture in their instructional approaches. Effective student learning also involves building teacher-student relationships that are warm and equitable and establishing a classroom environment that promotes cooperation

and collaboration through building cooperative learning strategies and encouraging student-initiated discourse and active participation (Banks, Cochran-Smith, Moll, Richert, Zeichner, LePage, et al., 2005).

The Q sorts that emerged from analyses of the three educator groups addressed these connections between psychological knowledge of individual/group differences and the various teaching practices. From the beginning to the end of the term, pre-service teachers in particular placed greater value of their knowledge for teaching practices that involve not only fostering opportunities for all students to engage with one another around academic content, but also interacting effectively with their students and with their students' parents about their students. They also continued to consider the role of their knowledge in fostering their ability to establish learning goals and environment that help them attend to and assess both individual and group learning. Comparison of positive rankings from beginning to end of the term however indicates less emphasis on the value of knowledge for teaching practices that involve surfacing and providing feedback about student learning and for evaluating, selecting and modifying instructional strategies both before and during class. Rather, the factors from the end of the term showed a shift in their focus to other aspects of teaching practices that involve designing and evaluating student learning as well as their own instruction.

Positive rankings across educator groups' Q sorts showed a general agreement in the beliefs that knowledge would enhance their ability to foster classroom discourse, set learning goals and sequence lessons accordingly, and monitor and evaluate student thinking. This showed that psychological knowledge of individual/group differences were valued primarily for creating and maintaining a classroom environment that promotes students' interaction with one another as well as for establishing learning goals, lessons, and assessments that ensure all students experience success in their interaction with academic content. Similarities that pre-service teachers' Q sorts shared with in-service teachers' Q sorts or educational psychology instructors' Q sorts related to teaching practices that involve fostering students' relationships with them or students' relationships with one another.

There were also teaching practices that were positively ranked by one educator group but not positively ranked by the other two educator groups. These teaching

practices however addressed students-content relationship. At least one pre-service teacher factor showed value of knowledge for anticipating and recognizing common patterns of student thinking. Two in-service teacher factors focused on the value of the knowledge for making academic content clear and explicit through appropriate means to represent content. One educational psychology instructor factor emphasized the value of knowledge for determining and selecting curriculum materials and learning tasks to support student learning. Thus while some pre-service teachers' Q sorts showed value of psychological knowledge for attending to and identifying patterns of student thinking, some in-service teachers' Q sorts and educational psychology instructors' Q sorts emphasized the value of psychological knowledge for evaluating instructional strategies and resources that can tap into and address students' interests, abilities and skills to ensure all students develop a firm understanding of the content in meaningful ways. Their focus on the role of psychological knowledge of individual/group differences in informing instructional strategies and resources is further supported by both educator groups' factors' positive ranking (but not pre-service teachers') of teaching practice around evaluating and using appropriate strategies to modify their instruction during class to challenge or extend students' thinking. Together, in-service teachers' and educational psychology instructors' Q sorts shed light to their greater recognition of the value of knowledge for aspects of teaching practices that involve implementing and determining the effectiveness of specific instructional strategies, resources and curriculum for a diverse group of students they teach. Additional studies could further explore how different educator groups think about the connections between psychological knowledge of individual/group differences and these teaching practices to better understand how the field of educational psychology can support culturally sensitive teaching that involves effectively evaluating, selecting and implementing curriculum that accounts for and addresses students' diverse interests, culture, values, perspectives, and skills

Findings 2.3a: Changes in Pre-Service Teachers' Beliefs about the Value of their Psychological Knowledge of Human Development

Preview

Three sub-groups emerged both at the beginning and end of the term. Twelve teaching practices were positively ranked by at least one of the three sub-groups across both time points. Sub-groups of pre-service teachers from both time points positively ranked ten of these teaching practices. Comparison of these factors indicate that all sub-groups at the beginning and end of the term valued the psychological knowledge of human development for attending to students' interactions with content by using appropriate instructional strategies to support, extend, or change common patterns of student thinking. Multiple factors from both time points also showed value of knowledge for teaching practices around establishing a learning environment that promotes efficient use of classroom space and time to maximize learning and foster classroom discourse, setting long- and short-term learning goals that inform them in selecting appropriate instructional strategies for building students' understanding of content as well as methods for evaluating student learning.

Differences in positively ranked items show that at the beginning of the term pre-service teachers emphasized on the value of knowledge for communicating with students and parents about students' learning. By the end of the term, the emphasis of the value shifted to reflecting on, analyzing and communicating about their instruction with other professionals in education to enhance their relationship with content.

Exploring Changes in Pre-Service Teachers' Beliefs

As indicated by the black boldfaced arrows and circles in Figure 5.5, pre-service teachers positively ranked a greater range of teaching practices in relation to their psychological knowledge of human development compared to their knowledge of learning and of individual/group differences. Their understanding of human development was believed to help strengthen not only teacher-content, student-content, and teacher-student relationship but also address issues around building classroom environments conducive to both individual and collective learning.

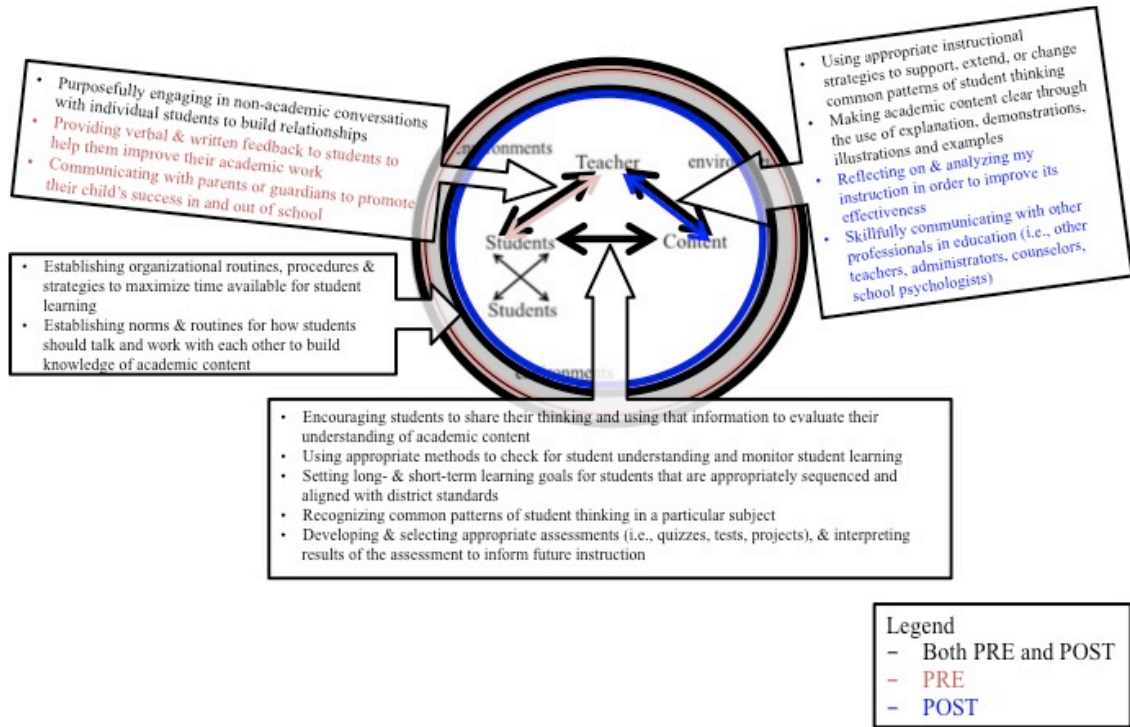


Figure 5.5 Mapping pre-service teachers' value of psychological knowledge of human development to the instructional triangle

For one, their knowledge of human development was valued for teaching practices that strengthen teacher-content and student-content relationship, which entail eliciting, recognizing, and responding to student thinking through instructional strategies and assessments:

- Using appropriate instructional strategies to support, extend, or change common patterns of student thinking
- Encouraging students to share their thinking and using that information to evaluate their understanding of academic content
- Using appropriate methods to check for student understanding and monitor student learning
- Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards
- Making academic content clear through the use of explanation, demonstrations, illustrations and examples
- Recognizing common patterns of student thinking in a particular subject
- Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction

This reinforces the understanding that knowledge of child and adolescent development is important in developing teachers' ability to attend to, interpret, and

respond to students' statements and behavior by structuring learning experiences for students that are constructive in building students' understanding of the content (e.g., Daniels, Shumow, 2003; Grimmer & MacKinnon, 1992). This includes activating students' knowledge and skills that would inform them in determining how to present new information or expand on an existing idea. The connection pre-service teachers made between their psychological knowledge of human development and these teaching practices points to the usefulness of developmental perspective as a framework for tapping into students' knowledge and needs to prepare and modify their instruction.

Other teaching practices for which knowledge was believed to be helpful include creating a learning environment conducive to both individual and collaborative learning:

- Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content
- Establishing organizational routines, procedures & strategies to maximize time available for student learning

Their recognition of teaching practices that involve considering the classroom environment within which the interaction between students, teachers and contents take place suggest pre-service teachers' reflection on Bronfenbrenner's (1974, 1979) ecological systems theory, which highlights the impact of various levels of environment on children's development. Relatedly, knowledge was also considered helpful for building meaningful relationships with individual students to foster not only student learning but also their overall development:

- Purposefully engaging in non-academic conversations with individual students to build relationships

This interaction between teachers and students that extend beyond the classroom context requires sensitivity to other various environmental contexts that has an equally important influence on students' learning and behavior in the classrooms. Pre-service teachers showed recognition that their understanding of human development can help them readily attend to these various contexts.

Differences in pre-service teachers' positive rankings across the two time points show that at the beginning of the term, there was greater value of knowledge of human development for interacting with students and parents about students' learning through appropriate feedback:

- Providing verbal & written feedback to students to help them improve their academic work
- Communicating with parents or guardians to promote their child's success in and out of school

Pre-service teachers appeared to have begun to consider the role of their understanding of human development in building meaningful relationships with students and parents that extend beyond interacting around academic content by effectively communicating trust, care and interest that could in turn influence students' engagement in the classroom. While these teaching practices were not positively ranked by the end of the term, the value of knowledge for teaching practices around professional development were emphasized:

- Reflecting on & analyzing my instruction in order to improve its effectiveness
- Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)

The shift in the emphasis from communicating with students and parents to engaging with other professionals in education indicates recognition that their understanding of human development can address the important role that the school as a structure has in influencing students' learning and development. By understanding how children's development is positively shaped by their schools, teachers and other professionals in education can collaborate and communicate their efforts to promote changes that help students be successful both academically and developmentally (Horowitz et al., 2005). Effective communication with other professionals in education as guided by their knowledge of human development would not only help ensure the school environment shapes student development, but it would also inform their own interaction with the content as they consider ways in which they can make content connected to their students' lives, interests and experiences.

Summary of Findings 2.3a

All factors from both time points showed a positive value of the psychological knowledge of human development for making instructional decisions, particularly during class, that ensure students successfully develop an understanding of the content at hand. They agreed in the belief that knowledge would be more helpful in choosing appropriate instructional strategies in response to the recognition of common patterns of student

thinking to support, challenge, or extend their understanding. To a lesser degree, there was also continued value of knowledge for establishing a learning environment that effectively organizes classroom space and time to maximize student learning and classroom discourse.

Variations in few of the items that were positively ranked at the two time points indicate that pre-service teachers at the beginning of the term focused on the value of knowledge for communicating with students and parents about students' learning. By the end of the term, however, pre-service teachers' emphasized on the value of knowledge for their professional development that entails reflecting on, analyzing and communicating about their instruction with other professionals in education.

Findings 2.3b: Comparing Pre-Service Teachers' Beliefs About the Value of Psychological Knowledge of Human Development to Educational Psychology Instructors and In-Service Teachers

Preview

Two educational psychology instructor factors and three in-service teacher factors emerged from analysis. The three educator groups shared in their beliefs that their knowledge of human development would be more helpful in using appropriate strategies for assessing student thinking and using instructional strategies to promote student learning, establishing organizational and interactional norms and strategies, and building relationships with students. In addition to these teaching practices, pre-service teachers indicated value of knowledge for setting learning goals that in turn can inform them in selecting appropriate strategies for making content explicit and for reflecting on and evaluating their own instruction, whereas no in-service teacher factors or educational psychology instructor factors did so. Some in-service teachers however placed greater value of knowledge for sequencing lessons toward specific goals and providing appropriate feedback to their students.

Comparing Pre-Service Teachers', In-Service Teachers' and Educational Psychology Instructors' Beliefs

Comparison of the three educator groups' positive rankings also pointed to a wide range of teaching practices for which they valued their psychological knowledge of human development (see Figure 5.6).

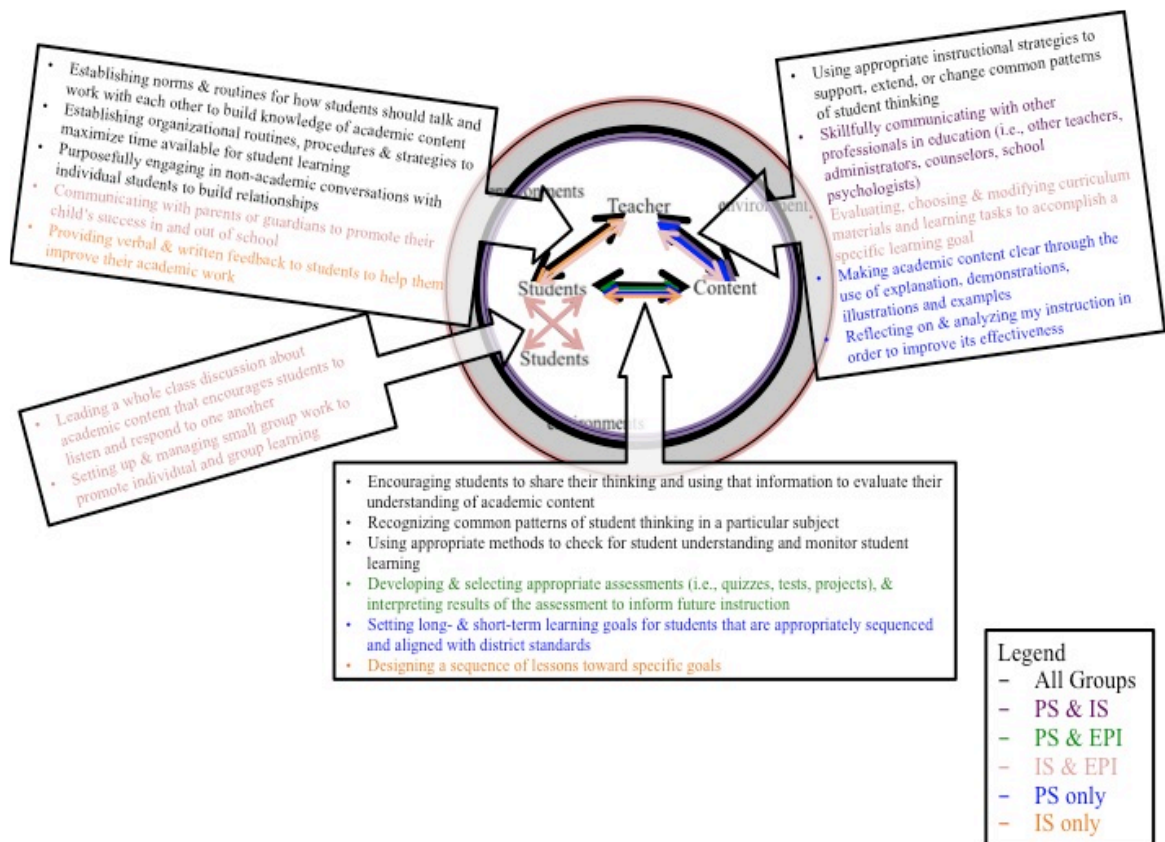


Figure 5.6 Mapping educators' value of psychological knowledge of human development to the instructional triangle

Black boldfaced arrows and the boldfaced inner circle indicate agreement in their belief that an understanding of human development can strengthen student-teacher relationships, teacher-content relationships, student-student relationships and the environment in which these relationships take place:

- Encouraging students to share their thinking and using that information to evaluate their understanding of academic content
- Using appropriate instructional strategies to support, extend, or change common patterns of student thinking
- Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content

- Recognizing common patterns of student thinking in a particular subject
- Establishing organizational routines, procedures & strategies to maximize time available for student learning
- Purposefully engaging in non-academic conversations with individual students to build relationships
- Using appropriate methods to check for student understanding and monitor student learning

In the case of teacher-student relationships, knowledge of human development was perceived to inform them in building relationships with students outside of the classroom context by engaging in non-academic conversations that help them attend to students' overall development and well-being. The connection made between knowledge of human development and student-content and teacher content relationship concerned eliciting, identifying and responding to students' thinking through formative assessment and subsequent modification of their instruction. In addition, educator groups valued their knowledge of human development for creating a learning environment conducive to both individual and collective learning by establishing routines and norms that help organize and maximize opportunities for students' interaction with one another and with the academic content. Taken together, taking a developmental perspective can help recognize the ways in which various elements of student development (such as emotional, social, psychological, and cognitive) interact with one another and with student learning and thus guide them in planning, creating a productive learning environment, and teaching in ways maximize students' potential (Horowitz et al., 2005).

In-service teachers and educational psychology instructors however showed greater agreement in their beliefs, more notably in their elaboration of their value of knowledge for facilitating student-student relationship:

- Leading a whole class discussion about academic content that encourages students to listen and respond to one another
- Setting up & managing small group work to promote individual and group learning

They believed knowledge would enhance teacher-student relationship as well by informing them in effectively communicating with their students' parents about their learning, which not only helps build teacher-student relationship, but also helps tap into the context within which students develop and make sense of the world. These positive rankings are consistent with Bronfenbrenner's (1979) ecological view of development,

which emphasizes the importance of settings and circumstances in which students live for understanding and promoting students' academic, emotional and social needs.

On the other hand, pre-service teachers placed a greater emphasis in their consideration of the role of their knowledge of human development in strengthening student-content and teacher-content relationships. Although educational psychology instructor factors and in-service teacher factors, to varying degrees, positively ranked teaching practices involving evaluating and selecting curriculum materials and/or summative assessments as well as sequencing lessons to ensure students' mastery of the content at hand, pre-service teachers showed value of their knowledge for a greater range of teaching practices that address these relationships:

- Making academic content clear through the use of explanation, demonstrations, illustrations and examples
- Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards
- Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction (which educational psychology instructors also positively ranked)

In addition to planning instruction, pre-service teachers believed their understanding of human development could serve as a framework with which they could engage in their professional development, thus further strengthening the teacher-content relationship. Strengthening this relationship could in turn enhance student-content relationship as well as the environment in which both students and teachers interact:

- Reflecting on & analyzing my instruction in order to improve its effectiveness
- Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)

Understanding of human development was generally perceived by all educator groups to enhance a wide range of elements of instruction that address the relationships between the teacher, the student, the content, and the environment within which teaching and learning takes place. In-service teachers and educational psychology instructors however placed a greater value of knowledge for teachers' ability to foster student-student relationship while this wasn't necessarily the case for pre-service teachers. Rather, pre-service teachers expanded on their value of knowledge for their students' and their own relationship with the content.

Summary of Findings 2.3b

All factors across the three educator groups agreed in their beliefs that one's psychological knowledge of human development would be more helpful for teaching practice around encouraging students to share and respond to one another's thinking about the content, which in turn helps to assess their understanding or misconceptions about the content. Different factors from each of the three educator groups however expanded on the value of their knowledge of human development by also positively ranking items including attending to and responding to student understanding and learning, along with establishing norms, routines and opportunities for students to engage with one another and with their teachers.

On the other hand, only pre-service teachers placed a greater value of knowledge for effectively setting learning goals, implementing strategies to present content clearly, and evaluating the effectiveness of their instruction. In-service teachers, however, emphasized on the value of knowledge for aspects of teaching practices around sequencing lessons toward learning goals and for communicating effectively with their students about their learning through verbal and written feedback.

Summary of Findings 2.3

Good teaching extends beyond knowing what students need to learn. It involves knowing how to teach content in a way that students understand and can successfully apply to develop a more advanced understanding and skills. It also involves presenting tasks that are not only engaging and interesting to students but are also challenging and achievable. This requires a complex set of skills wherein teachers must constantly check students' development and progress, subsequently select tasks that are appropriate and organized to help progressively build their understanding and provide a learning environment to support their growth into critical, reflecting thinkers and productive citizens who contribute to their society (Horowitz, Darling-Hammond, Bransford, Comer, Rosebrock, Austin, & Rust, 2005). These teaching practices must be grounded in their understanding of children's development and its impacts on students' learning in classrooms, and vice versa. Such understanding, as outlined by Horowitz et al. (2005), is considered to be essential for carrying out various teaching practices such as designing and sequencing lessons and activities, evaluating what students need to learn and how to

support them, organizing the learning environment, and fostering their social and emotional development, among other practices. In other words, teachers must prepare and implement developmentally appropriate materials and tasks that take into account where students are developmentally (e.g., understanding children's behavior, what they know in a particular domain, what types of support they need to make progress in their understanding or behavior).

Overall, there was a greater agreement in the ways in which pre-service teachers valued their knowledge of human development. Of the 12 teaching practices that were positively ranked across the three factors at the beginning and end of the term, 10 of them were positively ranked at both time points. Much of these teaching practices represented the belief that knowledge would be helpful for attending to students' thinking through various forms of assessment and responding to students' learning by selecting appropriate instructional strategies not only for presenting content clearly but also for challenging or extending students' understanding of the content. They also considered the role of knowledge for creating a learning environment that maximizes students' interaction with one another toward both individual and collective learning through effective implementation of norms and routines. In the beginning of the term, pre-service teachers placed an additional emphasis on the value of knowledge for communicating with students and parents about students' learning. In contrast, by the end of the term, this emphasis shifted to teaching practices around analyzing their instruction and communicating with other professionals in education, considering the role of knowledge in enhancing their own development.

In-service teachers and educational psychology instructors also shared in pre-service teachers' beliefs that knowledge would inform teachers in attending to and responding to student learning. In-service teachers and educational psychology instructors however, shared greater similarity with one another, as their Q sorts extended to other practices for which they believed knowledge would be helpful: communicating with parents, facilitating students' interaction with one another both during whole class and small group work, and selecting and modifying curriculum materials to support learning and instruction. One of pre-service teachers' and in-service teachers' Q sorts shared in the belief that knowledge would be more helpful for interacting with other

professionals in education, while one of pre-service teachers' and educational psychology instructors' Q sorts agreed in the value of knowledge for designing summative assessments to evaluate student learning across lessons. Pre-service teachers' Q sorts on the other hand were the only Q sorts to show value of knowledge for setting learning goals that help students develop and master understanding of the content, preparing and using instructional strategies to make academic content understandable for their students, and analyzing their own instruction – all of which were not positively ranked by in-service teachers' and educational psychology instructors' Q sorts. Despite the variations in the positive ranking of items, all items were positively ranked by at least one of the educator groups, which suggest their consideration of how knowledge of human development can encompass multiple aspects of high-leverage teaching practices. The degree to which courses in educational psychology, or the opportunities to work in the classrooms help these different educator groups recognize the value of one's understanding of human development for these different aspects of teaching practices is worth examining in future studies.

Findings 2.4a: Changes in Pre-Service Teachers' Beliefs about the Value of their Psychological Knowledge of Motivation

Preview

Compared to other domains of educational psychology, pre-service teachers showed the greatest variation in the aspects of teaching practices for which they believed their psychological knowledge of motivation would be more helpful. This is reflected by the greatest number of factors that emerged from analysis compared to other domains. Four factors emerged both at the beginning and end of the term. Fifteen of the eighteen teaching practices were positively ranked by at least one of the four factors at the beginning of the term, while sixteen were positively ranked by at least one of the four factors at the end of the term. Factors from both time points positively ranked fourteen of these teaching practices. Comparisons of the positive rankings from both time points show that multiple factors across the two time points generally showed positive value of knowledge for encouraging students to share their thinking with one another in class by eliciting student thinking and subsequently responding students' thinking through

appropriate implementation and modification of instructional strategies. Other teaching practices that were positively ranked by one factor from both time points also show some value of knowledge for designing well-sequenced sets of lessons, recognizing common patterns of student thinking and communicating effectively with parents about their students' learning.

The greatest shift in positive rankings from the beginning to the end of the term shows that pre-service teachers initially believed knowledge would be more helpful for communicating effectively with other professionals in education, an aspect that was not positively ranked by any of the pre-service teachers at the end of the term. Rather, more pre-service teachers at the end of the term placed a greater value of knowledge for establishing norms, routines and strategies for organizing classroom space and time and for facilitating classroom discourse. Additionally, greater emphasis was placed on providing appropriate feedback to students about their learning in their efforts to ensure students continue to engage in their learning. Thus pre-service teachers by the end of the term believed their understanding of student motivation would be more helpful for teaching practices around maximizing opportunities for students to engage in their learning through classroom norms and routines as well as their means for communicating effectively and frequently with their students about their learning.

Exploring Changes in Pre-Service Teachers' Beliefs

Compared to other domains of educational psychology, educators identified the greatest variation in the ways in which they believed their knowledge of motivation inform their teaching practices. Given these variations, a greater number of teaching practices were positively ranked, all of which address all forms of interactions that take place both in and out of the classrooms (see Figure 5.7).

Teaching practices that were positively ranked by the greatest number of factors from beginning and end of the term showed a particular value of knowledge for teaching practices around engaging students with one another around academic content. They also connected knowledge to their own engagement with the content as it relates to preparing and modifying instruction in ways that help sustain students' interest and engagement with their academic content:

- Setting up & managing small group work to promote individual and group learning
- Encouraging students to share their thinking and using that information to evaluate their understanding of academic content
- Using appropriate instructional strategies to support, extend, or change common patterns of student thinking
- Making academic content clear through the use of explanation, demonstrations, illustrations and examples

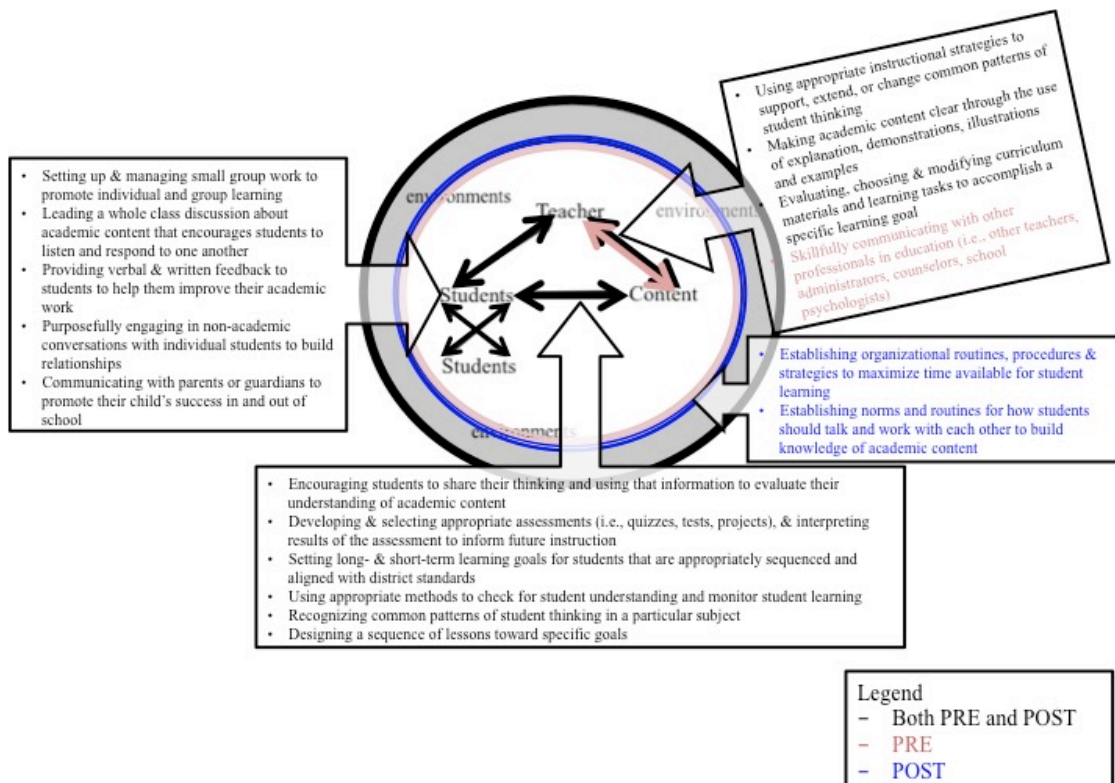


Figure 5.7 Mapping pre-service teachers' value of psychological knowledge of motivation to the instructional triangle

To varying degrees, pre-service teachers at both time points expanded on their value of knowledge for fostering students' engagement with one another around academic content and their relationship with the content.

- Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal
- Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction
- Leading a whole class discussion about academic content that encourages students to listen and respond to one another
- Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards

- Using appropriate methods to check for student understanding and monitor student learning
- Recognizing common patterns of student thinking in a particular subject
- Designing a sequence of lessons toward specific goals

Their identification of these teaching practices in light of their consideration of the role of their knowledge of motivation suggests an understanding that teachers' instructional practices that support student autonomy promote student motivation and learning. These instructional practices include teachers' willingness to not only listen to students, but to also respond to students' comments and incorporate their understanding, beliefs and interests into the lesson (Reeve & Jang, 2006). In this sense, the positive ranking suggests their belief that teachers' understanding of how instruction affects students' motivation and vice versa can inform teachers' instructional decisions with respect to specific questions or languages to use that effectively communicate to their students that they encourage their perspectives or ways of thinking about the content at hand (Reeve, 2009).

In addition, they considered the role of knowledge of motivation for building their own relationship with students and parents and for strengthening students' relationship with the content:

- Purposefully engaging in non-academic conversations with individual students to build relationships
- Providing verbal & written feedback to students to help them improve their academic work
- Communicating with parents or guardians to promote their child's success in and out of school

These positive rankings point to pre-service teachers' recognition of the relationship between feedback, motivation and learning. For example, providing positive feedback to students help promote their sense of accomplishment, confidence, and self-efficacy while supplementing it with guidance toward increasing their awareness of what to focus on to accomplish larger goals (Shepard et al., 2005), all of which contribute to students' motivation and learning. Keeping parents involved as well by informing them about students' progress and ways they can support their students can also contribute to fostering students' sense of autonomy, interest and willingness to persist in their learning (Ames, 1990; Grolnick, Friendly & Bellas, 2009). Pre-service teachers' understanding of the role of parents in fostering student motivation can help them guide their students' parents in actively engaging with their students to show interest and value for learning.

Taken together, pre-service teachers continued to recognize that their understanding of motivation can help them better attend to ways in which they could communicate with both students and parents through feedback that ensures students – and parents – actively engage in their learning.

Differences in positive rankings across the two time points indicated some shifts in pre-service teachers' beliefs about ways in which their psychological knowledge of motivation would be more helpful for their teaching practices. Beliefs at the beginning of the term placed a greater focus on the value of their knowledge for enhancing their relationship with the content and for collaboratively creating a learning environment that is conducive to students' active engagement in their learning through effective communication with other professionals in education; their knowledge of motivation can help them collaboratively attend to issues around student motivation and engagement that can in turn help improve quality of teaching and learning. By the end of the term, while this teaching practice was not positively ranked, pre-service teachers' beliefs about the relationship between knowledge of motivation and teaching practices emphasized on establishing a classroom environment conducive to students' learning of the content:

- Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content
- Establishing organizational routines, procedures & strategies to maximize time available for student learning

These teaching practices combined with those involving fostering collaborative work indicates the recognition that helping students build upon one another's experiences and knowledge by building a personal and social context can influence both student motivation and learning. And their knowledge of the features of the classroom environment combined with instructional strategies for fostering student collaboration that impact student motivation can strengthen these relationships. Given these slight shifts across time, pre-service teachers at both time points identified the greatest number of teaching practices for which they believed their psychological knowledge would be particularly helpful.

Summary of Findings 2.4a

Across the two time points, pre-service teachers positively ranked a wide range of teaching practices. Changes in the number of positively ranked items across time indicate

more of a shift in the emphasis of specific teaching practices for which they believed their understanding of motivation would be more helpful than other teaching practices. Based on the exploration of the shifts, pre-service teachers at the beginning showed a greater consideration of the role of their understanding of motivation for building relationships with various stakeholders in education that can set the context for helping students successfully engage in learning both individually and with their peers. By the end of the term however, they shifted their focus on the role of the same understanding for interacting with their students around academic content to ensure they continue to engage in their learning towards achieving learning goals.

Findings 2.4b: Comparing Pre-Service Teachers' Beliefs About the Value of Psychological Knowledge of Motivation to Educational Psychology Instructors and In-Service Teachers

Preview

Three educational psychology instructor factors and four in-service teacher factors emerged from analysis. Like the pre-service teachers, in-service teachers and educational psychology instructors showed the greatest variation in the identification of teaching practices for which they believed their knowledge of motivation would be more helpful. This is particularly the case for educational psychology instructors; given the small number of educational psychology instructor participants, their Q sort ranking of teaching practices as they related to psychological knowledge of motivation yielded the greatest number of factors, suggesting the most varied set of beliefs about ways in which teachers' understanding of motivation could enhance teaching practices.

The three educator groups showed positive value of their psychological knowledge of motivation for various teaching practices that mainly involve assessing and responding to student learning mainly through feedback, providing opportunities for group work, building relationships with students and parents, and preparing their instructional strategies and resources. In contrast to educational psychology instructors and in-service teachers, however, more pre-service teachers positively valued knowledge for using appropriate methods to check for and monitor student thinking. On the other hand, in-

service teachers placed more emphasis on planning and reflecting on instruction and resources as well as communicating with students and building relationships with them.

Comparing Pre-Service Teachers', In-Service Teachers' and Educational Psychology Instructors' Beliefs

In-service teachers and educational psychology instructors positively ranked nine of the teaching practices that the pre-service teachers positively ranked at the end of the term, which point to a wide array of teaching practices for which their knowledge of motivation was perceived to be useful (Figure 5.8).

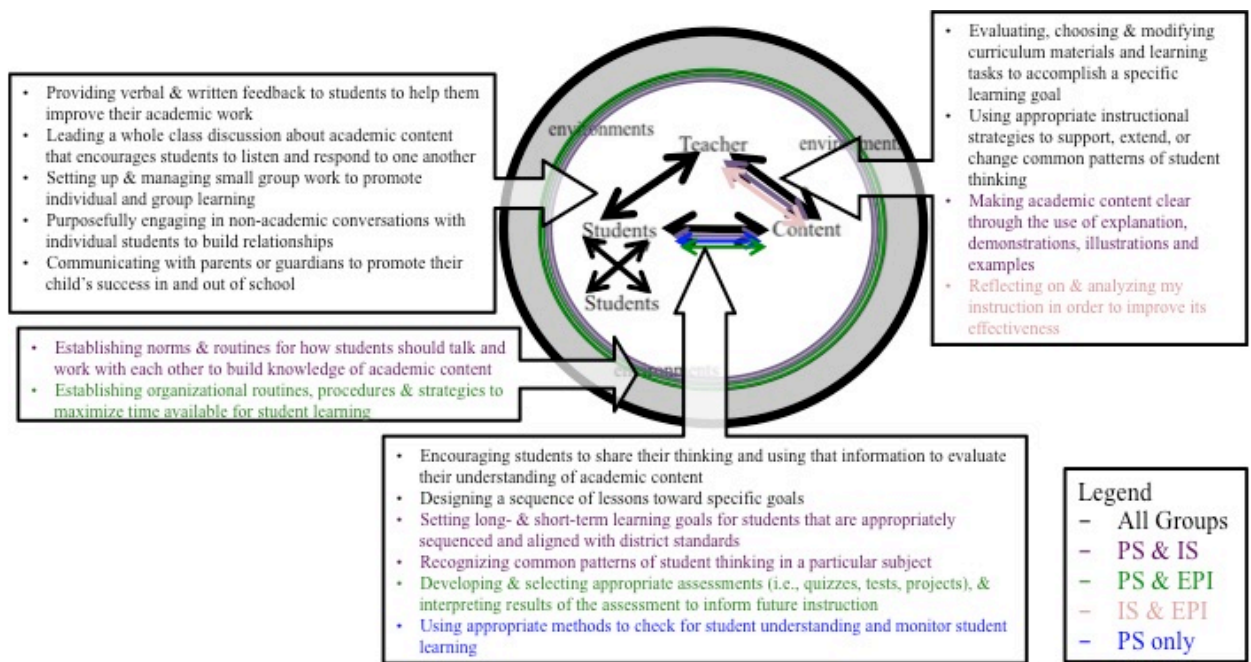


Figure 5.8 Mapping educators' value of psychological knowledge of motivation to the instructional triangle

There was a particular emphasis on the value of knowledge for eliciting and responding to student thinking through appropriate feedback and modification of their instruction as the following items were positively ranked by multiple factors of each educator group:

- Providing verbal & written feedback to students to help them improve their academic work
- Encouraging students to share their thinking and using that information to evaluate their understanding of academic content
- Using appropriate instructional strategies to support, extend, or change common patterns of student thinking

- Leading a whole class discussion about academic content that encourages students to listen and respond to one another

These teaching practices address teacher-student, student-content, and teacher-content relationships. This emphasis highlights feedback and instructional response as an essential feature of enhancing student motivation to further engage and maintaining students' interest in the topic.

Research in motivation has shown that providing positive feedback before offering productive critique that helps students focus on specific areas for improvement has shown to promote students' motivation because it increases their metacognitive attentiveness of their learning progress; it helps them to readily identify their own strengths and understanding, and pinpoint areas that they need to work on (Shepard, Hammerness, Darling-Hammond, Rust, Baratz Snowden, Gordon, Gutierrez, & Pacheco, 2005). More so than the frequency of feedback of feedback provide, the *types* of statements teachers make with respect to causes for students' outcome represent their beliefs about students' ability to succeed and can therefore influence students' own expectations and beliefs about themselves and their abilities, which in turn impact their motivation and persistence in their learning (Ames, 1990; Bandura, 1991; Stipek, 1996). In addition to responding to students through feedback that fosters' students' continued efforts and engagement in their learning, understanding motivation has been perceived to be just as helpful in responding to students through their instruction. Thus not only were different theories of motivation believed to inform them in offering effective and helpful feedback to students but they were also perceived to guide them in selecting instructional strategies that incorporate students' inputs in ways that support or challenge students and encourage them to push themselves towards building a more complex set of knowledge and skills (Reeve & Jang, 2006).

Additionally, at least one factor from each educator group believed their understanding of motivation would guide their efforts to manage student-student relationships particularly at a small group level, foster teacher-student relationship, and consider ways to strengthen students' relationship with the content:

- Setting up & managing small group work to promote individual and group learning

- Purposefully engaging in non-academic conversations with individual students to build relationships
- Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal
- Designing a sequence of lessons toward specific goals
- Communicating with parents or guardians to promote their child's success in and out of school

Members of each educator group pointed to the importance of helping students interact with peers in ways that foster a sense of belonging and enhance their motivation to engage in class (Ryan & Deci, 2000b), as well as engaging parents in their students' learning to help build their self-efficacy, interests and autonomy in their learning (Grolnick, Friendly & Bellas, 2009).

Pre-service teachers also considered the value of their knowledge for teaching practices that involve creating and organizing a learning environment that not only maximize opportunities for individual learning but also for collaborative learning:

- Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content
- Establishing organizational routines, procedures & strategies to maximize time available for student learning

On the other hand, in-service teachers shared in the value of knowledge for establishing norms that encourage students' discourse with one another while educational psychology instructors shared in the value of knowledge for establishing routines and norms that help organize space and time to maximize learning.

Pre-service teachers compared to the other educator groups placed a greater emphasis on the connection between knowledge of motivation and student-content relationship. For one, only pre-service teachers positively ranked teaching practice around monitoring and formatively assessing students' level of engagement with the content. Pre-service teachers, along with in-service teachers also showed value of knowledge for promoting and recognizing students' collective learning:

- Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards
- Recognizing common patterns of student thinking in a particular subject

Educational psychology instructors, on the other hand, shared pre-service teachers' beliefs that knowledge would also enhance their efforts to design and implement appropriate summative assessments in ways that not only help evaluate students' learning

but to also use the assessment as a means to encourage students in their efforts to advance in their mastery of academic content. These connections point to the importance of setting goals that support students' own goals that emphasize mastery over performance (e.g., Anderman & Midgley, 1997; Kaplan & Maehr, 1999). These goals in turn can guide them in implementation of both instruction and assessment of student learning.

In-service teachers further focused on the connection between knowledge of motivation and teacher-content relationship while pre-service teachers and educational psychology instructors varied in the ways that their beliefs aligned with those of in-service teachers. Pre-service teachers and in-service teachers shared in the belief that knowledge would help prepare instructional strategies prior to their instruction that would help make content understandable and engaging for their students. In contrast, educational psychology instructors focused on the value of knowledge for reflecting on and determining the effectiveness of their instruction, which was also positively ranked by in-service teachers. Thus while pre-service teachers emphasized the belief that their knowledge can guide them in preparing their instruction by determining whether and how instructional strategies can keep students interested and engaged, educational psychology instructors appeared to have focused on the role of knowledge of issues around motivation as a lens through which they can determine the effectiveness of their instruction. In-service teachers however recognized the role of knowledge in both aspects of teaching practices. Identification of numerous teaching practices within pre-service teachers and across educator groups when considering how knowledge of motivation can strengthen their work indicates their recognition of value of knowledge in attending to multiple aspects of the relationship between students, teachers and content.

Summary of Findings 2.4b

Comparison of factors that emerged from analyses of pre-service teachers', in-service teachers', and educational psychology instructors' Q sorts point to a wide range of teaching practices for which they believed their psychological knowledge of motivation would be helpful. This reinforces the critical role that student motivation has on both students' learning as well as teachers' instruction. Overall, educators identified the greatest variation in the teaching practices for which they believed their understanding of motivation would be more helpful. Despite these variations, however,

there was a general agreement in their beliefs that knowledge would be helpful for teaching practices that include eliciting and responding to student learning through appropriate feedback as well as modification of their instruction, fostering opportunities for collective work, building relationships with students and their parents, and preparing pedagogical strategies and curriculum materials to support student learning. In-service teacher factors and pre-service teacher factors shared more similarities than with educational psychology instructors; positive ranking of items suggest shared beliefs that their knowledge would be more helpful for preparing and implementing strategies for presenting content as informed by their established learning goals, developing norms for classroom discourse and identifying common patterns of students thinking. Meanwhile, in-service teachers and educational psychology instructors believed their knowledge would inform teachers in analyzing and determining the effectiveness of their instruction, while educational psychology instructors and pre-service teachers also positively ranked establishing organizational norms and routines and developing summative assessments. Examination of these shared positive rankings show that pre-service generally identified a greater range of teaching practices for which they believed their knowledge of motivation would be particularly helpful.

Summary or Findings 2.4

Student academic motivation is a critical component related to their engagement and learning, and is a critical concern of teachers, parents, and school administrators. Research in education and psychology has shown that academic motivation not only exists within individual students, but also involves a complex relationship between the students, teachers, and schools and classroom environments (Anderman, Gray, & Chang, 2013). This has great implications for teachers and the powerful impact of their instructional practices on student motivation. This complexity of factors that influence and are influenced by students' academic motivation poses a challenge for educational psychology instructors who must help teachers make the connection between motivation, instruction and learning and for teachers who must make these connections in their work.

The greatest number of factors emerged for each of the educator groups when analyzing their Q sorts in relation to the domain of motivation compared to other domains in educational psychology, which suggests greater variations in the ways that educators

believed their knowledge of motivation would inform teaching practices. The number of factors that emerged and the teaching practices that were positively ranked across these factors also point to the critical role that motivation plays in every aspect of student learning and teacher instruction. Examining pre-service teachers' Q sorts from beginning to the end of the term show that multiple factors across the two time points positively ranked teaching practices around facilitating students' discourse with one another and responding to their thinking by modifying their instruction to challenge, support or extend their understanding of the content at hand. To a lesser degree, Q sorts from beginning and end of the term also showed continued value of knowledge for designing well-sequenced sets of lessons, recognizing common patterns of student thinking and communicating effectively with parents about their students' learning. On the other hand, changes in teaching practices that were positively ranked point to initial value of knowledge for communicating with other professionals in education. By the end of the term, this focus shifted to a greater range of teaching practices, including establishing norms, routines and strategies for organizing classroom time, space and discourse, and effectively providing feedback that highlight for students their strengths and suggest areas for improvement.

In-service teachers and educational psychology instructors, like pre-service teachers, showed value of knowledge of motivation primarily for attending and responding to student learning by effectively eliciting student thinking through their engagement in student discourse and responding to their thinking through feedback and modification of their instruction. They also positively ranked teaching practices around building relationships with students and parents, and preparing their instructional strategies and resources. Differences in teaching practices that were positively ranked by no more than two of the educator groups pertained to setting learning goals and planning and analyzing instruction accordingly, establishing norms and routines, and monitoring and assessing student learning. Pre-service teachers and in-service teachers, but not educational psychology instructors, had factors whose Q sorts positively valued knowledge for preparing and implementing instruction, establishing norms for classroom discourse, and recognizing common patterns of student thinking. Pre-service teachers and educational psychology instructors, but not in-service teachers, yielded factors whose Q

sorts showed greater value of knowledge for establishing routines and procedures for organizing classroom space and time, and evaluating student thinking through design and implementation of summative assessments. In-service teachers and educational psychology instructors, but not pre-service teachers, had factors whose Q sorts represented belief that knowledge of motivation would enable teachers to analyze and determine the effectiveness of their instruction and better understand the complex interactions between their students, the content, and themselves. Although various teaching practices were positively ranked, pre-service teachers, in-service teachers and educational psychology instructors primarily showed value of knowledge of motivation for those that involve facilitating students' interaction with one another around academic content and ensuring students engage in their learning through appropriate assessment, effective feedback and modification of instruction and resources to extend students' learning.

Summary of Chapter

Q methodology helped to uncover similarities and variations in the ways in which the different educator groups believed their psychological knowledge can influence their teaching. An exploration of how the educator groups valued their psychological knowledge of the four domains – learning/cognition, individual/group differences, human development and motivation – indicates that they shared many similarities with respect to their identification of teaching practices for which they believed their psychological knowledge could be helpful. They also showed slight variations in the ways that they valued their understanding of the different domains in educational psychology. Furthermore, the teaching practices for which the different educator groups agreed their understanding of psychological knowledge would be helpful varied by the educational psychology domains being considered. These similarities and differences begin to provide an understanding of the different ways in which various domains of educational psychology can serve as a lens through which teachers can make sense of their work of teaching. This initial examination of the role of educational psychology in teacher learning and teaching serves as a step towards further empirical exploration and understanding of how educational psychology can contribute to teacher education, instruction, and professional development.

CHAPTER 6

DISCUSSION & CONCLUSION

Introduction

This research study was conducted to explore the ways in which different educators – pre-service teachers, in-service teachers, and educational psychology instructors – believed their psychological knowledge is or will be useful for the various aspects of teaching practices considered to be essential for quality teaching. This study was organized according to the following objectives: (1) to explore changes in pre-service teachers' psychological knowledge after taking an educational psychology course and comparing their psychological knowledge to that of in-service teachers who graduated from the same university-based teacher education program and (2) to examine changes in pre-service teachers' beliefs about the value of their psychological knowledge and compare their beliefs to those of in-service teachers as well as educational psychology instructors who have taught the educational psychology course designed for pre-service teachers. Two constructs of teacher cognition – psychological knowledge and belief – were conceptualized based on the research literature. Belief was conceptualized as utility value, or one's beliefs about the usefulness of a given task, or in this case, developing psychological knowledge, and was studied through Q methodology.

Exploration of pre-service teachers' psychological knowledge showed a slight pre- to post-term increase in their knowledge from their pre-service educational psychology course as represented by their knowledge scores, but this change was not significant. Furthermore, while in-service teachers showed greater psychological knowledge compared to pre-service teachers, this difference also was not significant. Qualitative examination of pre-service teachers' beliefs across time and between pre-service teachers, in-service teachers and educational psychology instructors showed similarities and differences in their beliefs about the ways in which their knowledge of

the different domains of educational psychology would enhance their teaching practices. The table below summarizes the findings for each research question.

Table 6.1 Summary of Research Questions and Findings

<i>RQ 1: Explore development of pre-service teachers' psychological knowledge and compare pre-service teachers' psychological knowledge to in-service teachers' psychological knowledge</i>	
Research question	Findings
1a. What happens to pre-service teachers' psychological knowledge after taking an educational psychology course?	<ul style="list-style-type: none"> • Pre-service teachers showed a higher mean score on their psychological knowledge survey at the end of the term than at the beginning of the term, but this difference was not significant • Secondary pre-service teachers showed a higher mean score than elementary pre-service teachers at both time points, but this difference was significant only at the end of the term
1b. Do pre-service teachers' psychological knowledge differ from in-service teachers' psychological knowledge?	<ul style="list-style-type: none"> • Pre-service teachers' mean score was lower than in-service teachers' mean score, but this difference was not significant • There was a significant interaction between the effects of status (pre- vs. in-service) and grade level (elementary vs. secondary) on the mean score of knowledge survey • Significant main effect showed that elementary in-service teachers' mean score was higher than elementary pre-service teachers' mean score
<i>RQ 2: Examine changes in pre-service teachers' beliefs about the value of their psychological knowledge for their teaching practices and compare them to those of educational psychology instructors and in-service teachers (organized by the four domains of educational psychology explored: learning/cognition, individual/group differences, human development, and motivation)</i>	
2.1. Learning	
2.1a. What happens to pre-service teachers' beliefs about the value of their psychological knowledge of learning/cognition after their educational psychology coursework?	<ul style="list-style-type: none"> • Pre-service teachers continued to believe that their psychological knowledge of learning would be more helpful for planning and preparing instruction and curriculum materials, and for using appropriate methods to evaluate student learning • Differences in positive rankings across time points show that pre-service teachers at the beginning of the term emphasized on the value of knowledge for communicating with students about their learning, analyzing their instruction, and other professionals in education about learning and instruction • By the end of the term, there was a greater focus on the value of knowledge for a wider range of teaching practices that involve providing opportunities for students to share and respond to one another's thinking, designing a sequence of lessons toward learning goals, and communicating with parents or guardians about student learning
2.1b. Are pre-service teachers' beliefs aligned with what educational psychology instructors are trying to communicate as important and with those of in-service teachers?	<ul style="list-style-type: none"> • Pre-service teachers, in-service teachers and educational psychology instructors generally shared in the beliefs that knowledge of learning would be more helpful for determining and modifying appropriate means to present content to students and attend to students' progress in the development of their understanding of content • Some pre-service teachers' beliefs however focused on the value of knowledge for promoting and facilitating opportunities for students to contribute to one another's learning • In-service teachers emphasized the value of knowledge for engaging in academic and non-academic conversation with students.

2.2 Individual/Group Differences

2.2a. What happens to pre-service teachers' beliefs about the value of their psychological knowledge of individual/group differences after their educational psychology coursework?

- All pre-service teacher factors were consistent in the value of their knowledge for teaching practices that involve establishing an environment and strategies conducive to students' interaction with one another around content as well as for assessing student learning and communicating with students and parents
- In the beginning, there was more focus on the value of knowledge for evaluating and selecting appropriate instructional strategies, curriculum materials and learning tasks to challenge students towards learning goal
- At the end of the term there existed greater value of knowledge for sequencing lessons, reflecting on and analyzing instruction, and establishing organizational routines and strategies that help maximize opportunities for student learning.

2.2b. Are pre-service teachers' beliefs aligned with what educational psychology instructors are trying to communicate as important and with those of in-service teachers?

- The three educator groups shared in the beliefs that understanding of individual/group differences would help inform them in fostering classroom discourse through establishment of norms and implementation of instructional strategies and group learning tasks, and developing summative and formative assessments
- Few pre-service teachers, but not other educator groups, showed value of knowledge for recognizing common patterns of student thinking
- Several in-service teachers but not other educator groups showed value of knowledge for selecting appropriate methods to represent content in ways that students can understand
- Educational psychology instructors made up the only group to value knowledge for preparing, implementing and modifying instructional resources and learning tasks

2.3 Human Development

2.3a. What happens to pre-service teachers' beliefs about the value of their psychological knowledge of human development after their educational psychology coursework?

- All pre-service teacher factors reflected agreement in the belief that psychological knowledge of human development would be more helpful for determining and implementing instructional response based on their assessment of common patterns of student thinking. There was also continued value of knowledge for establishing a learning environment conducive to individual and collective learning, setting long- and short-term learning goals that inform them in selecting appropriate instructional strategies for supporting students' thinking and evaluating their learning
- At the beginning of the term pre-service teachers showed greater value for communicating with students and parents about students' learning
- By the end of the term the focus of their value shifted to reflecting on, analyzing and communicating about instruction with other professionals

2.3b. Are pre-service teachers' beliefs aligned with what educational psychology instructors are trying to communicate as important and with those of in-service teachers?

- All educator groups shared in the beliefs that knowledge of human development would be more helpful in using appropriate strategies for assessing student thinking and using instructional strategies to promote student learning, establishing organizational and interactional norms and strategies, and for building relationships with students
- Some pre-service teachers, but not other educator groups, showed value of knowledge for setting learning goals that help determine strategies for making content explicit and evaluate their instruction
- In-service teachers placed greater value of knowledge for sequencing lessons toward specific goals and providing appropriate feedback to their students. In-service teachers and educational psychology instructors also showed greater similarities, as they valued knowledge for facilitating student discourse and group work, building relationships with students' parents, and evaluating and modifying resources

2.4 Motivation

2.4a. What happens to pre-service teachers' beliefs about the value of their psychological knowledge of motivation after their educational psychology coursework?	<ul style="list-style-type: none">• Overall, the greatest variation that existed was for teaching practices that were positively ranked when considering the value of the psychological knowledge of motivation• While at the beginning of the term there was some focus on the value of knowledge for communicating effectively with other professionals in education about issues around teaching and student learning, this was not the case by the end of the term• By the end of the term, more pre-service teachers showed greater value of knowledge for establishing norms and routines that not only guide classroom discourse but also help organize classroom time and space to maximize opportunities for learning. There was also greater emphasis on providing appropriate feedback to student about their learning
2.4b. Are pre-service teachers' beliefs aligned with what educational psychology instructors are trying to communicate as important and with those of in-service teachers?	<ul style="list-style-type: none">• Educator groups generally showed value of their knowledge for various teaching practices, including attending and responding to student learning through feedback, providing opportunities for group work, building relationships with students and parents and preparing their instructional strategies and resources• Pre-service teachers elaborated on using appropriate methods to check for student understanding whereas in-service teachers placed greater emphasis on planning and reflecting on instruction and resources as well as on communicating with students and building relationships with them

Q methodology was employed as a tool to explore pre-service teachers' beliefs, to determine whether there were any shared beliefs among them, and whether their initial beliefs changed after taking an educational psychology course designed to serve their preparation needs. It was also employed to compare pre-service teachers', in-service teachers' and educational psychology instructors' beliefs. The educators' beliefs about the value of their psychological knowledge was explored along four domains of educational psychology – learning/cognition, individual/group differences, human development, motivation – which are used to organize the discussion that follows. This dissertation concludes by discussing its limitations, significance and future work.

Summary of Findings

Psychological Knowledge

Chapter 4 described the three educator groups who participated: pre-service teachers, in-service teachers and educational psychology instructors. It also explored and compared pre-service teachers' and in-service teachers' psychological knowledge. Pre-service teachers' knowledge increased at the end of the term, but this increase was not significant. Comparison of elementary and secondary pre-service teachers showed that

secondary pre-service teachers on average scored higher than elementary pre-service teachers at both time points. However, this difference was only significant at the end of the term. Comparison of pre-service teachers and in-service teachers showed that in-service teachers, on average, scored higher than pre-service teachers, but this difference was not significant. There was, however, a statistically significant interaction between the effects of status and grade level on the mean score of knowledge survey. Further, simple main effects analyses showed that in the case of elementary teachers, in-service teachers scored significantly higher than pre-service teachers whereas for secondary teachers, in-service teachers' and pre-service teachers' mean scores were not significantly different. This interaction was not expected. However, it may be that elementary teachers' responsibility in spending more time with their students in the classroom calls for their need to attend to not only students' learning but to their development at a more holistic level (i.e., social, emotional, etc.). This stands in contrast to secondary teachers, who often work with a significantly greater number of students for significantly shorter periods of time (e.g., one-hour block). Secondary teachers may therefore be more limited to focusing on students' subject-specific needs, which comes at the cost of attending to their developmental needs (e.g., Eccles, Midgley, Wigfield, Buchanan, Reuman & MacIver, 1993; Horowitz et al., 2005). This finding helps in the effort to think about how educational psychology courses can better serve in connecting teachers' psychological knowledge to the work of teaching by considering who they are teaching and the contexts in which they teach, and consider how more experience in formal classroom settings can influence further development in their psychological knowledge.

Beliefs about the Value of Psychological Knowledge

Employing Q methodology helped uncover the complex ways in which the three educator groups believed their understanding of psychological knowledge of learning/cognition, individual/group differences, human development, and motivation would inform teachers in their work of teaching. First, it helped to explore similarities and differences in the patterns of beliefs that emerged *within* educator groups with respect to their value of their psychological knowledge of each domain for teaching practices. This exploration showed that pre-service teachers' beliefs for the most part were generally stable from the beginning of the end of the term. There were, however,

several noteworthy shifts in the teaching practices for which they believed their psychological knowledge of the four domains would be more helpful. Q methodology also allowed for a comparison *between* the three educator groups in the ways they believed their understanding of the four domains of educational psychology would inform the work of teaching. Contrary to my original hypothesis, the three educator groups shared greater similarities than differences in their beliefs about the value of their psychological knowledge for the work of teaching. Despite greater similarities in the teaching practices they connected to the teaching practices, there were some slight variations worth considering. Mapping the teaching practices for which the educators believed their knowledge of the four psychological domains onto Cohen, Raudenbush & Ball's (2003) instructional triangle helped organize similarities and differences across time (for pre-service teachers from PRE to POST-survey) and across the educator groups. These findings are summarized in the following sub-sections.

Learning/Cognition

Pre-service teachers continued to value their psychological knowledge of learning/cognition primarily for teaching practices that involve preparing and modifying instructional strategies to promote student learning as well as selecting appropriate strategies to assess students' progress in their learning. They also continued to consider the role of their psychological knowledge for maximizing opportunities for student learning by establishing norms and routines for organizing classroom space and time to maintain momentum in students' learning as well as promoting students' collective learning through their ability to select and implement group learning tasks. Given that theories around cognition are closely tied to learning and teaching of content, their value of psychological knowledge of learning for teaching practices that address teachers' and students' interaction with content across both time points is not that surprising.

Differences in positively ranked teaching practices across PRE and POST-term show interesting shifts. Pre-service teachers at the beginning of the term focused on the value of their psychological knowledge for their professional development that involves reflecting on and analyzing their instruction as well as for communicating with other professionals in education in addition to providing effective feedback to their students about their learning. This focus on their interaction with students and other professionals

shifted to their interaction with their students' parents. They additionally emphasized on the role of their psychological knowledge of learning in facilitating students' interaction with one another both at the small group and whole class level. This shift in pre-service teachers' focus on the relationship between theories of learning/cognition and their role in facilitating social learning suggests greater recognition of learning as not only an individual process but also as a social process.

The three educator groups shared an emphasis on the value of their psychological knowledge for teaching practices that involve designing, selecting and modifying strategies for presenting content and evaluating students' understanding of the content. In-service teachers however shared greater similarities with pre-service teachers. In addition to expanding on these teaching practices, they focused on the role of their psychological knowledge in building relationships with students' parents and fostering students' interaction with one another around academic content, though to varying degrees; pre-service teachers expanded on the value of knowledge for fostering students' interaction with one another while in-service teachers expanded on the value of their knowledge for building relationships with their students. This suggests their understanding and emphasis of learning as not only an individual process but also as a social process wherein teachers can help students serve as resources for one another's learning.

Individual/Group Differences

Pre-service teachers showed stability in their value of psychological knowledge of individual/group differences for teaching practices around building teacher-student and student-student relationships: facilitating students' discourse and collective work at both small group and whole class level and developing meaningful relationships with their students and students' parents. This suggests their understanding of individual/group differences can serve as a resource and lens through which they can tap into factors that influence students' learning. This in turn can help provide a collaborative and respectful learning environment that encourages students to build trust and relationship with teachers and their peers to support one another's learning. They also believed their psychological knowledge would help them attend to various ways in which they can

evaluate students' unique needs and progress in their learning to ensure students have multiple opportunities to showcase their learning.

Differences across time showed some noteworthy shifts. At the beginning of the term, they emphasized on the value of their psychological knowledge for teaching practices around evaluating and selecting appropriate instructional strategies and resources that would support students' learning. By the end of the term, the focus shifted to a greater range of teaching practices that involve designing, sequencing and analyzing instruction as well as establishing norms to organize classroom time and space to maximize opportunities for learning. These shifts point to an expansion in the ways pre-service teachers believed their awareness of individual/group differences can support teaching.

In-service teachers and educational psychology instructors shared pre-service teachers' emphasis on the value of their psychological knowledge of individual/group differences for teaching practices that involve building students' relationship with one another and attending to student learning through various forms of assessment. This highlights the role of psychological knowledge in building pedagogy and assessments that are sensitive to and responsive to students' learning needs and progress. Given these similarities, in-service teachers and pre-service teachers shared greater similarities with respect to their value of psychological knowledge for building meaningful relationships with students and their parents. This indicates their consideration for how their understanding of individual/group differences can increase their sensitivity to and awareness of various factors outside of the classroom context such that they can engage with students and parents to not only express care and interests but to also gain valuable resources about their students that can be incorporated into their instruction. Similarities between in-service teachers and educational psychology instructors point to value of their psychological knowledge for their interaction with content, particularly during class, as they both positively ranked teaching practice around modifying instructional strategies during class in response to their recognition of student thinking. While in-service teachers believed this psychological knowledge would also support their efforts to prepare instructional strategies *before* class, educational psychology instructors focused on the value of their knowledge for preparing and modifying instructional resources and

materials and reflecting on their instruction, the latter of which pre-service teachers also positively ranked. Despite these variations, all educator groups considered ways in which their understanding of individual/group differences would support their efforts to prepare instructional strategies and materials that address a wide range of students' interests and experiences in ways that promote their learning.

Human Development

When considering the utility of psychological knowledge of human development, pre-service teachers positively ranked a wide range of teaching practices. They positively ranked teaching practices around eliciting, recognizing and responding to students' thinking through modification of instruction, which address a range of elements within the instructional triangle. They also continued to value psychological knowledge of human development for engaging in non-academic conversations with students that extend beyond talking about academic issues as well as for providing a learning environment that fosters both individual and collective learning through effective norms and routines for classroom discourse and organization of classroom space and time. Given that human development provides an overarching view of various factors that influence students' development, the wide range of teaching practices that were positively ranked was not surprising. In fact, recognition of the role of their knowledge in addressing these various teaching practices reflect Bronfenbrenner's (1974, 1979) ecological systems theory that highlights the impact of various levels of environment on children's development and learning.

Differences in pre-service teachers' positive ranking across the two time points indicate an initial focus on the value of their psychological knowledge for building relationships with students by showing value of knowledge for communicating with their students' parents. By the end of the term, the value of their psychological knowledge shifted to communicating effectively with other professionals in education. This suggests their consideration for how their knowledge of human development can help them to collaboratively consider and communicate ways in which they can ensure what students learn and do in classrooms and in schools are well-connected to their students' lives, experiences, and personal goals and interests.

In-service teachers and educational psychology instructors, similar to pre-service teachers, also identified a greater range of teaching practices for which they believed their psychological knowledge of human development would be more helpful, which primarily involved eliciting, recognizing and responding to student learning. This suggests agreement in their beliefs that a developmental perspective that accounts for how various elements of student development (i.e., emotional, social, cognitive) interact with one another in ways that impact student learning can guide them in planning and modifying their instruction based on their evaluation of students' progress to maximize their potential and creating productive learning environment in which students can thrive (Horowitz et al., 2005). In contrast to the previous two domains of educational psychology, however, in-service teachers and educational psychology instructors shared greater similarities in their positive ranking of teaching practices when considering the role of their psychological knowledge of human development. They showed a more comprehensive consideration for how their knowledge could support their knowledge could support their work by showing value of psychological knowledge for teaching practices around selecting and modifying curriculum materials, facilitating students' interaction with one another, and communicating with students' parents. Pre-service teachers on the other hand showed a more focused consideration for how their understanding of human development can enhance teaching practices around setting learning goals, presenting content clearly, and analyzing and communicating with other professionals in education around learning and teaching. This difference may have existed because pre-service teachers' engagement in teacher education courses, in conjunction with field work, may have led them to focus on ideas around developmentally responsive teaching more so than considering how fostering students' success in schools extends beyond learning and involves building meaningful relationships through communication with students and parents. Despite these differences, all educator groups generally showed recognition of psychological knowledge of human development as encompassing a wide range of teaching practices that address multiple forms of interaction between the teacher, the students, the content and the greater environment in which teaching and learning takes place.

Motivation

Compared to the three other domains of educational psychology, educators displayed the greatest variation in the ways that they believed psychological knowledge of motivation would inform teaching practices. Pre-service teachers continued to value their psychological knowledge would support them in promoting students' engagement with one another by facilitating both small group work and whole group discussion. They also continued to believe their understanding of motivation would enhance their ability to prepare and modify instructional strategies and resources. This points to their belief that their understanding various factors of student motivation can inform their instruction decision-making that involves promoting students' sense of autonomy and integrating students' contributions and interests into their lessons (Reeve, 2009; Reeve & Jang, 2006). Pre-service teachers to varying degrees also continued to show value of their knowledge for teaching practices that include setting goals, designing and sequencing lessons toward the goals and designing and selecting various forms of assessment to ensure students meet their goals. They additionally indicated value of knowledge for engaging in academic and non-academic conversations with students and parents in ways that promote students' persistence in their learning (e.g., Ames, 1990; Shephard et al., 2005). Given the understanding that various elements of teachers' instruction and behavior can shape students' motivation to engage in their learning, the connections they made were not surprising.

Differences across time however show some shifts in the ways they valued their psychological knowledge of motivation. Initial beliefs focused on the value of their knowledge for communicating effectively with professionals around learning and instruction. By the end of the term, pre-service teachers' focus on the value of their knowledge shifted to teaching practices around establishing a learning environment conducive to students' individual and collective learning. This shows an expansion of their consideration for how their psychological knowledge can influence the greater environment in which students, their engagement with one another, and their learning are embedded. This points to an understanding that creating a personal and social context that help students build upon one another's experience can influence their motivation and learning.

In-service teachers and educational psychology instructors, similar to pre-service teachers, also positively ranked a wide range of teaching practices that primarily relate to eliciting and responding to student thinking both through the use of appropriate forms of feedback and instructional modifications. This indicates awareness that their responsiveness to students through both feedback and modification of instruction plays a critical role in promoting students' motivation. They also believed their psychological knowledge would help manage students' interaction and build their own relationship with student and parents. Differences in positive rankings show that pre-service teachers positively ranked a greater number of teaching practices, with in-service teachers and educational psychology instructors to varying degrees aligning with pre-service teachers' beliefs. For example, pre-service teachers placed a particular emphasis on the value of their psychological knowledge for monitoring and evaluating students' learning through various forms of assessment, whereas in-service teachers agreed in the belief that their psychological knowledge would support their ability to recognize student thinking during class while educational psychology instructors share in the value of psychological knowledge for developing summative assessments. Pre-service teachers also positively ranked both establishing routines that organize classroom time and space and establishing norms for classroom discourse; educational psychology instructors shared pre-service teachers' value of knowledge for first aspect of establishing norms that maximize classroom time and space while in-service teachers positively ranked the latter which involves establishing norms for classroom discourse and collective work. In-service teachers and educational psychology instructors on the other hand considered the role of psychological knowledge of motivation in reflecting on and analyzing the effectiveness of their instruction. Identification of the various teaching practices within and across educator groups in connection with their psychological knowledge of motivation points to their consideration of ways in which issues around motivation can impact multiple aspects of teaching practices.

Significance and Implications

This dissertation makes a contribution towards better understanding the role of educational psychology in teacher learning and teaching as informed by pre-service teachers, in-service teachers and educational psychology instructors. More specifically,

while much of the previous discussions of the role of educational psychology have been ideological, this study sought to empirically explore its value as perceived by various educators who must learn, apply, and/or teach psychological theories and principles in the context of teacher education. These findings can in turn have important theoretical and practical implications for understanding and applying the value of psychological knowledge for the work of teaching.

One contribution of the study is the employment of Q methodology to address the need to systematically examine the ways in which educators value educational psychology as it relates to the work of teaching. Q methodology specifically involves a scientific study of subjectivity or point of view (McKeown & Thomas, 1998). Q methodology has been advantageous in capturing educators' beliefs in several ways. I focus on its contributions by contrasting Q methodology's use of Q sorting tasks to R methodology, which traditionally uses surveys with Likert scale items asking respondents to determine the extent to which they agree or disagree with each item. In the case of Q sorting tasks, participants play an active role in organizing statements as they rank them in relation to one another. Through this, participants place their own meaning of the items whereas items in Likert-scale surveys come with built-in definitions. Furthermore, when rating teaching practices using Likert scales, participants consider each item independently. On the other hand, Q methodology asks participants to rank-sort the items along a fixed quasi-normal distribution that allows for an exploration of how participants interconnect the items (Watts & Stenner, 2005). This method limits the number of uncertain or extreme responses whereas with Likert-scale items there exists a greater likelihood that respondents can either heavily concentrate on one response side. For example, respondents who believed their psychological knowledge of motivation could inform all the identified teaching practices could mark every item under "strongly agree". Yet others may remain neutral to avoid choosing one response side over another. The use of Q-sorting tasks therefore ensured that participants considered each and every teaching practice *in relation* to one another in ways that represent their beliefs about ways in which their psychological knowledge can inform their teaching practices.

Additionally, Q methodology's practice of analyzing the whole configuration rather than of individual items enables a more complex, holistic and qualitative

exploration of the participants' viewpoints about the value of their psychological knowledge (Watts & Stenner, 2012). This was particularly advantageous for this study given that the different elements of teaching practices are interdependent and are not carried out in isolation (as illustrated by the instructional triangle. Through this approach, rather than asking the question of *whether* educational psychology is helpful for teachers, it addresses the more important question of *how* educational psychology can help teachers in their work of teaching. In fact, employing Q methodology has revealed that unlike previous studies showing that teachers found educational psychology to be too theoretical (e.g., Kiewra & Gubbels, 1997), educational psychology was perceived to be important for their work; many participants commented that completing the tasks was difficult because they believed almost every, if not all, teaching practices can be informed by their psychological knowledge. The findings from this study can serve as a step towards re-conceptualizing ways in which educational psychology can serve as a bridge in integrating their knowledge with skills necessary to be effective in their instruction, their interaction with students, and their efforts to collaborate with various stakeholders in education towards providing quality support to students.

A second contribution of the study is that it offers a way to consider how teachers at different stages in their career might compare in how they value of their psychological knowledge for teaching. Though limited to one teacher education program, this study explored the viewpoints of prospective teachers working towards receiving their teaching license, teachers who received their teaching license and had begun their profession in the classrooms, and instructors who had designed educational psychology courses specifically for teachers. Doing this allowed for exploration of similarities and differences in their beliefs about ways in which their psychological knowledge of learning, diversity, human development, and motivation can inform and support their teaching practices. Findings suggest that for the most part they identified similar teaching practices for which they believed their knowledge of the different domains in educational psychology would be more helpful. There were also some variations in their identification of teaching practices for which they believed their knowledge would be more helpful. Mapping the positively ranked items onto the instructional triangle helped illuminate the different emphases each educator groups placed in the ways in which their

psychological knowledge can strengthen the different interactions that take place in the classrooms, schools and the greater community.

This is not to say that one educator group's beliefs should be taken into consideration more so than the others' beliefs. Issues around learning, diversity, human development and motivation influence all of the relationships that are embedded in the classrooms. Rather, I argue that it is more important to reflect on how educational psychology instructors can effectively help support teachers in developing the ability to effectively integrate their psychological knowledge into their teaching. Given the time-limited nature of teaching a course, insights from pre-service teachers, in-service teachers and educational psychology instructors can inform how one can efficiently and effectively design and implement educational psychology course. Furthermore, in Chapter 2, I argued that teachers' values for educational psychology must be addressed to increase teachers' receptiveness to ideas and perspectives that potentially conflict with their own. This study's findings reiterate this point. It is important for educational psychology instructors to not only consider how their instruction could challenge pre-service teachers' beliefs, but to also reflect on how pre-service teachers' beliefs might challenge their own views about how educational psychology relates to teaching.

This is particularly important to consider for educational psychology instructors, who often vary in their experiences, as discussed in Chapter 1. For example, for educational psychology instructors who have not had K-12 teaching experience, various educator groups' insights about ways in which psychological knowledge is connected to high-leverage teaching practices might serve as important resources for thinking about how they can effectively bridge psychological knowledge of different domains to high-leverage teaching practices. These insights can be particularly important to consider in light of current textbooks' emphasis on theories. Studies in mathematics education (e.g., Carpenter, Fennema, Peterson, Chiang, & Loef, 1989) have shown that helping teachers understand how children's mathematical thinking develops can lead to important changes in teachers' knowledge and beliefs that in turn impact their instructional decision-making. This study's empirical examination of the ways in which educators believe their understanding of the different domains of psychological domains inform their teaching challenged and expanded my own thinking about how psychological principles and

theories connect to teaching practices. In the context of educational psychology courses for prospective teachers, helping course instructors gain an understanding of teachers' thinking around the utility of educational psychology might be helpful.

In a similar vein, variations in educators' beliefs about the value of their psychological knowledge both across and within groups call for greater flexibility in both the design of educational psychology courses and educational psychology instructors' instruction. For example, this study's findings might contribute to educational psychology instructors' understanding of common ways, as well as differences, in which pre-service teachers value their psychological knowledge. This can in turn influence instructors' ability to anticipate, recognize and respond to pre-service teachers' engagement in learning of educational psychology. Such responses often include modifying instruction and/or offering different forms of interventions to meet pre-service teachers' unique learning needs, or to challenge and extend pre-service teachers' knowledge and beliefs about the role of educational psychology in their future teaching. This points to the need for educational psychology instructors to be flexible in their approaches to teaching educational psychology in ways that are not only relatable and understandable, but more importantly, connected to pre-service teachers' experiences. This study's identification of commonalities and differences in ways that teachers connect their psychological knowledge to the work of teaching can contribute to helping educational psychology instructors more readily identify and appropriately modify their instruction in ways that help build teachers' ability to use their psychological knowledge.

By understanding how pre-service teachers' beliefs, in-service teachers' beliefs and educational psychology instructors' beliefs might be similar or different, findings such as those of this study can be used to reflect on how educational psychology instructors can effectively help support teachers in effectively using their psychological knowledge to inform their teaching. Making connections between psychology and education is complex, and understanding how pre-service teachers, in-service teachers and educational psychology instructors make these connections can be helpful in effectively designing courses in psychology that could be more readily understandable and of more value for teachers.

Limitations

Despite gaining important information from extensively studying three educator groups affiliated with one university-based teacher education program, there are limitations worth considering. One limitation lies in employing Q methodology and concerns generalizability. Given that this study's participants consisted of a small sample of pre-service teachers, in-service teachers and educational psychology instructors affiliated with the same university-based teacher education program, it is difficult to generalize findings beyond this teacher education program. As discussed in Chapter 3, Q methodology does not aim to generalize findings to a population of people. Rather, its aim is to sample the diverse viewpoints expressed by a specific group of participants (in this case, beliefs about the value of educational psychology for teaching); Q methodology's interests lie in the ways in which the factors differ. Its ultimate goal is to interpret expressed points of view that may in turn be generalized to the phenomenon being studied (Brown, 1980).

Although the primary aim of Q methodology is that of conceptual generalizability and not population generalizability, it is important to consider the extent to which findings of the study can be related to the general population of educators. Do the beliefs that were uncovered represent beliefs of other pre-service teachers, in-service teachers and educational psychology instructors? The institution from which the study's participants were recruited had a specific curriculum (e.g., what courses and when to take the courses) within its school of education set in place for each of the elementary and secondary pre-service teacher cohorts. Furthermore, educational psychology instructors from a specific population of teacher education program are assigned to teach the course to the pre-service teachers. The timing of the educational psychology course(s) pre-service teachers are required to take, the curriculum of the teacher education program, as well as instructors assigned to teach the course(s) to pre-service teachers could differ from other institutions in the state and in the country and potentially influence the ways in which one might make connections between educational psychology and the work of teaching.

Relatedly, missing data is another limitation to consider. Reasons for the missing data include challenges in obtaining fully completed questionnaires from participants

(e.g., completing beliefs survey but not knowledge survey, partially completed beliefs survey), pre-service teachers' completion and submission of PRE survey but not for the POST survey, and carelessness in filling out the questionnaires. For this study, missing data was excluded for analysis. Steps were taken to minimize this issue and increase participation rates, as addressed in Chapter 3. Although it cannot be tested, it is likely that the time commitment needed to complete the survey may have made it more challenging for educators with particularly busy schedules to participate. Additional replication studies with less missing data are recommended. This may require some revisions to the survey measures, which is discussed next.

The measures used to examine participants' psychological knowledge and beliefs about the value of their psychological knowledge for teaching practices may also be limited. In the case of the psychological knowledge survey, given the scarcity of tests used to measure psychological knowledge, items were adapted from *Praxis II: PLT*. The number of items used for the study was considerably reduced in the efforts to sustain participation. However, as discussed in Chapter 4, the number of items may not have been sufficient for teachers to showcase their psychological knowledge. Furthermore, it would be worth considering implementing a different survey to measure teachers' psychological knowledge. For one, Voss and colleagues (Voss, Kunter & Baumert, 2011) recently developed a more extensive test to empirically measure teachers' psychological knowledge and include multiple-choice items, short-answer items, and videotaped vignettes. Initial construction and analysis of this test have begun to see a connection between higher psychological knowledge and higher quality of instruction as perceived by the teachers' students (Voss et al., 2011). Given its promising outlook, future studies can seek to employ this test to more effectively explore teachers' psychological knowledge.

In the case of the survey used to measure participants' value of their psychological knowledge, although the aim of the survey was to cover a broad scope of the field of educational psychology, this may have been done so at the cost of participant recruitment and retention. The repetitive nature of sorting items for four domains in educational psychology, in addition to knowledge portion of the survey (albeit an abridged version) may have been burdensome for pre-service teachers in their student

teaching in conjunction with coursework requirements, for in-service teachers immersed in their classroom work, and for educational psychology instructors who are often simultaneously engaged in research work and other professional work. Furthermore, several participants expressed difficulty in completing the task, as they commented that they believed all aspects of teaching practices are connected to each domain of educational psychology. This may have affected the ways in which respondents sorted the items (e.g., random ranking) or their decision to complete the task because they may have believed their ranking did not truly reflect their views. Even though this concern was not raised during pilot testing of the survey, further steps can be taken to revise the survey, one possibility being modifying instructions and prompts to further facilitate participants' engagement with the task. Instructions can clarify that participants' negative ranking of a teaching practice does not necessarily reflect the belief that their psychological knowledge would be unhelpful for that particular teaching practice; rather, there are other teaching practices for which knowledge might be *more* helpful for. Task prompts can further reinforce this point. In the case of educational psychology instructors, for examples, prompts can be revised to those along the lines of: "Given the time constraint when teaching, I would prioritize the connection between educational psychology and the following teaching practices for DOMAIN X in the following ways."

Another limitation is the inert nature of one's knowledge and beliefs. While teachers can show what they know or believe when explicitly asked to do so, this does not always guide their thinking and actions in various settings (Hammerness et al., 2005). As Hammerness et al. (2005) state,

"One challenge in multicultural education is going beyond acquiring knowledge...to using "knowledge in action." That is, the problem of knowing something but failing to have it guide one's action is ubiquitous. Many years ago, Alfred Whitehead (1929) warned about the dangers of inert knowledge. This involves knowledge that is available to people in the sense that they can talk about it when explicitly asked to do so...However, the knowledge is inert in the sense that it does not guide one's thinking and action in new setting" (p. 372).

The participants' value of their psychological knowledge for certain teaching practices as expressed through their survey responses may not necessarily translate into practice. Thus

the findings and implications of these findings must be carefully considered. However, given that beliefs have shown to be significant in guiding one's behavior and essential in helping teachers make sense of and responds to the complex and dynamic nature of teaching (e.g., Calderhead, 1996; Clark & Peterson, 1986; Ernst, 1989; Richardson, 2003), this study is an important step towards conceptualizing the role of educational psychology through the lens of those teaching, learning, and making sense of the connection between educational psychology and the practice of teaching. However, this study can be extended by not only replicating the study but also including research questions that involve investigating "knowledge in action". This could entail observing teachers and educational psychology instructors and following up with interviews with the goal of identifying ways in which they use their psychological knowledge in the classrooms. Doing so can help connect their beliefs to their actions to gain an even better understanding of how educational psychology impacts teachers' learning and instruction.

Future Work

Although rich information was gained from studying a purposive sample of educators associated with one university-based teacher education program, the study should be expanded to additional institutions. Doing so would help determine whether the findings are a feature of a particular institution or more generalizable. As discussed in Chapter 3 this study was conducted in a specific university-based teacher education program with a specific set of curricula for elementary and secondary pre-service teachers. Educational psychology course was integrated within the teacher education program's curriculum wherein elementary pre-service teachers took the course during their first term of the course concurrently with their initial placement in classrooms and secondary pre-service teachers took the course during their second term in the program. Other teacher education programs require prospective teachers to take similar courses as a pre-requisite, prior to entering into the program. It is worth considering whether those who take or had taken educational psychology courses prior to their placement in the program and/or classrooms for their student teaching make similar or different connections between psychological knowledge and classroom teaching.

The current study also included instructors who taught educational psychology courses at different time points. They did not necessarily have interaction with the pre-

service teachers who participated in the study. As a result even though the educational psychology instructors were affiliated with the same teacher education program as pre-service teachers who participated in the study and taught at least one educational psychology course within the teacher education program, it is difficult to consider the direct relationship between pre-service teachers and educational psychology instructors. For example, do educational psychology instructors' beliefs about the value of psychological knowledge for teaching influence changes in pre-service teachers' value of psychological knowledge? Designing a study that includes pre-service teachers as well as educational psychology instructors who teach the pre-service teachers would facilitate an understanding of the direct relationship between educational psychology instructors' and their pre-service teachers' cognition. Understanding this educational psychology instructor-pre-service teacher relationship can have pedagogical and curricular implications.

Future studies examining the role of educational psychology in teacher learning and instruction should also examine the relationship between cognition and instruction. One of the limitations discussed pointed to the need to address the inert nature of one's knowledge and beliefs. Further studies must extend to determining the degree to which psychological knowledge and beliefs guide one's actions accordingly (Hammerness et al., 2005). Such studies can be conducted at two levels. The first level is to examine educational psychology instructors' beliefs and their actions in teaching an educational psychology course to pre-service teachers. For example, how effectively do their beliefs about the role of educational psychology guide them in their efforts to communicate to their pre-service teachers the connection between educational psychology and the work of teaching? Are these efforts successfully communicated to their student teachers? The second level is to examine the relationship between teachers' (both pre-service and in-service) cognition and their work in the classrooms. Including a more extensive set of data including interviews, observations, journals and classroom artifacts can help to better illuminate psychological knowledge (and beliefs) in action would be a great contribution in conceptualizing the role of educational psychology in teacher education, teaching, and student learning.

Conclusion

This study addresses the call for the need to better understand the role of educational psychology in teacher education and instruction. It has begun to address the existing conception that educational psychology is disconnected from the work of teaching (e.g., Kiewra & Gubbels, 1997). In contrast, this study's participants have expressed that their psychological knowledge of learning, individual/group differences, human development and motivation are important for their multifaceted work of teaching. Q methodology was employed across three educator groups – pre-service teachers, in-service teachers and educational psychology instructors to examine different viewpoints that might exist in relation to value of educational psychology for teaching. Changes in pre-service teachers' Q-sort rankings from beginning to end of the term showed slight shifts in their beliefs about ways in which their psychological knowledge of learning, differences, human development and motivation would be helpful, indicating that educational psychology courses can possibly help prospective teachers consider various ways in which their psychological knowledge can impact their learning and teaching. Comparisons of pre-service teachers', in-service teachers' and educational psychology instructors' Q-sorts showed that although there were great similarities in their beliefs, there were also variations in their identification of teaching practices for which they believed the knowledge would be more helpful. These similarities and differences both within and across the educator groups shed light to the extensive ways in which psychological knowledge can address the multiple interactions between students, teachers, content, and the environment. Based on these perspectives, the present study affords a demonstration of the important role of educational psychology for teacher learning and teaching. Efforts to conceptualize the value of educational psychology in teacher education should not focus on whether or not the field is important for teachers and their teaching, but rather *how* teachers' psychological knowledge can enhance their teaching practices. The findings of this work suggest that teacher education programs should focus on ways in which educational psychology can be more deeply integrated into teacher education program curricula. Deeper integration would help teachers more effectively develop psychological knowledge with which they can think about their students and their learning in increasingly complex ways. This in turn could increase

teachers ability to be more critical, reflective, purposeful, and effective in their work of teaching over time.

APPENDIX A
BELIEF AND BACKGROUND SURVEY ITEMS

A.1 Q Sort Items Used for Beliefs Survey⁴

Statement #	Statement
1	Making academic content clear through the use of explanation, demonstrations, illustrations and examples
2	Leading a whole class discussion about academic content that encourages students to listen and respond to one another
3	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content
4	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content
5	Recognizing common patterns of student thinking in a particular subject
6	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking
7	Establishing organizational routines, procedures & strategies to maximize time available for student learning
8	Setting up & managing small group work to promote individual and group learning
9	Purposefully engaging in non-academic conversations with individual students to build relationships
10	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards
11	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal
12	Designing a sequence of lessons toward specific goals
13	Using appropriate methods to check for student understanding and monitor student learning
14	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction
15	Providing verbal & written feedback to students to help them improve their academic work
16	Communicating with parents or guardians to promote their child's success in and out of school
17	Reflecting on & analyzing my instruction in order to improve its effectiveness
18	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)

⁴ This is a modified list of high-leverage teaching practice based on pilot study Q-sorting tasks adapted from www.teachingworks.org. Please visit www.teachingworks.org/work-of-teaching/high-leverage-practices for an updated and complete list of high-leverage teaching practices.

A.2 Beliefs Survey: Q Sorting Tasks

“How helpful do you believe knowing psychological principles and theories of COGNITION/LEARNING PROCESSES might be in supporting your ability to carry out the following teaching practices?” (Please note that this task does not ask you to consider which teaching practices you believe would support your students’ cognition/learning processes)

NOTE: Major issues around the topic of cognition or learning processes include (but are not limited to) students’ construction of knowledge, memory, attention, student perception, how misconceptions develop, higher-level thinking, and organizing knowledge.

Statements	
1. Making academic content clear through the use of explanation, demonstrations, illustrations, and examples.	I believe knowledge of COGNITION/LEARNING PROCESSES will be MOST HELPFUL in supporting: (list 3 statements from the left-handed column to this box)
2. Leading a whole-class discussion about academic content that encourages students to listen and respond to one another.	
3. Establishing norms and routines for classroom discourse and work that are central to the subject-matter domain.	
4. Communicating with parents or guardians to promote their child’s success in and out of school.	I believe knowledge of COGNITION/LEARNING PROCESSES will be SOMEWHAT HELPFUL in supporting: (list 4 statements from the left-handed column to this box)
5. Evaluating, choosing, and modifying curriculum materials and learning tasks to accomplish a specific learning goal.	
6. Developing and selecting appropriate assessments (i.e., quizzes, tests, projects), and interpreting results of the assessment to inform future instruction.	
7. Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	I believe knowledge of COGNITION/LEARNING PROCESSES will be NEITHER HELPFUL NOR UNHELPFUL in supporting: (list 4 statements from the left-handed column to this box)
8. Reflecting on and analyzing my instruction in order to improve its effectiveness.	
9. Purposefully engaging in non-academic conversations with individual students to build relationships.	
10. Using appropriate instructional strategies to support, extend, or change common patterns of student thinking.	I believe knowledge of COGNITION/LEARNING PROCESSES will be NOT VERY HELPFUL in supporting: (list 4 statements from the left-handed column to this box)
11. Designing a sequence of lessons towards a specific learning goal.	
12. Setting up and managing small group work to promote individual and group learning.	
13. Providing verbal and written feedback to students to help them improve their academic work.	I believe knowledge of COGNITION/LEARNING PROCESSES will be LEAST HELPFUL in supporting: (list 3 statements from the left-handed column to this box)
14. Setting long- and short-term learning goals for students that are appropriately sequenced and aligned with district standards.	
15. Establishing organizational routines, procedures and strategies to maximize time available for student learning.	
16. Using appropriate methods to check for student understanding and monitor student learning.	
17. Recognizing common patterns of students thinking in a particular subject.	
18. Encouraging students to share their thinking and using that information to evaluate their understanding of academic content.	

“How helpful do you believe knowing psychological principles and theories of INDIVIDUAL/GROUP DIFFERENCES might be in supporting your ability to carry out the following teaching practices?” (Please note that this task does not ask you to consider which teaching practices you believe would support your students’ cognition/learning processes)
 NOTE: Major issues around the topic of individual and/or group differences include issues of diversity. These include (but are not limited to) gender differences in behavior, performance and achievement, cultural differences in behavior, performance and achievement, and attending to and working with students with special needs.

Statements	
1. Making academic content clear through the use of explanation, demonstrations, illustrations, and examples.	I believe knowledge of INDIVIDUAL/GROUP DIFFERENCES will be MOST HELPFUL in supporting: (list 3 statements from the left-handed column to this box)
2. Leading a whole-class discussion about academic content that encourages students to listen and respond to one another.	
3. Establishing norms and routines for classroom discourse and work that are central to the subject-matter domain.	
4. Communicating with parents or guardians to promote their child’s success in and out of school.	I believe knowledge of INDIVIDUAL/GROUP DIFFERENCES will be SOMEWHAT HELPFUL in supporting: (list 4 statements from the left-handed column to this box)
5. Evaluating, choosing, and modifying curriculum materials and learning tasks to accomplish a specific learning goal.	
6. Developing and selecting appropriate assessments (i.e., quizzes, tests, projects), and interpreting results of the assessment to inform future instruction.	
7. Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	I believe knowledge of INDIVIDUAL/GROUP DIFFERENCES will be NEITHER HELPFUL NOR UNHELPFUL in supporting: (list 4 statements from the left-handed column to this box)
8. Reflecting on and analyzing my instruction in order to improve its effectiveness.	
9. Purposefully engaging in non-academic conversations with individual students to build relationships.	
10. Using appropriate instructional strategies to support, extend, or change common patterns of student thinking.	I believe knowledge of INDIVIDUAL/GROUP DIFFERENCES will be NOT VERY HELPFUL in supporting: (list 4 statements from the left-handed column to this box)
11. Designing a sequence of lessons towards a specific learning goal.	
12. Setting up and managing small group work to promote individual and group learning.	
13. Providing verbal and written feedback to students to help them improve their academic work.	I believe knowledge of INDIVIDUAL/GROUP DIFFERENCES will be LEAST HELPFUL in supporting: (list 3 statements from the left-handed column to this box)
14. Setting long- and short-term learning goals for students that are appropriately sequenced and aligned with district standards.	
15. Establishing organizational routines, procedures and strategies to maximize time available for student learning.	
16. Using appropriate methods to check for student understanding and monitor student learning.	
17. Recognizing common patterns of students thinking in a particular subject.	
18. Encouraging students to share their thinking and using that information to evaluate their understanding of academic content.	

“How helpful do you believe knowing psychological principles and theories of HUMAN DEVELOPMENT might be in supporting your ability to carry out the following teaching practices?” (Please note that this task does not ask you to consider which teaching practices you believe support your students’ development)

NOTE: Major issues around the topic of human development include (but are not limited to) cognitive development (e.g., brain development, perceptual skills), social development (e.g., influence of peers and families on students and their learning), language acquisition, emotional development, and moral development (e.g., promoting prosocial behavior).

Statements	
1. Making academic content clear through the use of explanation, demonstrations, illustrations, and examples.	I believe knowledge of HUMAN DEVELOPMENT will be MOST HELPFUL in supporting: (list 3 statements from the left-handed column to this box)
2. Leading a whole-class discussion about academic content that encourages students to listen and respond to one another.	
3. Establishing norms and routines for classroom discourse and work that are central to the subject-matter domain.	
4. Communicating with parents or guardians to promote their child’s success in and out of school.	I believe knowledge of HUMAN DEVELOPMENT will be SOMEWHAT HELPFUL in supporting: (list 4 statements from the left-handed column to this box)
5. Evaluating, choosing, and modifying curriculum materials and learning tasks to accomplish a specific learning goal.	
6. Developing and selecting appropriate assessments (i.e., quizzes, tests, projects), and interpreting results of the assessment to inform future instruction.	
7. Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	I believe knowledge of HUMAN DEVELOPMENT will be NEITHER HELPFUL NOR UNHELPFUL in supporting: (list 4 statements from the left-handed column to this box)
8. Reflecting on and analyzing my instruction in order to improve its effectiveness.	
9. Purposefully engaging in non-academic conversations with individual students to build relationships.	
10. Using appropriate instructional strategies to support, extend, or change common patterns of student thinking.	I believe knowledge of HUMAN DEVELOPMENT will be NOT VERY HELPFUL in supporting: (list 4 statements from the left-handed column to this box)
11. Designing a sequence of lessons towards a specific learning goal.	
12. Setting up and managing small group work to promote individual and group learning.	
13. Providing verbal and written feedback to students to help them improve their academic work.	I believe knowledge of HUMAN DEVELOPMENT will be LEAST HELPFUL in supporting: (list 3 statements from the left-handed column to this box)
14. Setting long- and short-term learning goals for students that are appropriately sequenced and aligned with district standards.	
15. Establishing organizational routines, procedures and strategies to maximize time available for student learning.	
16. Using appropriate methods to check for student understanding and monitor student learning.	
17. Recognizing common patterns of students thinking in a particular subject.	
18. Encouraging students to share their thinking and using that information to evaluate their understanding of academic content.	

“How helpful do you believe knowing psychological principles and theories of MOTIVATION might be in supporting your ability to carry out the following teaching practices?” (Please note that this task does not ask you to consider which teaching practices you believe support your students’ motivation)

NOTE: Major issues around the topic of motivation include (but are not limited to) cognitive factors of motivation, role of emotion on motivation, external and internal factors that impact students’ motivation, students’ development of learning goals.

Statements	
1. Making academic content clear through the use of explanation, demonstrations, illustrations, and examples.	I believe knowledge of MOTIVATION will be MOST HELPFUL in supporting: (list 3 statements from the left-handed column to this box)
2. Leading a whole-class discussion about academic content that encourages students to listen and respond to one another.	
3. Establishing norms and routines for classroom discourse and work that are central to the subject-matter domain.	
4. Communicating with parents or guardians to promote their child’s success in and out of school.	I believe knowledge of MOTIVATION will be SOMEWHAT HELPFUL in supporting: (list 4 statements from the left-handed column to this box)
5. Evaluating, choosing, and modifying curriculum materials and learning tasks to accomplish a specific learning goal.	
6. Developing and selecting appropriate assessments (i.e., quizzes, tests, projects), and interpreting results of the assessment to inform future instruction.	
7. Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	
8. Reflecting on and analyzing my instruction in order to improve its effectiveness.	I believe knowledge of MOTIVATION will be NEITHER HELPFUL NOR UNHELPFUL in supporting: (list 4 statements from the left-handed column to this box)
9. Purposefully engaging in non-academic conversations with individual students to build relationships.	
10. Using appropriate instructional strategies to support, extend, or change common patterns of student thinking.	
11. Designing a sequence of lessons towards a specific learning goal.	I believe knowledge of MOTIVATION will be NOT VERY HELPFUL in supporting: (list 4 statements from the left-handed column to this box)
12. Setting up and managing small group work to promote individual and group learning.	
13. Providing verbal and written feedback to students to help them improve their academic work.	
14. Setting long- and short-term learning goals for students that are appropriately sequenced and aligned with district standards.	
15. Establishing organizational routines, procedures and strategies to maximize time available for student learning.	I believe knowledge of MOTIVATION will be LEAST HELPFUL in supporting: (list 3 statements from the left-handed column to this box)
16. Using appropriate methods to check for student understanding and monitor student learning.	
17. Recognizing common patterns of students thinking in a particular subject.	
18. Encouraging students to share their thinking and using that information to evaluate their understanding of academic content.	

A.3 Demographic Information (From Pre-Service Teacher Survey)

Sex (select one):

1. Male
2. Female

Race (select one):

1. African-American/Black
2. Asian/Pacific Islander
3. Hispanic Native American/American Indian White/European American
4. Multiracial (Please specify)
5. Other (Please specify)

Current year of College (select one):

1. Freshman
2. Sophomore
3. Junior
4. Senior
5. Master's
6. Other (Please specify)

Please include the following information about your academic background. If you do not have a Minor, please indicate with "None".

Major(s):
Minor(s):

Level for Teaching Certificate:

1. Elementary
2. Secondary – subject-specific
3. K-8 Self-Contained
4. Other (Please specify)

Subject-Specific Cohort you are in:

1. Self-contained
2. English
3. Mathematics
4. Music
5. Physical Education
6. Science
7. Social Studies
8. Other (Please specify):

Please list the name(s) of other psychology course(s) you have taken prior to taking the course in educational psychology. If you have not taken any psychology courses, please indicate with “None”.

Please list the name(s) of other college-level courses you have taken that have helped you develop psychological knowledge as it relates to various aspects of teaching (e.g., methods courses, seminars, etc.). Please feel free to identify particular psychological theories or principles that you have learned from the courses you identify. If you have not taken any courses that have helped you develop psychological knowledge, please indicate with “None”.

Have you taken AP Psychology in your high school?

1. Yes
2. No

APPENDIX B
STUDY 2.1 FINDINGS: EXPLORING BELIEFS ABOUT THE VALUE OF
PSYCHOLOGICAL KNOWELDGE OF LEARNING/COGNITION

Findings 2.1a⁵: Changes in Pre-Service Teachers' Beliefs about the Value of their Psychological Knowledge of Learning/Cognition

Pre-Service Teachers' Beliefs: PRE-Term

Out of a total of 30 pre-service teachers, 22 pre-service teachers' Q sorts loaded significantly onto one of the three factors that emerged at the beginning of the term. Table B.1 shows the distribution of the number of elementary and secondary pre-service teachers whose Q sorts loaded onto each of the factors that emerged from analysis.

Table B.1 Pre-Service Teacher PRE Groups Matrix for Learning/Cognition

	Factor A	Factor B	Factor C	Non-Sig	Confounding
Elementary Pre-service	4	3	5	1	1
Secondary Pre-service	7	2	1	4	2
Total Pre-Service	11	5	6	5	3
Variance	21%	12%	11%		

Eight remaining pre-service teachers' Q sorts either did not load significantly onto any of the factors ($n = 5$) or were confounding Q sorts ($n = 3$). The three factors accounted for 44% of the variance. Factor A accounted for 21% of the variance, with 11 participants' Q sorts significantly associated with this factor: four elementary pre-service teachers and seven secondary pre-service teachers. Factor B accounted for 12% of the variance, with five participants' Q sorts associating significantly with this factor: three elementary pre-service teachers and two secondary pre-service teachers. Factor C accounted for 11% of the variance, with six participants' Q sorts associated significantly with this factor: five elementary pre-service teachers and one secondary pre-service teacher. Table B.2 displays the ranking assigned to each of the statements by each factor's representative Q sorts. The teaching practices are listed in order based on the degree to which they were positively ranked across the three groups; items that were positively ranked by the

⁵ To facilitate discussion of differences across time points and educator groups, factors that emerged from analysis will be labeled in the following ways: PS-1, PS-2, etc. for pre-service teacher's PRE-term factors, PS-A, PS-2, etc. for pre-service teachers' POST-term factors, IS-1, IS-2, etc. for in-service teachers' factors, and EPI-1, EPI-2, etc. for educational psychology instructors' factors.

greatest number of factors are listed first, and items that were negatively ranked by the greatest number of factors are listed last.

Table B.2 PRE: By-Factor Ranking of Teaching Practices Corresponding to the Statements, “My Knowledge of Learning/Cognition Would be Helpful For...”

Statement	Factor Arrays		
	A	B	C
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	2	2	2
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1	2	*1
Reflecting on & analyzing my instruction in order to improve its effectiveness	**0	1	2
Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	2	2	** -2
Recognizing common patterns of student thinking in a particular subject	1	1	** -1
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	*1	** -2	*1
Providing verbal & written feedback to students to help them improve their academic work	** -1	1	1
Using appropriate methods to check for student understanding and monitor student learning	**2	** -1	**0
Setting up & managing small group work to promote individual and group learning	*0	** -2	*1
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	** -2	*1	*0
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	**1	* -2	* -1
Purposefully engaging in non-academic conversations with individual students to build relationships	** -2	0	0
Communicating with parents or guardians to promote their child’s success in and out of school	** -2	0	0
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	0	0	** -2
Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1	-1	**2
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	-1	**0	-1
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	**0	* -1	* -2
Designing a sequence of lessons toward specific goals	-1	-1	-1

Note. An * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement

The next section briefly summarizes consensus statements that help provide an understanding of how the three different sub-groups agreed in their beliefs with respect to ways in which their knowledge of learning/cognition would be helpful or unhelpful.

Consensus Statements

The single positively ranked consensus statements between factors that emerged from analysis of PRE Q sorts indicate that despite the differences in Q sorts across the three factors, there was a general agreement in pre-service teachers' beliefs that their knowledge of learning/cognition would be helpful for making academic content clear through their appropriate selection of strategies for representing content through appropriate demonstrations, illustrations, and examples (see Table B.3).

Table B.3 Learning PRE: Consensus Statements

Statement	Factor					
	A		B		C	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	2	1.14	2	1.70	2	1.45
Designing a sequence of lessons toward specific goals	-1	-0.53	-1	-0.31	-1	-0.70

Though not identified as a consensus statement, further comparisons between the Q sorts across the three factors with respect to positive rankings indicate general agreement in pre-service teachers' value of knowledge for modifying instructional strategies *during* instruction in response to their assessment of student thinking to support, extend, or challenge student thinking. On the other hand, the second consensus statement indicates pre-service teachers' shared beliefs that the same knowledge would not be as helpful in sequencing lessons to ensure students have ample opportunities for inquiry and mastery of concepts and skills prior to advancing to more advanced areas of study.

Distinguishing Statements

This section provides a more extensive summary of each factor's Q sort configurations to better understand how each factor's beliefs distinguish from one another. The label representing each factor places an emphasis on the distinguishing statements.

PS-A: Setting and using learning goals to evaluate students and resources for learning

Table B.4 shows PS-A’s Q sort configuration. PS-A’s distinguishing statements, as highlighted in Table B.5, show an emphasis on the value of knowledge of learning/cognition for developing and implementing appropriate methods to monitor student learning as informed by the learning goals they establish for their students.

Table B.4 Learning PRE PS-A Q Sort Configuration

	Statement	PS-A
	Using appropriate methods to check for student understanding and monitor student learning	**2
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	2
<i>Knowledge of learning is more helpful for...</i>	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	2
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	*1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	**1
	Recognizing common patterns of student thinking in a particular subject	1
<i>Knowledge of learning is neither helpful nor unhelpful for...</i>	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	0
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	**0
	Reflecting on & analyzing my instruction in order to improve its effectiveness	**0
	Setting up & managing small group work to promote individual and group learning	*0
<i>Knowledge of learning is less helpful for...</i>	Providing verbal & written feedback to students to help them improve their academic work	** -1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1
	Designing a sequence of lessons toward specific goals	-1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	-1
	Communicating with parents or guardians to promote their child’s success in and out of school	** -2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	** -2
	Purposefully engaging in non-academic conversations with individual students to build relationships	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

PS-A's Q-sort was distinguished from other factors based on the emphasis of the value of their knowledge for aspects of teaching practices around establishing short- and long-term learning goals for their students, as it was the only Q sort to positively rank this teaching practice. This teaching practice, combined with their knowledge of learning, was in turn perceived to guide their efforts to develop and implement both formal assessments and methods for monitoring student thinking during class (e.g., by probing and eliciting student thinking through appropriate questions or tasks) in ways that allow them to evaluate students' understanding of content as they relate to the learning goals.

Table B.5 Distinguishing Statements for PS-A

Statement	Factor Q sort value and Z-score					
	A		B		C	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Using appropriate methods to check for student understanding and monitor student learning	*2	1.39	-1	-1.16	0	0.01
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	0/99	-2	-1.54	1	0.48
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	*1	0.76	-2	-1.31	-1	-0.57
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	*0	0.20	-1	-0.95	-2	-1.62
Reflecting on & analyzing my instruction in order to improve its effectiveness	*0	0.09	1	0.80	2	0.98
Setting up & managing small group work to promote individual and group learning	0	-0.20	-2	-1.44	1	0.42
Providing verbal & written feedback to students to help them improve their academic work	*-1	-0.36	1	0.93	1	0.82
Communicating with parents or guardians to promote their child's success in and out of school	*-2	-1.58	0	0.21	0	0.32
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	*-2	-1.73	1	0.75	0	0.14
Purposefully engaging in non-academic conversations with individual students to build relationships	*-2	-1.77	0	-0.14	0	0.10

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

On the other hand, negatively ranked distinguishing statements suggest the belief that the same understanding of learning would not be as helpful for aspects of teaching practices that involve communicating with various stakeholders in education about teaching and learning. While the other two factors showed either a neutral or positive

stance in their viewpoints about the usefulness of their knowledge of learning/cognition for these teaching practices, PS-A negatively ranked the following items: providing verbal and written feedback to students about their learning as well as engaging in non-academic conversations with their students, communicating with parents or guardians to solicit and provide information about student learning, and communicating with other professionals to discuss student learning. Taken together, pre-service teachers whose Q sorts loaded onto this factor appeared to have identified a distinct set of teaching practices for which they believed their understanding of learning/cognition would be more or less helpful; their knowledge of how students learn would help inform them in preparing and implementing strategies for evaluating and selecting strategies for teaching and assessing students more so than for engaging in conversations with students, parents, and other professionals about student learning and teacher instruction.

PS-B: Communicating with students and other professionals about learning

Much of PS-B's distinguishing statements emphasized teaching practices for which one's understanding of learning/cognition would be *less* helpful compared to other teaching practices (see Table B.6). PS-B's Q sorts show a contrasting set of beliefs to that of PS-A about how their understanding of learning/cognition would be helpful for their teaching practices (see Table B.7). Most notably, PS-B's negative distinguishing statements show that compared to PS-A, its pre-service teachers showed less value of their knowledge of learning/cognition for setting long- and short-term learning goals for students that could in turn inform them in developing and selecting appropriate formative and summative assessments and interpreting results about student learning. In addition, while there was a more neutral stance toward establishing norms and routines that guide students' discourse and work with one another toward building academic knowledge, the Q sort indicated the belief that the knowledge would be less helpful for carrying out specific strategies for setting up and managing small group work. On the other hand its positive distinguishing statement showed a greater value of knowledge for skillfully communicating with other professionals in education, a teaching practice that was not positively ranked by the other two groups; their understanding of how students learn would inform them in their ability to effectively communicate with other teachers,

counselors, school psychologists, etc. about issues around student learning. This is in addition to their positive ranking of teaching practices around providing feedback to students and reflecting on their teaching practice.

Table B.6 Learning PRE PS-B Q Sort Configuration

	Statement	PS-B
<i>Knowledge of learning is more helpful for...</i>	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	2
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2
	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	2
	Providing verbal & written feedback to students to help them improve their academic work	1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	*1
	Recognizing common patterns of student thinking in a particular subject	1
<i>Knowledge of learning is neither helpful nor unhelpful for...</i>	Communicating with parents or guardians to promote their child's success in and out of school	0
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	0
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	**0
	Purposefully engaging in non-academic conversations with individual students to build relationships	0
<i>Knowledge of learning is less helpful for...</i>	Designing a sequence of lessons toward specific goals	-1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	*-1
	Using appropriate methods to check for student understanding and monitor student learning	** -1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	*-2
	Setting up & managing small group work to promote individual and group learning	** -2
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

This indicates that their psychological knowledge of student learning and cognition could extend outside of the classroom context and enable them to use clear and accessible

language with students and various professionals to discuss and acquire appropriate learning resources and services for their students.

Table B.7 Distinguishing Statements for PS-B

Statement	Factor Q sort value and Z-score					
	A		B		C	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-1.73	1	0.75	0	0.14
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	-1	-0.67	*0	0.02	-1	-1.04
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0	0.20	-1	-0.95	-2	-1.62
Using appropriate methods to check for student understanding and monitor student learning	2	1.39	*-1	-0.95	0	0.01
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	1	0.76	-2	-1.16	-1	-0.57
Setting up & managing small group work to promote individual and group learning	0	-0.2	*-2	-1.31	1	0.42
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	0.99	*-2	-1.44	1	0.48

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

PS-C: Attending to and maximizing opportunities for individual and collective learning

As shown in Table B.8, PS-C showed a greater range of teaching practices for which their knowledge would be helpful. Similar to PS-A, PS-C's Q sorts showed beliefs that the knowledge would help inform one's ability to develop and select appropriate summative assessments, though this same knowledge was perceived to be less helpful in readily selecting and using formative assessments during instruction. Also, like PS-B, PS-C's Q sort showed value of their knowledge of learning for communicating with their students about their learning and for reflecting on and analyzing their instruction. According to their distinguishing statements (see Table B.9), however, PS-C's Q sort placed a greater value of their knowledge for organizing various aspects of their classroom to maximize opportunities for students to engage in both group and individual learning.

Table B.8 Learning PRE PS-B Q Sort Configuration

	Statement	PS-C
<i>Knowledge of learning is more helpful for...</i>	Establishing organizational routines, procedures & strategies to maximize time available for student learning	**2
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	2
	Reflecting on & analyzing my instruction in order to improve its effectiveness	2
	Providing verbal & written feedback to students to help them improve their academic work	1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	*1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*1
	Setting up & managing small group work to promote individual and group learning	*1
<i>Knowledge of learning is neither helpful nor unhelpful for...</i>	Communicating with parents or guardians to promote their child's success in and out of school	0
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	*0
	Purposefully engaging in non-academic conversations with individual students to build relationships	0
	Using appropriate methods to check for student understanding and monitor student learning	**0
<i>Knowledge of learning is less helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	** -1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	* -1
	Designing a sequence of lessons toward specific goals	-1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	-1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	** -2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	* -2
	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

For one, they positively ranked an item that the other two groups ranked negatively: establishing organizational routines, procedures and strategies that help them manage classroom time and space such that the potential for disruption is minimized and opportunities for learning is maximized.

Table B.9 Distinguishing Statements for PS-C

Statement	Factor Q sort value and Z-score					
	A		B		C	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1	-0.50	-1	-0.53	*2	1.94
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	0.99	-2	-1.54	1	0.48
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1	1.00	2	1.27	1	0.43
Setting up & managing small group work to promote individual and group learning	0	-0.20	-2	-1.44	1	0.42
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-1.73	1	0.75	0	0.14
Using appropriate methods to check for student understanding and monitor student learning	2	1.39	-1	-1.16	*0	0.01
Recognizing common patterns of student thinking in a particular subject	1	0.52	1	0.50	*-1	-0.37
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	1	0.76	-2	-1.31	-1	-0.57
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	0	0.22	0	0.03	*-2	-1.07
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0	0.20	-1	-0.95	-2	-1.62
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	2	1.04	2	1.16	*-2	-1.72

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

They also showed the viewpoint that their understanding of how students learn could guide their efforts to effectively set up and manage small group work (e.g., selection of tasks that will ensure all students collaborate with and engaging in one another’s learning, use of norms or directions that keep students accountable for their learning) – more so than for implementing strategies for facilitating whole-group discussion and eliciting student thinking to help them share and respond to one another’s thinking. This indicates that PS-C’s pre-service teachers began to believe that in addition to assessing and communicating about learning and teaching, they also believed psychological knowledge of learning would be as helpful for creating an environment conducive to students’ learning both at the individual and group level through their evaluation and implementation of instructional strategies, learning tasks, and norms and routines.

Pre-Service Teachers' Beliefs: POST

Out of a total of 30 pre-service teachers, 24 pre-service teachers' Q sorts loaded significantly onto one of the four factors that emerged (see Table B.10). Six remaining pre-service teachers' Q sorts either did not load significantly onto any of the groups or were confounding sorts. The four factors accounted for 57% of the variance.

Table B.10 Pre-Service Teacher POST Group Matrix for Learning/Cognition

	Factor 1	Factor 2	Factor 3	Factor 4	Non-Sig	Confounding
Elementary Pre-service	4	3	2	1	4	0
Secondary Pre-service	4	7	1	2	1	1
Total Pre-Service	8	10	3	3	5	1
Variance	15%	21%	10%	11%		

Factor 1 accounted for 15% of the variance, with eight pre-service teachers' Q sorts significantly associated with this factor: four elementary pre-service teachers and four secondary pre-service teachers. Factor 2 accounted for 21% of the variation, with ten pre-service teachers' Q sorts significantly associated with the factor: three elementary pre-service teachers and seven secondary pre-service teachers. Factor 3 accounted for 10% of the variance, with three pre-service teachers' Q sorts significantly associated with the factor: two elementary pre-service teachers and one secondary pre-service teacher. Factor 4 accounted for 11% of the variance, with three pre-service teachers' Q sorts significantly associated with the factor: one elementary pre-service teachers and one secondary pre-service teacher. Table B.11 shows the ranking of statements as represented by each of the four factors.

Consensus Statement

The single consensus statement (see Table B.12) is a negatively ranked item indicating agreement in pre-service teachers' beliefs that their understanding of learning/cognition would be less helpful for engaging in non-academic conversations with students compared to other teaching practices. Though not considered a consensus statement, however, all four factors' Q sorts positively ranked one item, making academic content clear through their ability to consider and select appropriate strategies, demonstrations, and representations of academic content, which was PRE Q sorts' consensus statement.

Table B.11 By-factor ranking of teaching practices corresponding to the statement, “My knowledge of learning/cognition would be helpful for...”

Statement	Factor Arrays			
	1	2	3	4
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	2	2	1	1
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1	1	*0	1
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	0	*2	1	1
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	**0	2	1
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	*0	2	*-1
Using appropriate methods to check for student understanding and monitor student learning	0	1	1	-1
Establishing organizational routines, procedures & strategies to maximize time available for student learning	1	** -2	2	*0
Recognizing common patterns of student thinking in a particular subject	** -1	2	** -1	2
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	**2	0	0	0
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	*2	-2	-2	*0
Setting up & managing small group work to promote individual and group learning	** -2	**1	** -1	**2
Designing a sequence of lessons toward specific goals	0	1	-2	-2
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	*-1	-1	0	0
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	0	0	-2
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	-1	-1	-1	**2
Communicating with parents or guardians to promote their child’s success in and out of school	** -2	-1	**1	-1
Providing verbal & written feedback to students to help them improve their academic work	**0	** -1	-2	-2
Purposefully engaging in non-academic conversations with individual students to build relationships	-2	-2	-1	-1

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement

Furthermore, at least three of the four POST factors positively ranked items representing teaching practices that include encouraging students to share their thinking to assess their learning, using appropriate strategies that challenge or extend on students’ understanding

based on their assessment of student thinking, and evaluating, selecting and modifying curriculum materials and learning tasks that support student learning.

Table B.12 Learning POST: Consensus statement

Statement	Factor							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Purposefully engaging in non-academic conversations with individual students to build relationships	-2	-1.23	-2	-1.31	-1	-0.80	-1	-0.92

This suggests that across time, pre-service teachers generally continued to value their knowledge of learning for considering and determining the appropriateness of various instructional strategies that help students build knowledge and skills around academic content at hand.

Distinguishing Statements

PS-1: Setting learning goals and norms for classrooms

PS-1, similar to PRE PS-A, was distinguished for its positive ranking of items around establishing short- and long-term learning goals for their students, which was neither positively ranked nor negatively ranked by other sub-groups (see Table B.13, B.14). Setting learning goals could in turn help them determine the appropriateness of representations, examples and demonstrations that make academic content explicit to help students effectively build an understanding of the content at hand. Furthermore, it could guide their efforts to develop both summative assessments and methods for monitoring student thinking during class (by probing and eliciting student thinking through appropriate questions or tasks) in ways that allow them to evaluate students' understanding of content as they relate to their learning goals. Compared to these teaching practices, however, one of the distinguishing negative statements suggests their beliefs that their understanding of learning would not be as useful in recognizing common patterns of student thinking in a particular subject.

Table B.13 Learning POST PS-1 Q Sort Configuration

	Statement	PS-1
<i>Knowledge of learning is more helpful for...</i>	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	2
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	**2
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	*2
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1
<i>Knowledge of learning is neither helpful nor unhelpful for...</i>	Providing verbal & written feedback to students to help them improve their academic work	**0
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	0
	Designing a sequence of lessons toward specific goals	0
	Using appropriate methods to check for student understanding and monitor student learning	0
<i>Knowledge of learning is less helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	** -1
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	-1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	-1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	* -1
	Purposefully engaging in non-academic conversations with individual students to build relationships	-2
	Communicating with parents or guardians to promote their child's success in and out of school	** -2
	Setting up & managing small group work to promote individual and group learning	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Another positive distinguishing statement, which was not positively ranked by other factors, shows particular emphasis on the value of knowledge for establishing norms and routines that help guide students' interaction with one another toward building a shared knowledge of content. In addition to this teaching practice, PS-1 showed belief that the same knowledge would be helpful for establishing norms and routines for organizing classroom space and time. On the other hand, it negatively ranked implementing specific

strategies and tasks to manage small group work to promote both individual and group learning.

Table B.14 Distinguishing Statements for PS-1

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	*2	1.27	0	-0.14	0	0.37	0	-0.51
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2	1.17	-2	-1.41	-2	-1.24	0	0.35
Providing verbal & written feedback to students to help them improve their academic work	*0	0.23	-1	-0.49	-2	-1.74	-2	-1.61
Recognizing common patterns of student thinking in a particular subject	*-1	0.00	2	1.68	-1	-0.96	2	1.37
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1	-1.18	-1	-0.70	0	-0.07	0	-0.18
Communicating with parents or guardians to promote their child's success in and out of school	*-2	-1.61	-1	-0.99	1	1.06	-1	-0.59
Setting up & managing small group work to promote individual and group learning	*-2	-1.94	1	0.39	-1	-1.01	2	1.25

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

Thus PS-1's Q sort suggested the belief that an understanding of how students learn was more helpful for creating an environment conducive to sharing and constructing knowledge through effective implementation of organizational norms and routines more so than for using specific instructional strategies during instruction to manage group work. Furthermore it showed less value of knowledge for communicating effectively with students' parents as well as with other professionals in education about issues around student learning.

PS-2: Assessing instructional resources and facilitating group work

One of the two positively ranked distinguishing statements points to PS-2's Q sort's emphasis on the value of knowledge for evaluating, choosing and modifying

curriculum materials and learning tasks, which was the most highly ranked by PS-2 (see Tables B.15 and B.16).

Table B.15 Learning POST PS-2 Q Sort Configuration

	Statement	PS-2
<i>Knowledge of learning is more helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	2
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	*2
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	2
	Using appropriate methods to check for student understanding and monitor student learning	1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Designing a sequence of lessons toward specific goals	1
	Setting up & managing small group work to promote individual and group learning	**1
<i>Knowledge of learning is neither helpful nor unhelpful for...</i>	Reflecting on & analyzing my instruction in order to improve its effectiveness	0
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	*0
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	**0
<i>Knowledge of learning is less helpful for...</i>	Providing verbal & written feedback to students to help them improve their academic work	** -1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	-1
	Communicating with parents or guardians to promote their child's success in and out of school	-1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	** -2
	Purposefully engaging in non-academic conversations with individual students to build relationships	-2
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

In addition to this distinguishing statement, PS-2's Q sort was the only Q sort to positively rank teaching practice around designing carefully sequenced lessons that maintain a coherent focus on the academic content and keep students engaged in their learning. These positively ranked statements together point to the perceived usefulness of

knowledge of learning for aspects of teaching practices that involve preparing lessons that ensure students master foundational knowledge and skills that prepare them for developing more advanced ones.

Table B.16 Distinguishing Statements for PS-2

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	0	0.10	2	1.52	1	0.87	1	0.45
Setting up & managing small group work to promote individual and group learning	-2	-1.94	*1	0.39	-1	-1.01	2	1.25
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	0.58	0	0.06	2	1.11	-1	-0.74
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	0.30	*0	-0.31	2	1.42	1	0.80
Providing verbal & written feedback to students to help them improve their academic work	0	0.23	*-1	-0.49	-2	-1.74	-2	-1.61
Establishing organizational routines, procedures & strategies to maximize time available for student learning	1	0.63	*-2	-1.28	2	1.07	0	-0.12

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

PS-2's Q sort also indicates that by the end of the term some pre-service teachers began to appreciate their knowledge of learning for attending to students' shared construction of knowledge, as another positive distinguishing statement showed value of knowledge for effectively managing small group work to ensure students can work collaboratively towards both collective and individual learning.

Though not considered distinguishing statement the Q sort showed value of the same knowledge for their ability to monitor and recognize common patterns of student thinking around particular topics and problems and respond accordingly by modifying their instruction that involves implementing instructional strategies that could appropriately support, challenge or extend student thinking. This however appears to mark only an initial consideration of the potential value of their knowledge for collective work as they placed positive value for work that involves managing small group work

while simultaneously placing negative value for teaching practices that involves facilitating greater whole-group discussion. Negative distinguishing statements meanwhile point to less value of knowledge for communicating with students about their learning through appropriate feedback as well as for establishing organizational routines and norms to maximize time available for learning.

PS-3: Assessing and communicating about student learning with parents

In contrast to other Q sorts, PS-3's Q sort emphasized value of knowledge for communicating with parents or guardians to support their students' learning by providing appropriate information about students' academic progress, behavior, or development (see Table B.17 and B.18). This was in addition to the Q sort's positive ranking of teaching practices around developing and implementing summative and formative assessment to evaluate their learning as well as evaluating, selecting and modifying curriculum materials and learning tasks that would appropriately help students work toward specific learning goals. Together, pre-service teachers whose Q sorts loaded onto PS-3 identified knowledge of learning as being more helpful for attending to student learning through assessment that would in turn serve as a basis for communicating effectively with parents about student learning and modifying instructional strategies and resources to support students' progress.

They additionally showed value of the same knowledge for establishing routines and norms that help organize classroom time and space in ways that maximize opportunities for student learning and minimize potential disruptions. Similar to PS-1, PS-3's negative distinguishing statements showed less value of knowledge for aspects of teaching practice that address students' collective work: setting up and managing small group work and recognizing common patterns of student thinking. This is supported by other negatively ranked statements that include establishing norms and routines for productive classroom discourse and leading whole class discussion in ways that encourage students to listen and respond to one another's thinking. PS-3's Q sort also indicated the belief that compared to other teaching practices, understanding learning/cognition would be less helpful for designing a sequence of lessons toward specific learning goals.

Table B.17 Learning POST PS-3 Q Sort Configuration

	Statement	PS-3
<i>Knowledge of learning is more helpful for...</i>	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	2
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	2
	Communicating with parents or guardians to promote their child's success in and out of school	**1
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	1
	Using appropriate methods to check for student understanding and monitor student learning	1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1
<i>Knowledge of learning is neither helpful nor unhelpful for.....</i>	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0
	Reflecting on & analyzing my instruction in order to improve its effectiveness	0
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*0
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	0
<i>Knowledge of learning is less helpful for...</i>	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	-1
	Purposefully engaging in non-academic conversations with individual students to build relationships	-1
	Recognizing common patterns of student thinking in a particular subject	** -1
	Setting up & managing small group work to promote individual and group learning	** -1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	-2
	Designing a sequence of lessons toward specific goals	-2
	Providing verbal & written feedback to students to help them improve their academic work	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Table B.18 Distinguishing Statements for PS-3

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Communicating with parents or guardians to promote their child’s success in and out of school	-2	-1.61	-1	-0.99	*1	1.06	-1	-0.59
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1	0.89	1	1.03	0	0.13	1	1.04
Recognizing common patterns of student thinking in a particular subject	-1	0.00	2	1.68	*-1	-0.96	2	1.37
Setting up & managing small group work to promote individual and group learning	-2	-1.94	1	0.39	*-1	-1.01	2	1.25

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

PS-4: Facilitating whole-class and small-group work

PS-4’s Q sort placed an emphasis on the value of their knowledge for teaching practices that entail facilitating both small group work and whole group discussions, the latter of which was not positively ranked by other factors (see Table B.19 and B.20). For one, this knowledge was perceived to be useful when working with students on specific content together by facilitating discussions that promote using one another’s ideas and thinking as resources for learning. They also showed belief that their knowledge would guide their ability to use group work to effectively promote student learning by selecting tasks that foster collaborative work, using and managing time efficiently and assigning groups that ensure students work collectively.

In addition to these distinguishing statements, PS-4 also positively ranked teaching practices around assessing and recognizing common patterns of student thinking based on contributions they make in class and responding to their thinking through implementation of appropriate instructional strategies and resources. The one negative distinguishing statement highlights less value of knowledge for developing, using, and interpreting assessments to evaluate student learning and inform future instruction.

Table B.19 Learning POST PS-4 Q Sort Configuration

	Statement	PS-4
<i>Knowledge of learning is more helpful for...</i>	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	**2
	Recognizing common patterns of student thinking in a particular subject	2
	Setting up & managing small group work to promote individual and group learning	**2
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	1
<i>Knowledge of learning is neither helpful nor unhelpful for...</i>	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	*0
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	*0
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	0
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0
<i>Knowledge of learning is less helpful for...</i>	Using appropriate methods to check for student understanding and monitor student learning	-1
	Communicating with parents or guardians to promote their child's success in and out of school	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	*-1
	Purposefully engaging in non-academic conversations with individual students to build relationships	-1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	-2
	Designing a sequence of lessons toward specific goals	-2
	Providing verbal & written feedback to students to help them improve their academic work	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Other negatively ranked statements that supported this aspect of teaching practice around evaluating student learning not only included selecting and using formative assessments to monitor student learning but also reflecting on and analyzing teachers' own instruction. Another aspect of teaching practice for which its pre-service teachers believed their knowledge of learning/cognition would be less helpful involved communicating with students as well as with their students' parents.

Table B.20 Distinguishing Statements for PS-4

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	-1	-0.21	-1	-0.91	-1	-0.62	*2	1.43
Setting up & managing small group work to promote individual and group learning	-2	-1.94	1	0.39	-1	-1.01	*2	1.25
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2	1.17	-2	-1.41	-2	-1.24	0	0.35
Establishing organizational routines, procedures & strategies to maximize time available for student learning	1	0.63	-2	-1.28	2	1.07	0	-0.12
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	0.58	0	0.06	2	1.11	-1	-0.74

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

Exploring Shifts in Pre-Service Teachers' Beliefs from PRE- to POST-Term

As previously noted, the increase in factors from PRE- to POST-term suggests a greater range in pre-service teachers' beliefs about the value of their psychological knowledge of learning and cognition at the end of the term. Such increase, in conjunction with the greater number of items that were positively ranked compared to the few items that were ranked negatively, points to the expansion in pre-service teachers' consideration of the ways in which they believed their knowledge of learning/cognition could inform, guide and enhance their teaching practices. Table 5.12 shows changes in Q sorts' positive ranking of items from the beginning to the end of the term. Exploration and discussion of shifts will be organized by discussing similarities in positive rankings from beginning of the term, followed by exploring changes across the term.

Similarities Across Beginning and End of Term

Comparisons of positive rankings of all factors' Q sorts at the beginning and at the end of the term revealed a continued value of psychological knowledge of learning for teaching practices that primarily involve preparing and modifying instructional strategies for presenting content in ways that are understandable for their students (see Table B.21).

Table B.21 Comparison of Positive Rankings from PRE to POST

Teaching Practices	PRE			POST			
	A	B	C	1	2	3	4
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	2	2	2	2	2	1	1
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1	2	1	1	1	0	1
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	2	2	-2	0	2	1	1
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	-2	1	1	0	2	-1
Recognizing common patterns of student thinking in a particular subject	1	1	-1	-1	2	-1	2
Setting up & managing small group work to promote individual and group learning	0	-2	1	-2	1	-1	2
Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1	-1	2	1	-2	2	0
Using appropriate methods to check for student understanding and monitor student learning	2	-1	0	0	1	1	-1
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	1	-2	-1	2	0	0	0
Reflecting on & analyzing my instruction in order to improve its effectiveness	0	1	2	-1	0	0	-2
Providing verbal & written feedback to students to help them improve their academic work	-1	1	1	0	-1	-2	-2
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	1	0	-1	-1	0	0
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	0	0	-2	1	0	2	1
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0	-1	-2	-1	-1	-1	2
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	-1	0	-1	2	-2	-2	0
Designing a sequence of lessons toward specific goals	-1	-1	-1	0	1	-2	-2
Communicating with parents or guardians to promote their child's success in and out of school	-2	0	0	-2	-1	1	-1
Purposefully engaging in non-academic conversations with individual students to build relationships	-2	0	0	-2	-2	-1	-1

Note. Green indicates positive rankings assigned to corresponding teaching practices by respective factor. Grey indicates teaching practices that have been negatively ranked by all factors.

All Q sorts of factors across both time points positively ranked the item representing teaching practice around making academic content explicit through the use of representations, demonstrations and examples that help students build understanding of the content. The majority of the factors' Q sorts (i.e., all of PRE factors and three of the

four POST factors: PS-1, PS-2, PS-4) also showed value of knowledge for modifying strategies that help challenge or expand on students' thinking in response to student thinking. Pre-service teachers' value of their knowledge for informing their instruction related to building a firm understanding of content was further supported by multiple factors' positive ranking of items around evaluating, selecting and modifying curriculum materials and tasks that could effectively support, challenge and build students' understanding of content at hand (PS-A, PS-B; PS-2, PS-3, PS-4). Taken together, the Q sorts' positive ranking of these items suggest that pre-service teachers generally continued to believe that their understanding of how students learn would primarily be helpful in making instructional decisions with respect to considering and selecting appropriate means and resources for representing content in ways that are understandable for students. This could perhaps point to their continued recognition of the constructive nature of knowing, which draws attention to determining what needs to be taught, why it should be taught, and how it should be taught in ways that are understandable to a specific group of students who bring in unique experiences, knowledge and interests (Bransford et al., 2005).

Factors across both time points also showed value of knowledge for attending to student learning through evaluation and selection of various means for assessing and monitoring their learning to ensure they make progress from achieving smaller learning goals toward larger ones. At least one factor's Q sort from beginning and end of the term positively ranked items representing setting long- and short-term learning goals (PS-A; PS-1), developing, selecting and using appropriate summative assessments (PS-A, PS-C; PS-1, PS-3), using various forms of assessment to monitor student learning during lessons (PS-A; PS-2, PS-3), and recognizing common patterns of the ways in which students develop their thinking about particular topics (PS-A, PS-B; PS-2, PS-4). The connection made between evaluating and monitoring students' learning during, between and at the end of each lesson can be rooted in sociocultural constructivist perspective of learning wherein students are perceived as active constructors of knowledge within a social context. Active construction of knowledge suggests that existing knowledge can enhance or hinder development of new knowledge or skills. Successful learning also involves awareness of when and how to use their knowledge and skills across different

contexts. In addition, one's development of knowledge can be further enhanced with the guidance of those with greater expertise, such as teachers. Based on these ideas, assessments, both summative and formative, can serve as important tools for enhancing student learning. Assessment items can challenge students to elicit higher order thinking and skills, clarify expectations and learning goals to students, and address learning process and outcomes. Teachers can in turn use information from assessments results to provide appropriate guidance, either through feedback or modification of their instruction. In this sense, teachers' knowledge of learning can serve as a framework that enables teachers to consider the content and form of assessment to ensure it incorporates important thinking and problem-solving skills teachers want students to develop and to evaluate and use results of the assessment to inform future instruction to ensure students make progress toward learning goals (Shepard, 2001).

Difference Across Time Points

Despite these similarities, there were notable differences that provide some insight into how viewpoints about the value of knowledge of learning varied from beginning to the end of the term. Q sorts in the beginning of the term placed a greater emphasis on the value of knowledge of learning for analyzing and communicating with students and other professionals in education about learning and teaching, all of which were not positively ranked at the end of the term. Two PRE factors' Q sort indicated the belief that knowledge of learning would not only enable one to effectively communicate with students through appropriate forms of feedback about students' learning, but also reflect on and analyze one's own instruction to determine its effectiveness and consider how he/she could improve instruction in the future (PS-B, PS-C). One factor's Q sort (PS-B) expanded on the latter teaching practice by also showing value of knowledge for engaging in discourse with other professionals in education to meaningfully discuss student needs and plan teaching. This indicates that knowledge of learning was perceived to serve as a tool with which one could consider and talk about learning and instruction with various stakeholders in education, including students, colleagues, and administrators, about important issues around student learning needs and goals and teachers' own instruction and professional development.

By the end of the term, however, more Q sorts showed a greater value of knowledge of learning for attending to a wider range of teaching practices that include fostering student discourse with one another, designing carefully sequenced lessons, and communicating effectively with students' parents or guardians. These items were not positively ranked by Q sorts at the beginning of the term. While positive value of knowledge for setting up and managing small group work existed at the beginning of the term, this positive connection between knowledge of learning and fostering students' collaborative work and learning was expanded upon at the end of the term. For one, one POST factor's Q sort positively ranked not only establishing norms and routines for organizing classroom time and space but also for establishing norms and routines that would help students engage in meaningful interactions with one another around academic content (PS-1). Another factor's Q sort expanded on the value of knowledge for managing small group work as it also positively ranked leading and facilitating whole group discussions that entail encouraging students to listen, share and respond to one another's thinking (PS-4). This Q sort, along with two other factors (PS-1, PS-3), also showed value of knowledge of learning for eliciting student thinking during class to not only reveal ideas that would benefit one another but also give teachers insight to students' progress in their thinking and understanding of the content at hand. Altogether, this shows pre-service teachers' increased focus on value of knowledge of learning for allowing various opportunities for students to build understanding and knowledge through their interaction with one another, a key feature highlighted by learning theories such as sociocultural theory of learning. Vygotsky's (1978) emphasis on learning as being socially mediated by one's culture has called for the need to develop a respectful learning community wherein students can benefit from sharing and responding to one another's thinking. Additionally, PRE-3's Q sort shows consideration of the value of their knowledge of learning for communicating effectively with their students' parents and guardians to provide useful information about students' progress in their learning. This emphasis on fostering student-to-student relationship as well as teacher-parent suggests pre-service teachers' consideration that community-centered learning not only applies to the classroom context but can also extend to the greater community (i.e., home

environment), and that their understanding of knowledge and learning can facilitate their ability to communicate and model teaching and learning.

Findings 2.1b: Comparing Pre-service Teachers' Beliefs to Educational Psychology Instructors and In-Service Teachers

Educational Psychology Instructors

Only one factor emerged from analysis in relation to the ways in which educational psychology instructors believed teachers' understanding of learning/cognition would be helpful for their teaching practices, with all of their Q sorts loading onto the factor (see Table B.22). The one factor accounted for 56% of the variance. The factor's Q sort points to a particular value of teachers' knowledge of learning for designing, implementing and evaluating strategies to foster, assess and respond to student learning. The teaching practices for which they believed knowledge of learning would be most helpful pointed to those involving anticipating and identifying common patterns of student thinking in relation to academic topics, both through informal and summative assessments. They also identified knowledge of learning to be useful for responding to their assessment of student thinking and learning through appropriate instructional strategies that not only make academic content explicit to students but also extend on and advance their students' thinking. Lastly, they believed the knowledge would be helpful for designing carefully sequenced lessons and analyzing its effectiveness by reflecting on their teaching to improve their instruction.

Table B.22 Educational Psychology Instructors: By-Factor Rankings of Statements Corresponding to Statement, “Teachers’ Knowledge of Learning/Cognition Would be Helpful For...”

Statement	Factor Array
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2
Using appropriate methods to check for student understanding and monitor student learning	2
Recognizing common patterns of student thinking in a particular subject	2
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1
Designing a sequence of lessons toward specific goals	1
Reflecting on & analyzing my instruction in order to improve its effectiveness	1
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1
Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	0
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	0
Providing verbal & written feedback to students to help them improve their academic work	0
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	-1
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	-1
Setting up & managing small group work to promote individual and group learning	-1
Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1
Communicating with parents or guardians to promote their child’s success in and out of school	-2
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2
Purposefully engaging in non-academic conversations with individual students to build relationships	-2

In-Service Teachers

Out of a total of 29 in-service teachers, Q sorts of 22 in-service teachers loaded significantly onto one of the three factors that emerged from analysis (see Table B.23). Six remaining in-service teachers’ Q sorts either did not load significantly onto any of the

groups ($n = 5$) or were confounding sorts ($n = 2$). The three factors accounted for 46% of the variance.

Table B.23 In-Service Teacher Group Matrix for Learning

	Factor 1	Factor 2	Factor 3	Non-Sig	Confounding
Elementary In-Service	3	2	2	2	0
Secondary In-service	6	4	5	3	2
Total Pre-Service	9	6	7	5	2
Variance	20%	13%	13%	-	-

Factor A accounted for 20% of the variance, with nine participants' Q sorts significantly associated with this factor: three elementary in-service teachers and six secondary in-service teachers. Factor B accounted for 13% of the variance, with six participants' Q sorts significantly associated with this factor: two elementary in-service teachers and four secondary in-service teachers. Factor C also accounted for 13% of the variance, with seven participants' Q sorts significantly associated with this factor: two elementary in-service teachers and five secondary in-service teachers. Table B.22 shows the ranking assigned to each of the statements of the factors' representative Q sorts.

Consensus Statements

In-service teacher factors had more consensus statements than pre-service teacher factors (see Table B.24 and Table B.25). The positively ranked consensus statements show general agreement in in-service teachers' value of their knowledge of learning for designing carefully-sequenced lessons to ensure students can develop and master their understanding of concepts and skills and for providing appropriate verbal or written feedback to students that help highlight students' strengths as well as areas for improvement. These stand in contrast to aspects of teaching practices pre-service teachers identified at the end of the term for which they generally believed their knowledge would be helpful; whereas pre-service teachers' Q sorts positively ranked items related to teaching practices around evaluating and implementing appropriate instructional strategies and resources for teaching and learning, in-service teachers' Q sorts placed a greater value for more overarching aspect of preparing lessons that involve sequencing lessons to ensure students are given the opportunity to master foundational knowledge prior to developing a more advanced understanding of academic content.

Table B.24 In-Service Teachers: By-Factor Ranking of Teaching Practices Corresponding to the Statement, “My Knowledge of Learning/Cognition Would be Helpful For...”

Statement	Factor Arrays		
	1	2	3
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	**2	**0	**2
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2	2	** -1
Reflecting on & analyzing my instruction in order to improve its effectiveness	** -1	2	2
Designing a sequence of lessons toward specific goals	1	1	0
Providing verbal & written feedback to students to help them improve their academic work	0	1	1
Using appropriate methods to check for student understanding and monitor student learning	1	1	** -1
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	-1	**2	0
Establishing organizational routines, procedures & strategies to maximize time available for student learning	**0	** -2	**2
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	**0	**1	** -2
Recognizing common patterns of student thinking in a particular subject	**2	-1	-1
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	**1	** -2	** -1
Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	**1	-2	-2
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	* -1	0	1
Purposefully engaging in non-academic conversations with individual students to build relationships	** -2	*0	*1
Communicating with parents or guardians to promote their child’s success in and out of school	* -2	* -1	**1
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0	-1	0
Setting up & managing small group work to promote individual and group learning	** -1	0	0
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-1	-2

NOTE: An * denotes distinguishing statement at $p < .05$, and ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement

Furthermore, while pre-service teachers Q sorts shared in the beliefs that an understanding of student learning and cognition may not be as helpful for their ability to

communicate with their students, in-service teachers' Q sorts shared a more positive view about its helpfulness for communicating effectively with students about their learning.

Table B.25 Learning IS: Consensus Statement

Statement	Factor Q Sort and Z-value					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0	-0.15	-1	-0.65	0	-0.32
Designing a sequence of lessons toward specific goals	1	0.68	1	0.49	0	0.32
Providing verbal & written feedback to students to help them improve their academic work	0	0.24	1	0.49	1	0.57

This appears to indicate that in-service teachers believed their understanding of students' learning would guide their ability to not only provide feedback about students' performance in the classrooms but to also provide the guidance and support students need to improve or advance their knowledge and skills.

In-service teachers also agreed in their beliefs that on the other hand, their knowledge of learning would be less helpful for communicating with other professionals to plan and discuss teaching or to communicate about students' learning needs. Extending beyond these consensus statements, in-service teachers' Q sorts showed more variation than pre-service teachers in that despite these consensus statements, there were no other overlapping items that were positively ranked by all three factors.

Distinguishing Statements

IS-1: Preparing Instruction and Assessment of Student Learning

IS-1's Q sort and its distinguishing statements are shown in Table B.26 and B.27, respectively. IS-1's Q sort emphasized the belief that knowledge of learning would be more helpful for teaching practices that involve preparing instructional strategies and resources for teaching and learning, as well as assessments, prior to their teaching. Despite this emphasis, the overall Q sort indicates a fairly holistic beliefs with respect to the ways in which their understanding of student learning and cognition would enhance teaching practices that primarily happen prior to and during instruction.

Table B.26 Learning IS-1 Q Sort Configuration

	Statement	IS-1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	**2
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2
<i>Knowledge of learning is more helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	**2
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	**1
	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	**1
	Designing a sequence of lessons toward specific goals	1
	Using appropriate methods to check for student understanding and monitor student learning	1
<i>Knowledge of learning is neither helpful nor unhelpful for...</i>	Providing verbal & written feedback to students to help them improve their academic work	0
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	**0
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	**0
<i>Knowledge of learning is less helpful for...</i>	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	-1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	** -1
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	* -1
	Setting up & managing small group work to promote individual and group learning	** -1
	Purposefully engaging in non-academic conversations with individual students to build relationships	** -2
	Communicating with parents or guardians to promote their child's success in and out of school	* -2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

The ability to design well-sequenced lessons that help maintain a clear focus on the content, in combination with an understanding of student learning, would inform the efforts to evaluate, select, and modify curriculum materials and learning tasks as well as representations and examples of content that help make content explicit for their students.

Table B.27 Distinguishing Statements for IS-1

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	*2	1.81	0	-0.42	2	1.17
Recognizing common patterns of student thinking in a particular subject	*2	1.04	-1	-0.52	-1	-0.42
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	*1	0.76	-2	-1.22	-1	-0.47
Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	*1	0.71	-2	-1.39	-2	-1.11
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	*0	-0.12	1	0.82	-2	-1.88
Establishing organizational routines, procedures & strategies to maximize time available for student learning	*0	-0.21	-2	-1.68	2	1.33
Reflecting on & analyzing my instruction in order to improve its effectiveness	*-1	-0.46	2	1.51	2	1.84
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	-1	-0.62	0	-0.02	1	0.45
Setting up & managing small group work to promote individual and group learning	*-1	-1.06	0	0.28	0	0.04
Purposefully engaging in non-academic conversations with individual students to build relationships	*-2	-1.35	0	0.43	1	1.00
Communicating with parents or guardians to promote their child's success in and out of school	-2	-1.48	-1	-0.93	1	0.63

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

IS-1's Q sort was particularly distinguished from other Q sorts for showing positive value of knowledge for both designing summative assessments and implementing appropriate methods to monitor student learning to evaluate both individual learning and to recognize common patterns of student thinking; these teaching practices were negatively ranked by IS-2 and IS-3's Q sorts. Such ability would in turn help them select instructional strategies that could appropriately support, extend, or change students' thinking about academic content.

On the other hand, IS-1 showed less value of knowledge for analyzing their own instruction, engaging in conversations with their students, their parents and other professionals in education. Furthermore, while they placed a positive value of their knowledge for instructional practices aimed to promote and assess students' learning, they did not necessarily place the same value of their knowledge for fostering

opportunities for students to engage in classroom discourse during whole-class discussion and small group work. Taken together, IS-1's in-service teachers placed a greater value of their knowledge of learning for teaching practices focused on direct instruction and less value in addition to evaluating students' progress in their learning and less value for using and providing opportunities for interaction with and among various stakeholders in education – students, parents and other professionals in education.

IS-2: Attending to and Evaluating Student Thinking

Like IS-1's Q sort, IS-2's Q sort showed value of its in-service teachers' knowledge for designing a well-sequenced set of lessons (see B.28 and B.29). In contrast to IS-1, however, they placed less value of their knowledge for evaluating and using curriculum materials and tasks. Instead, the Q sort represented belief that understanding student learning would be more helpful for identifying clear goals that would enable them to appropriately sequence their lessons to ensure all students are afforded the opportunity to master the content. It was also identified as being helpful in focusing on how they could monitor their students' learning during instruction – one of which could be accomplished by eliciting and allowing students to share their thinking with one another through questions or tasks – and respond to such informal assessment of student learning with instructional strategies that challenge or extend their students' thinking.

While they believed their knowledge and their established goals would inform their ability to carry out informal assessments, they did not believe their knowledge would be as helpful for designing and implementing more formal, summative assessments as well as for recognizing common patterns of student thinking. Rather, they believed their knowledge would better serve their efforts to provide effective feedback that helps students understand their strengths and areas for improvement and to reflect on and analyze their own teaching and its effectiveness on student learning. While IS-2 shared similarity with IS-1 in their beliefs that their knowledge would be less helpful for communicating with parents and other professionals in education, IS-2 was the only group to also place less value for establishing norms and routines that both help manage classroom space and time to maximize learning and govern how students should engage in classroom discourse to promote both collective and individual learning.

Table B.28 Learning IS-2 Q Sort Configuration

	Statement	IS-2
<i>Knowledge of learning is more helpful for...</i>	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2
	Reflecting on & analyzing my instruction in order to improve its effectiveness	2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	**2
	Using appropriate methods to check for student understanding and monitor student learning	1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	**1
	Providing verbal & written feedback to students to help them improve their academic work	1
	Designing a sequence of lessons toward specific goals	1
<i>Knowledge of learning is neither helpful nor unhelpful for...</i>	Purposefully engaging in non-academic conversations with individual students to build relationships	*0
	Setting up & managing small group work to promote individual and group learning	0
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	**0
<i>Knowledge of learning is less helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	-1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	-1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1
	Communicating with parents or guardians to promote their child's success in and out of school	*-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	** -2
	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	-2
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Table B.29 Distinguishing Statements for IS-2

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	-1	-0.30	*2	1.10	0	-0.09
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0	-0.12	*1	0.82	-2	-1.88
Purposefully engaging in non-academic conversations with individual students to build relationships	-2	-1.35	0	0.43	1	1.00
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	2	1.81	*0	-0.42	2	1.17
Communicating with parents or guardians to promote their child's success in and out of school	-2	-1.48	-1	-0.93	1	0.63
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	0.76	*-2	-1.22	-1	-0.47
Establishing organizational routines, procedures & strategies to maximize time available for student learning	0	-0.21	*-2	-1.68	2	1.33

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

IS-3: Establishing Classroom Norms, Planning Lessons and Communicating with Students and Parents

IS-3's Q sort, like that of IS-1, emphasized the importance of knowledge of learning for helping make academic content clear for students, particularly through the appropriate selection and use of representations and examples of content (see Table B.2.30). Similar to IS-2's Q sort, it also valued the knowledge for reflecting on and analyzing the effectiveness of instruction. Given these similarities, however, IS-3's Q sort showed less value of the knowledge compared to other groups for other aspects of teaching practices that involve designing and assessing resources for teaching as well as for developing and implementing various forms of formative and summative assessments to track students' progress in their learning both during and between lessons (see Table B.31). This includes setting short- and long-term learning goals and using these goals to evaluate and select curriculum materials and learning tasks and to modify their instructional strategies during instruction in response to their assessment of student learning that could help them identify common patterns of student thinking.

Table B.30 Learning IS-3 Q Sort Configuration

	Statement	IS-3
<i>Knowledge of learning is more helpful for...</i>	Reflecting on & analyzing my instruction in order to improve its effectiveness	2
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	**2
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	**2
	Purposefully engaging in non-academic conversations with individual students to build relationships	*1
	Communicating with parents or guardians to promote their child's success in and out of school	**1
	Providing verbal & written feedback to students to help them improve their academic work	1
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	1
<i>Knowledge of learning is neither helpful nor unhelpful for...</i>	Designing a sequence of lessons toward specific goals	0
	Setting up & managing small group work to promote individual and group learning	0
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	0
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0
<i>Knowledge of learning is less helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	** -1
	Using appropriate methods to check for student understanding and monitor student learning	** -1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	** -1
	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	-2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Rather, IS-3's Q sort represented a greater emphasis on the value of their knowledge for their ability to engage in and promote productive interactions with students as well as their parents. For one, even though they believed their understanding of student learning would help them provide effective feedback to their students about their progress and areas for improvement, they also believed it would be just as helpful for communicating

about students' learning and their needs for support with their parents and for engaging in non-academic conversations with their students.

Additionally, their knowledge was considered to be useful in their efforts to lead whole-class discussion that involve encouraging students to use one another's ideas as resources to build a collective knowledge and skills around academic content at hand. IS-3 was the only group to positively rank these two aspects of teaching practices. Its in-service teachers also made up the only group to emphasize the importance of their knowledge for establishing and implementing routines and strategies for organizing classroom space, materials and space to maximize time available for student learning.

Table B.31 Distinguishing Statements for IS-3

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Establishing organizational routines, procedures & strategies to maximize time available for student learning	0	-0.21	-2	-1.68	*2	1.33
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	2	1.81	0	-0.42	*2	1.17
Purposefully engaging in non-academic conversations with individual students to build relationships	-2	-1.35	0	0.43	1	1.00
Communicating with parents or guardians to promote their child's success in and out of school	-2	-1.48	-1	-0.93	*1	0.63
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	0.76	-2	-1.22	*-1	-0.47
Using appropriate methods to check for student understanding and monitor student learning	1	0.57	1	0.83	*-1	-0.88
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2	1.52	2	1.68	*-1	-1.00
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0	-0.12	1	0.82	*-2	-1.88

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

Comparing Pre-Service Teachers', In-Service Teachers' and Educational Psychology Instructors' Beliefs

Table B.32 shows positive rankings of Q sorts representing factors that emerged for each educator groups: pre-service teachers, in-service teachers and educational psychology instructors.

Table B.32 Comparison of Positive Rankings Between Educator Groups

Teaching Practice	PS				IS			EPI
	1	2	3	4	1	2	3	1
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	2	2	1	1	2	0	2	1
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1	1	0	1	2	2	-1	2
Using appropriate methods to check for student understanding and monitor student learning	0	1	1	-1	1	1	-1	2
Recognizing common patterns of student thinking in a particular subject	-1	2	-1	2	2	-1	-1	2
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	0	2	-1	1	-2	-1	1
Designing a sequence of lessons toward specific goals	0	1	-2	-2	1	1	0	1
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	0	2	1	1	1	-2	-2	0
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	0	2	1	-1	2	0	0
Establishing organizational routines, procedures & strategies to maximize time available for student learning	1	-2	2	0	0	-2	2	-1
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	2	0	0	0	0	1	-2	0
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	-1	-1	-1	2	-1	0	1	-1
Communicating with parents or guardians to promote their child's success in and out of school	-2	-1	1	-1	-2	-1	1	-2
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	0	0	-2	-1	2	2	1
Setting up & managing small group work to promote individual and group learning	-2	1	-1	2	-1	0	0	-1
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2	-2	-2	0	0	-1	0	-1
Providing verbal & written feedback to students to help them improve their academic work	0	-1	-2	-2	0	1	1	0
Purposefully engaging in non-academic conversations with individual students to build relationships	-2	-2	-1	-1	-2	0	1	-2
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1	-1	0	0	-2	-1	-2	-2

Similarities Between Pre-service Teachers and Other Educator Groups

Six items were positively ranked in Q sorts of at least one factor from each group. These items encompass teaching practices around planning, selecting and modifying strategies for teaching and evaluating student learning. There was a particular emphasis on the value of the knowledge of learning for designing, selecting and modifying

strategies for instruction, including strategically choosing appropriate representations and examples to help students build an understanding of academic content, and modifying these strategies and resources during instruction based on their ability to elicit and interpret student thinking. For one, Q sorts of at least one factor that emerged from analyses of each educator group positively ranked teaching practice around sequencing a series of lessons toward larger learning goals. This was elaborated on by Q sorts of all educator groups, as multiple factors that emerged from these groups positively ranked items around selecting, using, and modifying appropriate strategies and representations to make content explicit and understandable for their students. These positive rankings indicate that pre-service teachers, in-service teachers and educational psychology instructors believed teachers' understanding of learning would enable them to anticipate and identify whether and how students might interpret particular representations, demonstrations or examples, and prepare instructional response to remediate misconceptions or expand upon their thinking. Such emphasis on the perceived usefulness of their knowledge of learning for these practices may have been influenced by current theories of learning that highlight the idea that students actively construct their own understanding and ideas. Students as active constructors of knowledge point to the need to continuously attend to what students understand or do not understand and prepare and respond accordingly both in preparation for and during instruction.

Attending to and evaluating student thinking and learning through their design and selection of assessments was another aspect of teaching practice for which members of all educator groups believed their knowledge of learning would be helpful. At least one factor from each educator group showed positive value of the knowledge for the following teaching practices: using appropriate methods to check for and monitor student understanding, developing and selecting appropriate summative assessments, and recognizing common patterns of student thinking. If students actively construct their knowledge and do so in various ways at a different pace, it is important for teachers to seek and investigate students' thinking and how they might be building their understanding of content. Positive ranking by pre-service teachers, in-service teachers and educational psychology instructors of items corresponding to assessing and monitoring student thinking suggests their recognition that understanding how students

learn can inform them in designing appropriate questions and tasks that would help teachers tap into students' progress in their thinking and understanding of content.

Given that only one factor emerged from analysis of educational psychology instructors' Q sorts, there was a greater number of items that were positively ranked by pre-service teachers' and in-service teachers' Q sorts compared to that of the instructors. In addition to the six items that were positively ranked by all three groups of educators, at least one Q sort of pre-service teachers' and in-service teachers' factors positively ranked six items, most of which expanded upon the teaching practices that primarily involve designing appropriately sequenced lessons and evaluating, selecting and modifying instructional strategies for presenting content. These items that were positively ranked in pre-service teachers' and in-service teachers' Q sorts but not in educational psychology instructors' Q sorts include teaching practices such as setting long- and short-term learning goals for students and evaluating, selecting and modifying curriculum materials and tasks. Pre-service teachers' and in-service teachers' Q sorts also positively ranked an item that represents another form of actively tapping into students' thinking during class: eliciting student thinking by encouraging them to share their thinking, which in turn can serve as information to evaluate their understanding of the content at hand. This indicates both prospective and practicing teachers' consideration of the role of student learning, particularly with respect to the idea that students' development of new knowledge is built upon their existing knowledge and experience; understanding of students' learning can enable them to not only set learning goals that ensure students master foundational and complex knowledge and skills, but also sequence and design lessons to ensure students attain increasingly complex knowledge and skills through the selection and use of appropriate resources for student learning and use these goals to attend to student thinking and learning.

To a lesser degree, both pre-service teachers and in-service teachers showed some value of their knowledge for promoting peer interaction around academic content as well as facilitating their own interaction with parents or guardians. Q sorts from one of pre-service teacher factors, along with one in-service teacher factor's Q sort, positively ranked items around leading whole class discussion and eliciting student thinking. This connection made between knowledge of learning and facilitating peer interaction may

have been informed by Vygotsky's sociocultural theory, which highlights peer interactions as one of the primary sources for building student understanding. By considering how students' interaction with one another facilitates students' development of knowledge, teachers can select appropriate tasks and questions that effectively prompt and elicit student thinking in ways that would benefit one another. Another Q sort from pre-service teacher factor and in-service teacher factor also showed value of knowledge of learning for their own ability to interact with students' parents or guardians. Their understanding of learning may have been perceived to be useful in using appropriate language to communicating about learning with parents in ways that are understandable and helpful for the parents, and in soliciting relevant information about students' background and interests such that they can incorporate students' lives into their curriculum and instruction. Lastly, one Q sort each from pre-service and in-service teacher factors showed value of the same knowledge for creating a learning environment conducive to student learning by establishing organizational norms, routines and strategies to maximize opportunities for student learning and minimize disruptions. Altogether, this connection made by pre-service and in-service teachers show that they have begun to recognize the role of their knowledge of learning in supporting teaching practices that extend beyond presenting content or assessing students; their understanding of important factors that influence the process of learning can inform their efforts to foster student interaction, communicate with parents, and establish an organized classroom environment just as much as it enables them to effectively present content in ways that help students remember and master and to determine the degree to which their students are making progress in their learning.

Differences Between Pre-service Teachers and Other Educator Groups

While several pre-service teachers and in-service teachers indicated that they valued their knowledge of learning for leading whole class discussion, pre-service teachers expanded on this role of their knowledge for promoting peer interaction around academic content. While no Q sorts of in-service teacher factors did so, two pre-service teacher factors' Q sorts positively ranked setting up and managing small group work, which entails assigning members to specific small groups, designing, selecting and assigning tasks that keep each member accountable for both collective and individual

learning, and managing the groups to ensure students are working collaboratively. Another Q sort from pre-service teacher factor showed value of their knowledge for establishing norms and routines for how students should interact appropriately with one another.

On the other hand, in-service teachers placed a greater emphasis on the role of their knowledge of learning for their own interaction with their students and for their professional development (the latter of which was also positively valued by educational psychology instructors) more so than for fostering students' interaction with one another. The Q sort of the same group of in-service teachers that positively ranked communicating with students' parents and guardians also positively ranked engaging in non-academic conversations with students and providing appropriate feedback to their students about their learning. This suggests that for this group of in-service teachers, their understanding of processes and factors that influence student learning was perceived to be important in helping them to interact with students in ways that not only inform students how they can improve their learning but to also gain insights from students about their experiences, goals and interests that could serve as resource for their teaching. Q sorts of two in-service teacher factors who positively ranked providing feedback to students, along with educational psychology instructors' Q sort, also showed more value of their knowledge for reflecting on and analyzing the effectiveness of their instruction. This points to the idea that theories of learning could serve as an important framework with which they can evaluate their own instruction and consider how they can improve on their teaching.

APPENDIX C

**STUDY 2.2 FINDINGS: EXPLORING BELIEFS ABOUT THE VALUE OF
PSYCHOLOGICAL KNOWLEDGE OF INDIVIDUAL/GROUP DIFFERENCES**

Findings 2.2a: Changes in Pre-Service Teachers' Beliefs about the Value of their Psychological Knowledge of Individual/Group Differences

Pre-Service Teachers' Beliefs: PRE

Out of a total of 30 pre-service teachers, 20 pre-service teachers' Q sorts loaded significantly onto one of the three factors that emerged at the beginning of the term (see Table C.1). Ten remaining pre-service teachers' Q sorts either did not load significantly onto any of the factors ($n = 8$) or were confounding Q sorts ($n = 2$). The three factors accounted for 47% of the variance.

Table C.1 Pre-Service Teacher PRE Group Matrix for Individual/Group Differences

	Factor A	Factor B	Factor C	Non-Sig	Confounding
Elementary Pre-service	5	2	3	3	1
Secondary Pre-service	5	3	2	5	1
Total Pre-Service	10	5	5	8	2
Variance	20%	13%	14%		

Factor A accounted for 20% of the variance, with ten pre-service teachers' Q sorts significantly associated with this factor: five elementary pre-service teachers and five secondary pre-service teachers. Factor B accounted for 13% of the variance, with five pre-service teachers' Q sorts significantly associated with this factor: two elementary pre-service teachers and three secondary pre-service teachers. Factor C accounted for 14% of the variance, with five pre-service teachers' Q sorts significantly associated with this factor: three elementary pre-service teachers and two secondary pre-service teachers. Table C.2 shows the ranking of statements as represented by each of the three factors.

Consensus Statements

According to one of the two consensus statements (see Table C.3), Q sorts at the beginning of the term generally agreed in the beliefs that compared to other teaching practices, one's understanding of individual and group differences would be more helpful for providing students appropriate feedback that effectively outline their strengths and suggest areas for improvement in their learning and performance. In addition to this consensus statement, all three groups positively ranked eliciting and encouraging students to share their thinking with one another for the purpose of both evaluating their

understanding of the content and helping students use one another’s ideas as resources for learning.

Table C.2 PRE: By-Factor Ranking of statements Corresponding to the Statement, “My Knowledge of Individual/Group Differences Would be Helpful for...”

Statement	Factor Arrays		
	A	B	C
Providing verbal & written feedback to students to help them improve their academic work	1	1	1
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	2	**1
Purposefully engaging in non-academic conversations with individual students to build relationships	*2	**0	*1
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2	** -1	2
Communicating with parents or guardians to promote their child’s success in and out of school	*1	** -2	*2
Setting up & managing small group work to promote individual and group learning	1	1	** -2
Using appropriate methods to check for student understanding and monitor student learning	0	**1	0
Recognizing common patterns of student thinking in a particular subject	-1	**2	0
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	** -2	**2	**0
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1	**1	-1
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1	-1	**1
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1	-1	**2
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	**2	** -1	** -2
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	0	0	-1
Reflecting on & analyzing my instruction in order to improve its effectiveness	0	** -2	0
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	**0	** -2	* -1
Designing a sequence of lessons toward specific goals	** -2	*0	* -1
Establishing organizational routines, procedures & strategies to maximize time available for student learning	-2	**0	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement

On the other hand, the Q sorts showed a relatively neutral belief in that the same knowledge may not be as helpful for identifying and implementing specific instructional

strategies that effectively respond to their informal assessment of student thinking during instruction.

Table C.3 Differences PRE: Consensus Statement

Statement	Factor Q Sort and Z-value					
	A		B		C	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	0	-0.33	0	0.10	-1	-0.35
Providing verbal & written feedback to students to help them improve their academic work	1	0.12	1	0.57	1	0.69

Distinguishing Statements

PS-A: Communicating with students and parents

Table C.4 shows PS-A’s Q sort configuration and Table C.4 shows PS-A’s distinguishing statements. PS-A’s Q sort’s distinguishing statements placed an emphasis on the value of knowledge of individual/group differences for building relationships with students and parents. For one, understanding of and sensitivity to their students’ individual and group differences was perceived to enable teachers in engaging in non-academic conversations that help attend to their students’ personal interests and goals. PS-A’s Q sort showed value of the knowledge for engaging in conversations with students around academic content as well; it would inform them in using appropriate language and means to provide feedback that helps students understand both their strengths as learners and areas for improvement to be successful in the classroom.

They also believed this knowledge would enable them to engage with their students’ parents through regular communication with them in their joint efforts to address students’ individual learning and social needs. Though neutral, PS-A’s higher ranking compared to the other two groups suggest a greater value of the knowledge for communicating with other professionals in education compared to other groups of pre-service teachers. Altogether PS-A’s Q sort highlighted the role of the understanding of individual/group differences for building productive relationships with various stakeholders in education including students, parents and other professionals in education.

Table C.4 Differences PS-A Q Sort Configuration

	Statement	PS-A
	Purposefully engaging in non-academic conversations with individual students to build relationships	*2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	**2
<i>Knowledge of individual/group differences is more helpful for...</i>	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1
	Communicating with parents or guardians to promote their child's success in and out of school	*1
	Setting up & managing small group work to promote individual and group learning	1
	Providing verbal & written feedback to students to help them improve their academic work	1
		Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)
<i>Knowledge of individual/group differences is neither helpful nor unhelpful for...</i>	Reflecting on & analyzing my instruction in order to improve its effectiveness	0
	Using appropriate methods to check for student understanding and monitor student learning	0
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	0
		Recognizing common patterns of student thinking in a particular subject
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
<i>Knowledge of individual/group differences is less helpful for...</i>	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	-2
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	** -2
	Designing a sequence of lessons toward specific goals	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

The Q sort's positive ranking of teaching practices around interacting and building relationships with students and parents extended to fostering opportunities for students to build relationships with one another around academic content as well; PS-A's pre-service teachers not only believed their knowledge would guide them in establishing norms and routines for sharing knowledge with one another, but they also believed it

would help them effectively model the importance of sharing knowledge by making students' contributions integral to whole-class discussions and effectively managing small group work that hold each member accountable for both individual and collective learning. This suggests that they primarily valued their knowledge for ensuring that students, teachers and parents were altogether active participants in ensuring students' success and achievement in their learning.

Table C.5 Distinguishing Statements for PS-A

Statement	Factor Q sort value					
	A		B		C	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Purposefully engaging in non-academic conversations with individual students to build relationships	2	1.54	0	-0.23	1	0.99
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	*2	1.38	-1	-0.26	-2	-1.17
Communicating with parents or guardians to promote their child's success in and out of school	1	1.09	-2	-1.36	2	1.60
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	*0	0.10	-2	-1.72	-1	-1.03
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	*-2	-1.27	2	1.44	0	-0.27
Designing a sequence of lessons toward specific goals	*-2	-1.67	0	-0.10	-1	-0.88

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

Negative distinguishing statements showed less value for aspects of teaching that involve planning, designing and implementing lessons and assessments. PS-A's Q sort showed less value of knowledge for setting long- and short-term learning goals for all of their students and in designing and sequencing their lessons accordingly. Extending upon this, PS-A was the only factor to place a more negative value of their knowledge for evaluating, modifying and selecting curriculum materials and learning tasks for specific learning goals in addition to choosing and using appropriate instructional strategies to make academic content clear for their students (e.g., through explanations, modeling or representations of content). In addition to designing and implementing lessons, preparing and using appropriate formative and summative assessments was another aspect of teaching practice for which PS-A's pre-service teachers believed their knowledge would

be less helpful. In fact, PS-A was the only group to negatively rank item representing teaching practice around recognizing common patterns of student thinking and development in a subject matter. Thus while the factor showed belief that the knowledge of individual/group differences would play a greater role in their ability to effectively use and provide opportunities for productive interactions among and between students and their students' parents, the same knowledge would be less essential for teaching practices that involve teaching and assessing students' understanding of the academic content.

PS-B: Evaluating resources for and assessment of student thinking

PS-B's Q sort differed from the other groups for its emphasis on the value of knowledge for attending to student learning through various instructional and assessment strategies, more so than around fostering relationship building (see Table C.6 and C.7). PS-B was the only Q sort that placed less value of the knowledge for communicating with parents or guardians. Positive distinguishing statements focused on the value of the understanding of individual/group differences for aspects of teaching practices that involve setting long- and short-term learning goals referenced to external standards which could serve as a guideline in evaluating and using appropriate resources for fostering and evaluating student learning. More specifically, they believed their knowledge, combined with their ability to set learning goals, would enable them to select and modify curriculum materials to ensure students meet the learning goals. PS-B, like PS-A, also believed the knowledge would be more helpful for managing small group work that provides students opportunities to interact with one another collectively toward building an understanding of the content at hand through appropriate use of tasks or activities that keep students engaged with one another.

On the other hand, PS-B placed less value of the knowledge for aspects of direct instruction such as making content explicit through effective use of examples, demonstrations and representations of academic content or developing and modeling norms for how students are to participate in classroom discourse by skillfully selecting students to share their thinking. Taken together, PS-B valued their knowledge primarily for evaluating, modifying and implementing resources to support instruction and collective learning more so than for determining the appropriateness of specific strategies for presenting new content.

Table C.6 Differences PS-B Q Sort Configuration

	Statement	PS-B
<i>Knowledge of individual/group differences is more helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	**2
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	**2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2
	Using appropriate methods to check for student understanding and monitor student learning	**1
	Setting up & managing small group work to promote individual and group learning	1
	Providing verbal & written feedback to students to help them improve their academic work	1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	**1
<i>Knowledge of individual/group differences is neither helpful nor unhelpful for...</i>	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	0
	Designing a sequence of lessons toward specific goals	*0
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	**0
	Purposefully engaging in non-academic conversations with individual students to build relationships	**0
<i>Knowledge of individual/group differences is less helpful for...</i>	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	** -1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	** -1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	** -2
	Communicating with parents or guardians to promote their child's success in and out of school	** -2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

PS-B also valued knowledge for considering and selecting appropriate methods to monitor student learning and recognize common patterns of student thinking during instruction. Additionally they shared in PS-A's beliefs that their knowledge could inform their efforts to communicate with their students about their learning through various forms of feedback. While its pre-service teachers believed their knowledge could help

evaluate and implement assessments of student learning, they did not believe their knowledge would be as helpful when analyzing their own instruction and communicating about their instruction with other professionals in education.

Table C.7 Distinguishing Statement for PS-B

Statement	Factor Q sort value					
	A		B		C	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Recognizing common patterns of student thinking in a particular subject	-1	-0.39	*2	1.54	0	0.00
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	-2	-1.27	*2	1.44	0	-0.27
Using appropriate methods to check for student understanding and monitor student learning	0	-0.16	*1	1.04	0	0.13
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1	-0.95	*1	0.36	-1	-1.11
Designing a sequence of lessons toward specific goals	-2	-1.67	0	-0.10	-1	-0.88
Establishing organizational routines, procedures & strategies to maximize time available for student learning	-2	-1.11	*0	-0.13	-2	-1.61
Purposefully engaging in non-academic conversations with individual students to build relationships	2	1.54	*0	-0.23	1	0.99
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2	1.38	*-1	-0.26	-2	-1.17
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2	1.26	*-1	-1.12	2	1.29
Reflecting on & analyzing my instruction in order to improve its effectiveness	0	-0.14	*-2	-1.17	0	0.14
Communicating with parents or guardians to promote their child's success in and out of school	1	1.02	*-2	-1.36	2	1.60
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	0	0.10	-2	-1.72	-1	-1.03

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

PS-C: Supporting, assessing and discussing student learning with students and parents

Although PS-C shared several similarities with PS-A, its Q sort identified a more diverse array of teaching practices for which its pre-service teachers believed their knowledge of individual/group differences would be helpful (see Tables C.8). Like PS-A, PS-C's Q sort emphasized on the value of knowledge for engaging in both academic and non-academic conversations with their students and parents and less helpful for communicating with other professionals in education. This was further supported by

positive ranking of developing and using summative assessments, and to a lesser degree informal assessments, that provide rich information about each of their students' progress and struggles.

Table C.8 Differences PS-C Q Sort Configuration

	Statement	PS-C
<i>Knowledge of individual/group differences is more helpful for...</i>	Communicating with parents or guardians to promote their child's success in and out of school	*2
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	**2
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	**1
	Purposefully engaging in non-academic conversations with individual students to build relationships	*1
	Providing verbal & written feedback to students to help them improve their academic work	1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	**1
<i>Knowledge of individual/group differences is neither helpful nor unhelpful for...</i>	Reflecting on & analyzing my instruction in order to improve its effectiveness	0
	Using appropriate methods to check for student understanding and monitor student learning	0
	Recognizing common patterns of student thinking in a particular subject	0
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	**0
<i>Knowledge of individual/group differences is less helpful for...</i>	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	-1
	Designing a sequence of lessons toward specific goals	*-1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	*-1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1
	Setting up & managing small group work to promote individual and group learning	** -2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	** -2
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

In contrast to PS-A and PS-B, PS-C's positive distinguishing statement also showed belief that the knowledge would be more helpful preparing and presenting

content in ways that make it understandable for all students through appropriate use of various demonstrations, examples and representations of content (see Table C.9).

Table C.9 Distinguishing Statement for PS-C

Statement	Factor Q sort value and Z-score					
	A		B		C	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Communicating with parents or guardians to promote their child's success in and out of school	1	1.02	-2	-1.36	2	1.60
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1	-0.68	-1	-0.71	*2	1.27
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1	-0.77	-1	-0.51	*1	1.00
Purposefully engaging in non-academic conversations with individual students to build relationships	2	1.54	0	-0.23	1	0.99
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	1.17	2	1.36	*1	0.44
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	-2	-1.27	2	1.44	*0	-0.27
Designing a sequence of lessons toward specific goals	-2	-1.67	0	-0.10	-1	-0.88
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	0	0.10	-2	-1.72	-1	-1.03
Setting up & managing small group work to promote individual and group learning	1	0.89	1	0.91	*-2	-1.13
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2	1.38	-1	-0.26	*-2	-1.17

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

On the other hand, PS-C's negative ranking indicated belief that the same knowledge may be less helpful during instruction, particularly when trying to modify their teaching by selecting instructional strategies based on their recognition of common patterns of student thinking to extend or challenge them. Understanding of individual/group differences was also considered less necessary compared to other teaching practices for the ability to set long- and short-term learning goals and to sequence their lessons accordingly. These rankings together indicate that PS-C's pre-service teachers began to consider the value of their knowledge for their teaching practices around determining the effectiveness and appropriateness of presenting content, particularly before instruction, to

ensure students develop foundational knowledge and skills related to the academic content.

PS-C's Q sort also indicated the belief that an understanding of diversity would enhance the ability to establish classroom environments that fosters and facilitates student interaction with one another through implementation of norms and routines that encourage students to engage in classroom discourse and shared construction of knowledge, more so than their ability to establish norms that help organize classroom time and space. However, it identified the knowledge to be less helpful for considering and selecting specific instructional strategies for both setting and managing small group work and for leading the larger whole class discussion in ways that get students involved in sharing and responding to one another's thinking. This stands in contrast to PS-B's Q sort that positively ranked managing small group work and in contrast to PS-A's Q sort that positively ranked leading a whole-group discussion. PS-C's Q sort thus emphasizes that rather than implementing particular instructional strategies to engage students with one another, it focused on the value of the understanding of individual/group differences for creating a learning environment, through the effective use of norms and routines, that help students develop sensitivity towards and appreciation for the various resources (e.g., knowledge, culture, personal life experiences and perspectives) each peer brings into the classroom. These various aspects of teaching practices that were positively ranked in relation to other teaching practices show the range of practices for which its pre-service teachers believed their knowledge could address: communicating with students and parents, presenting new content to make it understandable for all students, and establishing norms and routines and help ensure all students are active participants in one another's learning.

Pre-Service Teachers' Beliefs: POST

Out of a total of 30 pre-service teachers, 22 pre-service teachers' Q sorts loaded significantly onto one of the three factors that emerged at the end of the term (Table C.10). Eight remaining pre-service teachers' Q sorts either did not load significantly onto any of the factors ($n = 7$) or were confounding Q sorts ($n = 1$). The three factors accounted for 46% of the variance.

Table C.10 Pre-Service Teacher POST Group Matrix for Individual/Group Differences

	Factor 1	Factor 2	Factor 3	Non-Sig	Confounding
Elementary Pre-service	4	4	2	4	0
Secondary Pre-service	6	2	4	3	1
Total Pre-Service	10	6	6	7	1
Variance	20%	12%	14%		

Factor 1 accounted for 20% of the variance, with 10 participants' Q sorts significantly associated with this factor: four elementary pre-service teachers and six secondary pre-service teachers. Factor 2 accounted for 12% of the variance, with six participants' Q sorts associated significantly with this factor: four elementary pre-service teachers and two secondary pre-service teachers. Factor 3 accounted for 14% of the variance, with six participants' Q sorts associated significantly with this factor: two elementary pre-service teachers and four secondary pre-service teachers. Table C.12 shows the ranking assigned to each of the Q sorts' statements.

Consensus Statements

The two consensus statements (see Table C.11) point to the pre-service teachers' agreement in their beliefs about the ways in which their knowledge of individual/group differences would be *less* helpful: making academic content explicit through the use of representations and examples and skillfully communicating with fellow teachers, administrators or other professional educators to discuss student needs and to inform their future instruction or role of the greater educational community to promote students' learning and well-being.

Table C.12 Differences POST: Consensus Statement

Statement	Factor Q Sort and Z-value					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1	-0.75	-1	-0.44	0	-0.35
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	0	-0.04	-1	-0.38	0	-0.39

Table C.11 POST: By-Factor Ranking of Teaching Practices Corresponding to the Statement, “My Knowledge of Individual/Group Differences Would be Helpful For...”

Statement	Factor Arrays		
	1	2	3
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2	2	**0
Setting up & managing small group work to promote individual and group learning	2	**0	2
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	1	2	*0
Communicating with parents or guardians to promote their child’s success in and out of school	**1	**_1	**2
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	**_1	1	1
Purposefully engaging in non-academic conversations with individual students to build relationships	1	**_2	1
Reflecting on & analyzing my instruction in order to improve its effectiveness	**_2	1	1
Providing verbal & written feedback to students to help them improve their academic work	**0	**0	**2
Establishing organizational routines, procedures & strategies to maximize time available for student learning	**0	**1	**_1
Using appropriate methods to check for student understanding and monitor student learning	**_2	**0	**1
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	**2	-1	-1
Designing a sequence of lessons toward specific goals	*_1	**2	*_2
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	**_1	**1	**_2
Recognizing common patterns of student thinking in a particular subject	**1	**_2	**_1
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	**0	**0	**_2
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	0	-1	0
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1	-1	0
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	-2	-2	**_1

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement

Distinguishing Statements

PS-1: Eliciting, assessing and communicating about student thinking and learning with parents

Table C.13 shows PS-1's Q sort configuration and C.14 shows its distinguishing statements.

Table C.12 Differences PS-1 Q Sort Configuration

	Statement	PS-1
	Setting up & managing small group work to promote individual and group learning	2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	**2
<i>Knowledge of individual/group differences is more helpful for...</i>	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2
	Purposefully engaging in non-academic conversations with individual students to build relationships	1
	Communicating with parents or guardians to promote their child's success in and out of school	**1
	Recognizing common patterns of student thinking in a particular subject	**1
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	1
<i>Knowledge of individual/group differences is neither helpful nor unhelpful for...</i>	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	**0
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	**0
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	0
	Providing verbal & written feedback to students to help them improve their academic work	**0
<i>Knowledge of individual/group differences is less helpful for...</i>	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	** -1
	Designing a sequence of lessons toward specific goals	* -1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	** -1
	Using appropriate methods to check for student understanding and monitor student learning	** -2
	Reflecting on & analyzing my instruction in order to improve its effectiveness	** -2
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

By the end of the term, PS-1's Q sort emphasized the value of knowledge of individual/group differences for eliciting and recognizing patterns of student thinking and communicating about student learning with parents.

Table C.13 Distinguishing Statements for PS-1

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	*2	1.41	-1	-0.43	-1	-0.55
Communicating with parents or guardians to promote their child's success in and out of school	*1	0.84	-1	-1.06	2	1.54
Recognizing common patterns of student thinking in a particular subject	*1	0.48	-2	-1.33	-1	-.59
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*0	0.37	0	-0.35	-2	-1.19
Establishing organizational routines, procedures & strategies to maximize time available for student learning	*0	-0.03	1	0.68	-1	-1.00
Providing verbal & written feedback to students to help them improve their academic work	*0	-0.60	0	0.26	2	1.52
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	*-1	-0.63	1	0.66	-2	-1.32
Designing a sequence of lessons toward specific goals	-1	-0.67	2	1.37	-2	-1.17
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	*-1	-0.94	1	0.82	1	0.42
Using appropriate methods to check for student understanding and monitor student learning	*-2	-1.18	0	0.15	1	1.05
Reflecting on & analyzing my instruction in order to improve its effectiveness	*-2	-1.26	1	0.52	1	0.15

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

Although its pre-service teachers identified their knowledge as being less helpful for communicating about student learning with students than with their students' parents, they believed it would be more helpful when engaging in non-academic conversations with students. The Q sort also showed belief that the understanding would help foster students' ability to interact with one around as they positively ranked teaching practices around developing norms and routines that encourage students to share their thinking with one another as well as to manage small group work in ways that ensure students can work collectively towards both individual and group learning. Altogether, PS-1 pointed to the awareness of and sensitivity to individual/group differences would enhance their

ability to attend to ways in which they could build meaningful relationships with students and parents and to provide an environment in which students have successful opportunities to engage with one another.

On the other hand, even though PS-1 positively ranked eliciting and recognizing common patterns of student thinking, suggesting initial consideration of the role of the knowledge in attending to student thinking, its Q sort, compared to other Q sorts, showed less value of the knowledge for analyzing individual student learning.

Unlike the other factors, it negatively ranked teaching practices around developing and implementing various types of formative and summative assessments as well as for analyzing their own instruction. In addition to evaluating and using assessment of student learning and instruction to inform future teaching, PS-1's Q sort identified various forms of lesson planning for which the knowledge was perceived to be less helpful: setting short- and long-term learning goals for students, designing and sequencing lessons that align with those goals, and evaluating, choosing and modifying both instructional strategies for presenting content clearly and curriculum materials and learning tasks that support student learning.

PS-2: Sequencing lessons toward larger learning goals and establishing classroom norms to maximize both individual and group learning

In contrast to PS-1's and PS-3's Q sorts, PS-2's Q sort highlighted the belief that knowledge of individual/group differences would be particularly useful for teaching practices that involve designing lessons that are well sequenced and aligned with the long- and short-term learning goals they establish (see Tables C.15 and C.16). Despite the positive ranking of these teaching practices, however, it placed less value for evaluating and using appropriate instructional strategies for making content explicit and curriculum materials and tasks to support students' learning. Thus while knowledge of individual/group differences was considered to help inform in considering and establishing learning goals and designing well-sequenced lessons that align with these goals, it was considered less helpful in selecting specific strategies or resources that ensure students attain the learning goals.

Table C.14 Differences PS-2 Q Sort Configuration

	Statement	PS-2
<i>Knowledge of individual/group differences is more helpful for...</i>	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2
	Designing a sequence of lessons toward specific goals	**2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	**1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	**1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	1
<i>Knowledge of individual/group differences is neither helpful nor unhelpful for...</i>	Providing verbal & written feedback to students to help them improve their academic work	**0
	Using appropriate methods to check for student understanding and monitor student learning	**0
	Setting up & managing small group work to promote individual and group learning	**0
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	**0
<i>Knowledge of individual/group differences is less helpful for...</i>	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	-1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1
	Communicating with parents or guardians to promote their child's success in and out of school	** -1
	Recognizing common patterns of student thinking in a particular subject	** -2
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	-2
	Purposefully engaging in non-academic conversations with individual students to build relationships	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

PS-2's positive distinguishing statement also emphasized the value of the knowledge for establishing routines and norms that maximize opportunities for students to engage in individual and collective learning. For one, PS-2 positively ranked organizing classroom time and space such that potential disruptions and misbehavior would be minimized and opportunities for active engagement in learning would be

maximized. Though not considered distinguishing statement, PS-2's Q sort like PS-1's Q sort showed value of knowledge for fostering opportunities for students to interact with one another by establishing norms and routines that guide students' productive discourse with one another around academic content and by modeling these norms through their ability to facilitate whole-class discussion in ways that encourage students to share and use one another's thinking as resources for their learning. On the other hand, PS-2 was the only group who placed less value of their knowledge of individual/group differences for engaging in non-academic conversations with their students and for communicating with their students' parents about the students' learning.

Table C.15 Distinguishing Statements for PS-2

Statement	Factor Q sort value					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Designing a sequence of lessons toward specific goals	-1	-0.67	*2	1.37	-2	-1.17
Establishing organizational routines, procedures & strategies to maximize time available for student learning	0	-0.03	*1	0.68	-1	-1.00
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1	-0.63	*1	0.66	-2	-1.32
Providing verbal & written feedback to students to help them improve their academic work	0	-0.60	*0	0.26	2	1.52
Using appropriate methods to check for student understanding and monitor student learning	-2	-1.18	*0	0.15	1	1.05
Setting up & managing small group work to promote individual and group learning	2	1.74	*0	0.12	2	1.71
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	0	0.37	*0	-0.35	-2	-1.19
Communicating with parents or guardians to promote their child's success in and out of school	1	0.84	*-1	-1.06	2	1.54
Recognizing common patterns of student thinking in a particular subject	1	0.48	*-2	-1.33	-1	-0.59
Purposefully engaging in non-academic conversations with individual students to build relationships	1	0.90	*-2	-1.74	1	1.09

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

In contrast to PS-1, PS-2's Q sort showed value of the knowledge for several aspects of analyzing teaching and learning. While it showed less value of the knowledge for anticipating and recognizing common patterns of student thinking during instruction based on their ability elicit student thinking, it placed a more positive emphasis on its

value for designing and implementing more formal, summative assessments that tap into student' thinking and learning. It also believed the knowledge of individual/group differences would guide the ability to evaluate their own teaching to inform future instruction towards successful student learning.

PS-3: Monitoring and providing feedback about student learning to both students and parents

PS-3's Q sort pointed to the belief that knowledge of individual/group differences would help to effectively communicate with both students, through verbal or written feedback, and with their parents, about their learning based on their summative and formative assessment of student thinking and learning (see Tables C.15 and C.16). This contrasts to PS-1's Q sort, which showed a greater value of the knowledge for communicating with students' parents about student learning and less value for providing feedback directly to their students. In addition to communicating and building relationships with students, knowledge of individual/group differences was perceived to be helpful in fostering students' interactions with one another by setting up and managing small group work effectively through their decision-making around assigning members of each group and providing learning tasks around which students can collaborate.

PS-3 shared similarities with both PS-1 and PS-2 in the beliefs about how the knowledge would be less helpful. For one, similar to PS-1, they placed less value of their knowledge for aspects of teaching practices that involve designing lessons, particularly in setting long- and short-term learning goals, sequencing their lessons accordingly and evaluating and modifying curriculum materials and tasks. PS-3, similar to PS-2, also showed belief that their knowledge would be less helpful for eliciting student thinking and using their students' contributions to recognize common patterns of student thinking. PS-3 however extended upon these negatively ranked practices as they believed that in addition to preparing their instruction in advance, their knowledge would not be as helpful for guiding their efforts to adjust or modify their instruction during instruction based on their recognition of these common patterns of student thinking.

Table C.16 Differences PS-3 Q Sort Configuration

	Statement	PS-3
	Setting up & managing small group work to promote individual and group learning	2
	Providing verbal & written feedback to students to help them improve their academic work	**2
<i>Knowledge of individual/group differences is more helpful for...</i>	Communicating with parents or guardians to promote their child’s success in and out of school	**2
	Purposefully engaging in non-academic conversations with individual students to build relationships	1
	Using appropriate methods to check for student understanding and monitor student learning	**1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	1
<i>Knowledge of individual/group differences is neither helpful nor unhelpful for...</i>	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	*0
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	**0
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	0
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	0
<i>Knowledge of individual/group differences is less helpful for...</i>	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	-1
	Recognizing common patterns of student thinking in a particular subject	** -1
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	** -1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	** -1
	Designing a sequence of lessons toward specific goals	* -2
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	** -2
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Lastly, PS-3’s Q sort was the only Q sort to also indicate less value of the knowledge for establishing organizational routines or strategies that organize classroom time and space to ensure student’ learning opportunities are maximized.

Table C.17 Distinguishing Statements for PS-3

Statement	Factor Q sort value					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Communicating with parents or guardians to promote their child's success in and out of school	1	0.84	-1	-1.06	*2	1.54
Providing verbal & written feedback to students to help them improve their academic work	0	-0.60	0	0.26	*2	1.52
Using appropriate methods to check for student understanding and monitor student learning	-2	-1.18	0	0.15	*1	1.05
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	1	0.47	2	0.88	0	-0.11
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2	1.40	2	1.84	*0	-0.15
Recognizing common patterns of student thinking in a particular subject	1	0.48	-2	-1.33	*-1	-0.59
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	-2	-1.52	-2	-1.57	*-1	-0.66
Establishing organizational routines, procedures & strategies to maximize time available for student learning	0	-0.03	1	0.68	*-1	-1.00
Designing a sequence of lessons toward specific goals	-1	-0.67	2	1.37	-2	-1.17
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	0	0.37	0	-0.35	*-2	-1.19
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1	-0.63	1	0.66	*-2	-1.32

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

Exploring Shifts in Pre-Service Teachers' Beliefs from PRE to POST

Table C.19 shows changes in Q sorts' positive ranking of items from the beginning to the end of the term. Exploration and discussion of shifts in positive rankings will be discussed in the next two sections.

Similarities Across Beginning and End of Term

Diverse characteristics and conditions through which children develop can impact the ways in which teachers' responses matter and influence students' performance in the classrooms and success in their learning. Comparisons of positive rankings at the beginning and at the end of the term indicate continued belief that understanding of these characteristics and conditions that make up individual/group differences would be helpful for interacting effectively with individual students (PS-A, PS-B, PS-C; PS-1, PS-3) and with their students' parents (PS-A, PS-C; PS-1, PS-3) about their students and their

learning. Establishing a meaningful relationship with students and their parents is an important step towards building an effective curriculum and instruction that incorporates elements of students’ cultural practices and language, which have shown to promote successful learning and achievement.

Table C.18 Comparison of Positive Rankings from PRE to POST

Teaching Practice	A	B	C	1	2	3
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	2	1	2	-1	-1
Providing verbal & written feedback to students to help them improve their academic work	1	1	1	0	0	2
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2	-1	2	2	2	0
Purposefully engaging in non-academic conversations with individual students to build relationships	2	0	1	1	-2	1
Setting up & managing small group work to promote individual and group learning	1	1	-2	2	0	2
Communicating with parents or guardians to promote their child’s success in and out of school	1	-2	2	1	-1	2
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2	-1	-2	1	2	0
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1	-1	2	-1	1	1
Using appropriate methods to check for student understanding and monitor student learning	0	1	0	-2	0	1
Recognizing common patterns of student thinking in a particular subject	-1	2	0	1	-2	-1
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1	1	-1	-1	1	-2
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	-2	2	0	-2	-2	-1
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1	-1	1	-1	-1	0
Reflecting on & analyzing my instruction in order to improve its effectiveness	0	-2	0	-2	1	1
Establishing organizational routines, procedures & strategies to maximize time available for student learning	-2	0	-2	0	1	-1
Designing a sequence of lessons toward specific goals	-2	0	-1	-1	2	-2
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	0	0	-1	0	0	-2
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	0	-2	-1	0	-1	0

Learning about individual and group differences and how these differences impact their behaviors and approaches to learning may have reinforced the initial beliefs that such psychological knowledge can help establish a productive means to communicate with students and parents; it could guide them in initiating and maintaining purposeful interactions through which they can gain access to the different experiences, meanings, and strengths each students bring to the class. At the same time, it can enable teachers to effectively communicate care and interest such that students feel valued as members of the learning community.

In addition to teachers' interaction with their students and their students' parents or guardians, some of the pre-service teachers continued to believe that their understanding of individual/group differences would also be helpful for fostering opportunities for all students to engage with one another around academic content. Understanding various aspects of diversity can influence their ability to determine and provide essential conditions and opportunities for students to build a collaborative learning community. This first involves establishing norms and routines that govern how students treat one another as members of a learning community and engage in productive discourse around academic content (PS-A, PS-C; PS-1, PS-2). Creating and maintaining a collaborative learning community also entails determining how students are grouped for small group work (PS-A, PS-B; PS-1, PS-3) and using appropriate questioning, prompts, and tasks to elicit student thinking during whole group discussion such that students can share and contribute to one another's thinking (PS-A, PS-B, PS-C; PS-1, PS-2). Pre-service teachers continued to positively identify these teaching practices for which they believed their knowledge would be helpful.

There also continued to be consideration of the connection between their understanding of individual/group differences and aspects of teaching that involve considering and assessing student learning (PS-A, PS-B, PS-C; PS-1, PS-2, PS-3). The various forms of diversity students bring to class (e.g., cultural, gender, learning styles, motivation) generate diverse learning needs. Assessment is a useful way to help deal with these diverse learning needs in ensuring all students achieve learning goals set by the teachers. Students' different and unique needs call for teachers' ability to use various types of assessments that ensure students are given sufficient opportunities to showcase

and demonstrate their abilities along with their needs. These types of assessments include, and are not limited to, traditional paper-and-pencil exams, journals and other forms of students' reflection of their learning, performance-based assessments, portfolios, and oral presentations/interviews. In turn, teachers must effectively interpret results from these assessments by gathering and evaluating the information they need from the assessments to determine students' strengths, progress and needs. An awareness and understanding of issues around individual/group differences and its impact on student learning can serve as a framework with which teachers can flexibly and purposefully determine what forms of assessment to use to gather information they need and subsequently collect and obtain the necessary information to effectively evaluate student learning. Some of the pre-service teachers have appeared to make such connection both at the beginning and end of the term.

Pre-service teachers at the beginning of the term placed a particular emphasis on the value of their knowledge for implementing formative assessments during instruction. For one, all factors from the beginning of the term, compared to one factor at the end of the term (PS-1), positively ranked the item around eliciting student thinking through questions or tasks that have been carefully selected to check for alternative interpretation of students' ideas or methods for solving problems. This is in addition to all PRE factors' positive ranking of providing feedback to students about their learning. Continuous, meaningful feedback is an important means through which teachers can build relationships with students and identify and communicate their appreciation of the diverse strengths students bring to the class both outside of class and during instruction. Furthermore, one PRE factor in particular positively ranked items representing teaching practices around attending to student learning, which includes developing and selecting summative assessments, using appropriate methods to monitor student thinking (PS-B; PS-3), and recognizing common patterns of student thinking (PS-B; PS-1).

By the end of the term, different factors positively ranked each of these teaching practices, emphasizing on the value of the knowledge for composing and implementing summative assessments. This teaching practice was positively ranked by two POST factors (PS-2, PS-3; PS-C), as opposed to other forms of assessment that were ranked by one of the three different POST factors. Summative assessments are aimed to provide

rich information about what each student has learned an/or where students are struggling. To gain such information, teachers must design and select assessments that are valid and fair in terms of providing equal opportunities for students to demonstrate their knowledge. Furthermore, teachers must be able to take careful, unbiased approach in analyzing and interpreting students' performance. Pre-service teachers' positive ranking indicates that their awareness of children's struggle as influenced by their individual and group differences can help them ensure they not only compose fair assessments but also make valid conclusions about students' strengths and areas for their improvement. Despite variations in the emphasis of the knowledge for different forms of assessment, pre-service teachers continued to believe that understanding how differences students bring to classrooms can influence one another's learning experiences can inform them in attending to and evaluating students' progress.

Differences Across Time Points

From beginning to the end of the course, pre-service teachers' Q sorts showed value of their understanding of individual/group differences for fostering various relationships and for assessing individual students' learning through appropriate use and evaluation of assessments. In addition to these practices, Q sorts from factors at the beginning of the term showed its pre-service teachers' beliefs that the knowledge would also be helpful for aspects of teaching practices that involve planning instruction. One factor's Q sort (PS-C) positively ranked considering and determining the appropriate representations or examples to make content explicit to students, while another factor's Q sort (PS-B) positively ranked reviewing, selecting and modifying curriculum materials to help students work toward their learning goals. Both of these teaching practices, which were not positively ranked in Q sorts of factors that emerged at the end of the term, involve teachers' consideration for each students' progress, interests and needs in conjunction with questions or ideas a particular method or material would raise. Lessons and instructions are effective if students believe the activities are achievable and make sense to them. An understanding of issues around diversity appears to have been perceived to be a helpful resource in effectively and efficiently selecting methods and resources that appropriately challenge and guide their students' interests, goals and need toward their learning of the content at hand. Their understanding of students' various

experiences and interests would help them to carefully plan and implement activities that are highly interesting and personally relevant to students.

By the end of the course, pre-service teachers showed a shift in their focus of the role of their knowledge for teaching to a wider range of practices that included designing and sequencing lessons, establishing organizational routines to maximize learning, and reflecting on their teaching. This was particularly the case for one POST factor (PS-2) that positively ranked these three teaching practices that were not positively ranked at the beginning of the course. This group of pre-service teachers whose Q sorts loaded onto this factor expanded on their beliefs that their psychological knowledge would enable them to set short- and long-term learning goals that are realistic and achievable for their students. In addition to setting attainable goals, PS-2'S Q sort showed value of the knowledge for using these learning goals to design carefully sequenced lessons that ensure students develop mastery of concepts before moving onto more advanced ones. While setting goals and expectations that are not too low or too high for their students is an important first step for teachers, appropriately sequencing lessons is essential in encouraging students to focus on long-term achievement by ensuring all students experience success in their learning process through setting and helping students achieve smaller learning goals along the way. This involves designing lessons that meet students' current level of understanding and moving them along efficiently and as far as possible in the context of the diverse group of students in terms of their abilities, experiences and interests. This factor's positive ranking of these teaching practices together suggests that its pre-service teachers' believed their understanding of issues around individual/group differences would facilitate their efforts to set short- and long-term learning goals that are appropriate for their students and to design and sequence lessons accordingly such that they can help students see and evaluate their progress towards experiencing long-term achievement in successful learning.

The PS-2 also extended on the value of the knowledge for establishing norms and routines of classroom discourse and showed value of the same knowledge for establishing a more general set of norms for organizing classroom space and time to minimize distractions and maximize opportunities for learning. A learning environment that recognizes students' social and cultural perspectives can lead to a sense of belonging that

contributes to active engagement and learning (e.g., Willms, Friesen, & Milton, 2009). Such a learning environment helps children feel safe, productive, and well connected to their peers, teachers, and the academic content. A part of setting up such an environment entails teachers' ability to use clear and organized directions, through various means of communicating their expectations, and introduce tasks that serve as a smooth transition into the content so that distractions are minimized. Another element of building a successful learning environment often involves students being a participant in establishing norms and routines they believe would effectively structure and organize the time and space in which they could not only engage with the content but be able to move around such that they have multiple opportunities to engage and be actively involved in classroom activities. Pre-service teachers' whose Q sorts loaded onto the POST factor appeared to have begun to consider the degree to which their understanding of student diversity could help facilitate the process of collaboratively establishing these norms and routines that foster students' interaction with their peers and maximize opportunities for successful and productive learning.

Lastly, two POST factors' Q sorts (PS-2, PS-3) showed value of the understanding of individual/group differences for engaging in reflective practice, wherein they reflect on and analyze the effectiveness of their instruction. Teachers' reflection of their teaching must include an examination of their personal attitudes and beliefs. In fact, teachers' attitudes that have shown to be critical for effective teaching include not only respect for all students and their individual experiences and interests as well as confidence in their students' abilities to be successful in the classrooms, but also their willingness to challenge and change their own practice if their current approaches are not effective for a particular group of students and commitment to continually seek various solutions to learning problems (Banks et al., 2005). Their awareness of individual/group differences and its impact on students' response to instruction and learning could influence teachers' examination of their attitudes and approaches to reflecting on and analyzing their instruction, more specifically related to social group identities such as race, gender and socioeconomic status. By the end of the term, their exposure to issues around diversity in education may have led them to consider such need to examine their own beliefs, attitudes and assumptions of different groups of instruction in ways that

could inform future behavior and teaching in the classrooms. Such awareness could further enable them to examine their own position within the community and how such position informs what and how they see and react to certain situations in the classrooms.

Findings 2.2b: Comparing Pre-Service Teachers' Beliefs to Educational Psychology Instructors and In-Service Teachers

Educational Psychology Instructors

Out of a total of 10 educational psychology instructors, Q sorts of eight educational psychology instructors loaded significantly onto one of the two factors that emerged from analysis. Two remaining educational psychology instructors' Q sorts did not load significantly onto any of the factors. The two factors accounted for 49% of the variance. Factor 1 accounted for 26% of the variance, with five educational psychology instructors significantly associated with this factor. Factor 2 accounted for 23% of the variance, with three educational psychology instructors significantly associated with the factor. Table C.20 shows the rankings assigned to each teaching practice by the representative Q sorts.

Consensus Statements

Educational psychology instructors' consensus statements indicate the two groups' similarities in their beliefs (see Table C.21). More specifically they believed teachers' knowledge of individual/group differences would be less helpful for teaching practices that involve skillfully communicating with other professionals in education and making academic content clear through their appropriate use of models, examples, demonstrations or representations of content. On the other hand, both groups' Q sorts showed agreement in the beliefs that the same knowledge would be more helpful for analyzing both their students' learning and teaching through their use of summative assessments and reflection of their instruction, as well as for providing opportunities for students to build a collective understanding of the content at hand.

Table C.19 Educational Psychology Instructors: By-Factor Rankings of Teaching Practices Corresponding to the Statement, “Teachers’ Knowledge of Individual/Group Differences Would be Helpful For...”

Teaching Practice	Factor Arrays	
	1	2
Reflecting on & analyzing my instruction in order to improve its effectiveness	1	2
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	1
Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	**2	0
Using appropriate methods to check for student understanding and monitor student learning	**2	0
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0	1
Setting up & managing small group work to promote individual and group learning	*0	2
Designing a sequence of lessons toward specific goals	**2	-1
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	**1	-1
Providing verbal & written feedback to students to help them improve their academic work	**1	-2
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	** -1	1
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	** -1	1
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	** -2	2
Recognizing common patterns of student thinking in a particular subject	0	-1
Communicating with parents or guardians to promote their child’s success in and out of school	** -1	0
Purposefully engaging in non-academic conversations with individual students to build relationships	** -2	0
Establishing organizational routines, procedures & strategies to maximize time available for student learning	**0	-2
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1	-1
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-2
Number of educational psychology instructors loading onto factor		5 3
Variance		26% 23%

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement

Table C.20 Differences POST: Consensus Statement

Statement	Factor Q Sort and Z-value			
	1		2	
	Q	Z-scr	Q	Z-scr
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1	-0.32	-1	-0.64
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0	0.25	1	0.86
Recognizing common patterns of student thinking in a particular subject	0	-0.18	-1	-0.11
Setting up & managing small group work to promote individual and group learning	0	0.53	2	1.24
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	0.63	1	0.77
Reflecting on & analyzing my instruction in order to improve its effectiveness	1	0.81	2	0.91
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-1.36	-2	-1.77

Distinguishing Statements

EPI-1: Designing lessons, monitoring student learning and providing appropriate feedback

As Tables C.22 and C.23 show, EPI-1's Q sort represents belief that teachers' understanding of individual/group differences would be particularly helpful for developing learning goals, and designing and sequencing lessons in ways that align with those goals to ensure all students make progress in their learning. This involves evaluating, modifying and selecting curriculum materials with which all students could engage to support their learning. The learning goals in conjunction with the knowledge was perceived to also guide teachers in designing informal and summative assessments that help them gain a rich understanding of individual students' learning and struggles with the academic content both between lessons and at the end of each unit. The ability to use assessments as guided by the knowledge would serve as a resource for providing appropriate verbal or written feedback that help students know their strengths and focus on areas for improvement, along with teachers' own ability to analyze their own instruction.

Table C.21 Differences EPI-1 Q Sort Configurations

	Statement	EPI-1
<i>Knowledge of individual/group differences is more helpful for...</i>	Using appropriate methods to check for student understanding and monitor student learning	**2
	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	**2
	Designing a sequence of lessons toward specific goals	**2
	Providing verbal & written feedback to students to help them improve their academic work	**1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	**1
<i>Knowledge of individual/group differences is neither helpful nor unhelpful for...</i>	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1
	Setting up & managing small group work to promote individual and group learning	*0
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	**0
<i>Knowledge of individual/group differences is less helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	0
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	** -1
	Communicating with parents or guardians to promote their child's success in and out of school	** -1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	** -1
	Purposefully engaging in non-academic conversations with individual students to build relationships	** -2
<i>Knowledge of individual/group differences is less helpful for...</i>	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

In contrast, EPI-1's Q sort showed less value of the knowledge for aspects of teaching practices that involve more explicit forms of direct instruction (e.g., presenting new content) and leading whole-class discussions that promote students' interaction with one another around academic content. It also negatively ranked communicating with students

about non-academic issues and with their students' parents and other professionals in education.

EPI-2: Providing opportunities for students to share their thinking about academic content

Table C.23 shows EPI-2's Q sort configuration.

Table C.22 Differences EPI-2 Q Sort Configuration

	Statement	EPI-2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2
	Setting up & managing small group work to promote individual and group learning	2
<i>Knowledge of individual/group differences is more helpful for...</i>	Reflecting on & analyzing my instruction in order to improve its effectiveness	2
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1
<i>Knowledge of individual/group differences is neither helpful nor unhelpful for...</i>	Communicating with parents or guardians to promote their child's success in and out of school	0
	Using appropriate methods to check for student understanding and monitor student learning	0
	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	0
	Purposefully engaging in non-academic conversations with individual students to build relationships	0
<i>Knowledge of individual/group differences is less helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	-1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1
	Designing a sequence of lessons toward specific goals	-1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1
	Providing verbal & written feedback to students to help them improve their academic work	-2
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	-2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

EPI-2's Q sort, like EPI-1, showed belief that teachers' knowledge of diversity would be useful for designing appropriate summative assessment that informs teachers about their students' learning in conjunction with their ability to reflect and analyze their own instruction. However, the two factors stand in stark contrast with one another in the beliefs about the ways in which teachers' knowledge of individual/group differences would be helpful for their teaching. In contrast to EPI-1's emphasis on the value of the knowledge for designing instruction, EPI-2's Q sort showed greater value of the knowledge for promoting shared construction of knowledge. It positively ranked establishing norms that help students share and respond to one another's thinking, managing small group work that ensure students work collaboratively toward their learning, and facilitating discussions that encourage students to attend to and respond to one another's thinking about the content at hand. This suggests that understanding of individual/group differences can help attend to ways in which individual students, as members of a greater learning community, could serve as resources and support for one another's learning. EPI-2's Q sort also believed the understanding would enable teachers to effectively respond to their assessment of student thinking through their selection of instructional strategies that would challenge, support or extend their students' level of understanding of the content at hand.

EPI-2's Q sort also contrasted with EPI-1's Q sort about ways in which the knowledge would be less helpful. For one, EPI-2's Q sort pointed to the belief that compared to other teaching practices the knowledge would be less helpful for setting long- and short-term learning goals and using these goals to design well-sequenced lessons to ensure all students could master foundational knowledge and skills around academic content. The Q sort also extended upon the beliefs that the knowledge would be of less value for planning lessons by also negatively ranking for considering, selecting, and using appropriate instructional strategies for making academic content clear to their students. Furthermore, in contrast to EPI-1, EPI-2's Q sort showed less value of the knowledge for providing appropriate verbal or written feedback to their students about their learning. However, like EPI-1, EPI-2 also placed less value of their knowledge for skillfully communicating with other professionals in education. Other aspects of teaching practices for which they believed their knowledge would be less helpful included

establishing organizational procedures, routines and strategies for managing classroom space and time and recognizing common patterns of student thinking. Given these variations, however, EPI-2's instructors believed the knowledge of individual/group differences would primarily be less helpful for elements of teaching practices that involve preparing lessons and communicating with students and other professionals in education about student learning. On the other hand they placed a greater value of their knowledge for facilitating opportunities for students to interact with one another around academic content.

In-Service Teachers

22 of the 29 in-service teachers' Q sorts loaded significantly onto one of the four factors that emerged from analysis (see Table C.24). Seven remaining in-service teachers' Q sorts either did not load significantly onto any of the groups ($n = 5$) or were confounding sorts ($n = 2$). The four factors accounted for 53% of the variance.

Table C.23 In-Service Teacher Group Matrix for Individual/Group Differences

	Factor 1	Factor 2	Factor 3	Factor 4	Non-Sig	Confounding
Elementary In-Service	3	3	0	1	2	0
Secondary In-service	7	2	4	2	3	2
Total Pre-Service	10	5	4	3	5	2
Variance	18%	12%	12%	11%	-	-

Factor 1 accounted for 18% of the variance, with ten participants' Q sorts significantly associated with this factor: three elementary in-service teachers and seven secondary in-service teachers. Factor 2 accounted for 12% of the variance, with five participants' Q sorts significantly associated with this factor: three elementary in-service teachers and two secondary in-service teachers. Factor 3 also accounted for 12% of the variance, with four secondary in-service teachers' Q sorts significantly associated with this factor. Factor 4 accounted for 11% of the variance, with three in-service teachers' Q sorts significantly associated with the factor: one elementary in-service teacher and two secondary in-service teachers. Table C.22 shows the ranking assigned to each of the statements of the factors' representative Q sorts.

Table C.24 In-Service Teachers: By-Factor Ranking of Teaching Practices Corresponding to the Statement, “My Knowledge of Individual/Group Differences Would Be Helpful For...”

Statement	Factor Arrays			
	1	2	3	4
Purposefully engaging in non-academic conversations with individual students to build relationships	2	1	2	**0
Setting up & managing small group work to promote individual and group learning	1	**0	1	2
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2	2	** -2	1
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	**1	** -2	2	2
Establishing organizational routines, procedures & strategies to maximize time available for student learning	1	1	** -1	1
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1	1	1	0
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	0	2	1	-2
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	1	** -2	**0	1
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-2	1	-1	2
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	** -2	0	1	1
Communicating with parents or guardians to promote their child’s success in and out of school	**2	0	0	** -2
Using appropriate methods to check for student understanding and monitor student learning	0	-1	**2	-1
Designing a sequence of lessons toward specific goals	-2	**2	0	-1
Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	-1	0	-1	0
Recognizing common patterns of student thinking in a particular subject	0	* -1	* -2	0
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	-1	0	-1
Providing verbal & written feedback to students to help them improve their academic work	**0	-1	-1	-2
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1	-2	-2	-1

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement

Consensus Statements

Similar to psychological knowledge of learning, in-service teachers’ Q sorts showed more variation than pre-service teachers’ Q sorts particularly with respect to beliefs about how the knowledge of individual/group differences might be more helpful

for their teaching practices (see Table C.22). Consensus statements however point to more agreement in their beliefs about the teaching practices for which their knowledge would be *less* helpful compared to other teaching practices – reflecting on and analyzing their own instruction and evaluating, selecting and modifying their curriculum material or learning tasks. In addition to these consensus statements, examination of the Q sorts shows agreement in the belief that the understanding of differences would not be as helpful in developing their ability to skillfully communicate with other professionals about various issues such as their instruction and providing proper support to their students.

Table C.25 Differences IS: Consensus Statements

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	-1	-0.77	0	-0.23	-1	-0.32	0	-0.58
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	-0.46	-1	-1.01	0	-0.27	-1	-0.84

Distinguishing Statements

IS-1: Fostering opportunities for interactions between students and communicating with parents

IS-1’s distinguishing statements (Table C.27 and Table C.28) highlight the beliefs that knowledge of individual/group differences would be more helpful for two specific aspects of teaching practices: communicating with parents and guardians to discuss and support student learning and for encouraging students to share with one another ideas that will benefit their peers’ learning as well as their own. IS-1’s Q sort further supported positive ranking of the latter by also positively ranking items that represent leading a whole-class discussion that encourages students to actively listen to, respond to and learn from one another’s ideas, establishing norms and routines that guide students’ ability to construct and share knowledge with one another, and setting up and managing small group work to help them work collaboratively.

Table C.26 Differences IS-1 Q Sort Configuration

	Statement	IS-1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2
	Communicating with parents or guardians to promote their child's success in and out of school	**2
<i>Knowledge of individual/group differences is more helpful for...</i>	Purposefully engaging in non-academic conversations with individual students to build relationships	2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	1
	Setting up & managing small group work to promote individual and group learning	1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	**1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	1
<i>Knowledge of individual/group differences is neither helpful nor unhelpful for...</i>	Providing verbal & written feedback to students to help them improve their academic work	**0
	Recognizing common patterns of student thinking in a particular subject	0
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	0
	Using appropriate methods to check for student understanding and monitor student learning	0
<i>Knowledge of individual/group differences is less helpful for...</i>	Reflecting on & analyzing my instruction in order to improve its effectiveness	-1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1
	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	-1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1
	Designing a sequence of lessons toward specific goals	-2
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	** -2
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

In addition to implementing norms to encourage students to share their knowledge with one another, IS-1 identified establishing procedures and strategies that help organize and manage classroom time and space as another teaching practice for which their knowledge was perceived as helpful. The Q sort also showed belief that the knowledge would guide the ability to build meaningful relationships by determining when and what

to talk about with individual students in the efforts to address students' learning and developmental needs. Although the Q sort showed a neutral stance toward providing feedback to students about their learning, it was more highly ranked to other Q sorts that negatively ranked this item. This supports the greater value IS-1 placed on the knowledge for aspects of teaching practices that involve communicating effectively with students as well as their parents about their learning.

Table C.27 Distinguishing Statements for IS-1

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Communicating with parents or guardians to promote their child's success in and out of school	*2	1.35	0	0.02	0	0.14	-2	-1.67
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	*1	0.56	-2	-1.37	2	1.39	2	1.43
Providing verbal & written feedback to students to help them improve their academic work	*0	0.38	-1	-0.52	-1	-0.91	-2	-1.00
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*-2	-1.34	0	0.22	1	0.82	1	0.58

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

While the Q sort emphasized the value of the knowledge for promoting opportunities for students to interact with and construct a shared knowledge of academic content, the same knowledge was considered less helpful for teaching practices that involve planning and reflecting on instruction. In fact, in addition to evaluating and selecting appropriate curriculum materials and learning tasks for use during instruction, IS-1 was the only group to negatively rank items that represent setting long- and short-term learning goals for students, designing and sequencing their lessons as they align with the learning goals, and considering and selecting appropriate instructional strategies for clearly representing academic content to their students. It also identified the knowledge as less helpful in informing them in their efforts to reflect on and analyze the effectiveness of their instruction and in skillfully communicating with other professionals.

IS-2: Designing lessons and establishing classroom norms and routines

In contrast to IS-1, IS-2's Q sort highlighted the value of knowledge of individual/group differences for aspects of teaching practices that involve designing lessons (see Tabled C.29 and C.30).

Table C.28 Differences IS-2 Q Sort Configuration

	Statement	IS-2
<i>Knowledge of individual/group differences is more helpful for...</i>	Designing a sequence of lessons toward specific goals	**2
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	2
	Purposefully engaging in non-academic conversations with individual students to build relationships	1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1
<i>Knowledge of individual/group differences is neither helpful nor unhelpful for...</i>	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	0
	Communicating with parents or guardians to promote their child's success in and out of school	0
	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	0
	Setting up & managing small group work to promote individual and group learning	**0
<i>Knowledge of individual/group differences is less helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	*-1
	Providing verbal & written feedback to students to help them improve their academic work	-1
	Using appropriate methods to check for student understanding and monitor student learning	-1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	-1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	** -2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

It was identified as helpful for setting long- and short-term learning goals that all students could achieve, which could subsequently serve as a guide for designing a sequence of lessons that align with these goals to ensure all students can develop deep understanding of academic content at hand, and considering and choosing representations and examples that help students build understanding or correct misunderstandings about content. In addition to designing lessons, IS-2's Q sort showed value in the psychological knowledge for designing and implementing summative lessons that would help tap into students' learning and inform future instruction. The same knowledge however was considered to be less helpful in selecting more informal forms of assessment to monitor student thinking during instruction and to recognize common patterns of student thinking.

Table C.29 Distinguishing Statements for IS-2

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Designing a sequence of lessons toward specific goals	-2	-1.16	*2	1.49	0	-0.05	-1	-0.74
Setting up & managing small group work to promote individual and group learning	1	0.78	*0	-0.30	1	0.80	2	1.33
Recognizing common patterns of student thinking in a particular subject	0	0.12	-1	-0.50	-2	-1.25	0	0.48
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	0.56	*-2	-1.37	2	1.39	2	1.43
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	1	1.17	*-2	-1.63	0	-0.05	1	1.09

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

Despite the differences in IS-1 and IS-2's positive value of psychological knowledge, there were some similarities. For one, IS-2's Q sort showed positive value of the knowledge for communicating with students and parents to help address students' needs and for establishing norms and routines that both help manage classroom time and space and promote students' opportunity to engage with one another around academic content. They also shared in the beliefs that the knowledge would be less helpful for reflecting on and analyzing instruction and for skillfully communicating with other

professionals in education to discuss students' learning needs, their learning, or other school-related issues.

Thus although IS-1 and IS-2 both agreed that the knowledge would be useful to a degree for promoting collective learning and building relationships with students, IS-2 differed from IS-1 in placing greater value of knowledge of individual/group differences for preparing lessons that account for their students' differences with respect to their abilities, personal goals and interests. IS-1 on the other hand emphasized on the value of psychological knowledge for teaching practices that involve communicating with students and parents and facilitating students' interactions with one another around academic content.

IS-3: Assessing and responding to student learning

IS-3's distinguishing statements emphasized the value of the knowledge of individual/group differences for using formative assessments, such as through questions or tasks that elicit student thinking, to monitor student learning during and across lessons (see Tables C.31 and C.32). This, combined with the knowledge of individual/group differences, was considered to effectively provide information about students' thinking such that teachers could make adjustments between lessons that help support, extend or change student thinking about content. In addition to formative assessment of student learning, IS-3 positively ranked developing and implementing appropriate summative assessments to gain rich information about what students have learned in relation to specific learning goals. In response, teachers could consider appropriate representations of content, examples, or demonstrations that help make content explicit and remediate students' misconceptions or extend students' knowledge of the content. While the knowledge was perceived to help inform teachers in designing or using various forms of assessment, IS-3 did not believe it would be as helpful in recognizing common patterns of student thinking especially during instruction or in providing appropriate verbal or written feedback to students based on the assessment of student learning.

Lastly, similar to IS-1, IS-3 believed the knowledge would help to foster students' interactions with one another around content through opportunities to work collaboratively in small groups as well as one's own ability to engage with students outside of the classroom context to build meaningful relationships with students.

Table C.30 Differences IS-3 Q Sort Configuration

	Statement	IS-3
	Purposefully engaging in non-academic conversations with individual students to build relationships	2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2
<i>Knowledge of individual/group differences is more helpful for...</i>	Using appropriate methods to check for student understanding and monitor student learning	**2
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Setting up & managing small group work to promote individual and group learning	1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1
<i>Knowledge of individual/group differences is neither helpful nor unhelpful for...</i>	Communicating with parents or guardians to promote their child's success in and out of school	0
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	**0
	Designing a sequence of lessons toward specific goals	0
	Reflecting on & analyzing my instruction in order to improve its effectiveness	0
<i>Knowledge of individual/group differences is less helpful for...</i>	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	-1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	** -1
	Providing verbal & written feedback to students to help them improve their academic work	-1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1
	Recognizing common patterns of student thinking in a particular subject	* -2
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	** -2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

IS-3 also shared some similarity with respect to the belief that the knowledge would be less helpful for some aspects of planning lessons that involve setting long- and short-term learning goals for students, and evaluating, choosing and modifying curriculum materials and learning tasks to ensure students are challenged to progress towards the learning goals. In contrast to other groups, however, IS-3 did not believe their knowledge would be so helpful in establishing norms and routines aimed to both promote classroom

discourse and organize classroom time and space to maximize learning.

Table C.31 Distinguishing Statements for IS-3

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Using appropriate methods to check for student understanding and monitor student learning	0	-0.44	-1	-0.83	*2	1.23	-1	-0.92
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	1	1.17	-2	-1.63	*0	-0.05	1	1.09
Establishing organizational routines, procedures & strategies to maximize time available for student learning	1	0.43	1	0.70	*-1	-0.48	1	0.93
Recognizing common patterns of student thinking in a particular subject	0	0.12	-1	-0.50	-2	-1.25	0	0.48
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2	1.75	2	1.45	*-2	-1.34	1	1.08

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

IS-4: Establishing learning goals and opportunities for collective learning

IS-4's distinguishing statements primarily characterize the Q sort for the identification of teaching practices for which the knowledge was perceived to be *less* helpful (see Tables C.33 and C.34). The lack of positively ranked distinguishing statements indicate that its positively ranked items encompass many of the teaching practices identified by the other groups as those for which they believed their knowledge of individual/group differences would be useful. IS-4's positively ranked items shared similarities particularly with those of IS-1. These teaching practices include establishing classroom norms and routines that both organize classroom time and space and guide students' productive interaction with one another around content. In addition to setting norms and routines for how students are to interact with one another, IS-4 showed value of the knowledge for facilitating whole-class discussions and managing small group work to ensure students contribute to both individual and collective understanding of content. Similarly, it represented the belief that the knowledge would enable teachers to encourage and elicit students' sharing of their ideas with one another in ways that would

allow them to attend to students' learning and identify and implement instructional response or strategy that supports, challenges, or extends student thinking.

Table C.32 Differences IS-4 Q Sort Configuration

	Statement	IS-4
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2
	Setting up & managing small group work to promote individual and group learning	2
<i>Knowledge of individual/group differences is more helpful for...</i>	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
<i>Knowledge of individual/group differences is neither helpful nor unhelpful for...</i>	Recognizing common patterns of student thinking in a particular subject	0
	Purposefully engaging in non-academic conversations with individual students to build relationships	**0
	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	0
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	0
<i>Knowledge of individual/group differences is less helpful for...</i>	Designing a sequence of lessons toward specific goals	-1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	-1
	Using appropriate methods to check for student understanding and monitor student learning	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-2
	Providing verbal & written feedback to students to help them improve their academic work	-2
	Communicating with parents or guardians to promote their child's success in and out of school	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Table C.33 Distinguishing Statements for IS-4

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Purposefully engaging in non-academic conversations with individual students to build relationships	2	1.21	1	1.18	2	1.53	*0	-0.08
Communicating with parents or guardians to promote their child's success in and out of school	2	1.35	0	0.02	0	0.14	*-2	-1.67

Note: An * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

Lastly, IS-4's Q-sort positively ranked developing long- and short-term learning goals that help students make progress in their learning – though the same knowledge was identified as less helpful for *designing* and *sequencing* their lessons. While the positively ranked statements represent various teaching practices for which the knowledge was perceived to be helpful, negatively ranked items show a more focused set of beliefs about ways in which their knowledge would be less helpful. Based on their distinguishing statements, their Q sorts highlighted their beliefs that their knowledge would be neither helpful nor unhelpful for engaging in non-academic conversations with students and more unhelpful for communicating with their students' parents to build meaningful relationships with them in their efforts to address their students' individual learning and developmental needs. They also did not believe their knowledge would be as helpful for designing and using both summative and informal assessments to evaluate students' thinking and learning as well as for reflecting on and analyzing their own instruction.

Comparing Pre-Service Teachers', In-Service Teachers' and Educational Psychology Instructors' Beliefs

Table C.35 shows positive rankings of Q sorts representing factors that emerged for pre-service teachers, in-service teachers and educational psychology instructors. At least one factor from each educator group positively ranked seven of the eighteen teaching practices.

Table C.34 Comparison of Positive Rankings Between Educator Groups

Teaching Practice	PS			IS				EPI	
	1	2	3	1	2	3	4	1	2
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2	2	0	2	2	-2	1	0	1
Setting up & managing small group work to promote individual and group learning	2	0	2	1	0	1	2	0	2
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1	1	1	0	2	1	-2	1	1
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	1	2	0	1	-2	0	1	-2	2
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1	1	-2	-2	1	-1	2	1	-1
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2	-1	-1	1	-2	2	2	-1	1
Using appropriate methods to check for student understanding and monitor student learning	-2	0	1	0	-1	2	-1	2	0
Designing a sequence of lessons toward specific goals	-1	2	-2	-2	2	0	-1	2	-1
Purposefully engaging in non-academic conversations with individual students to build relationships	1	-2	1	2	1	2	0	-2	0
Communicating with parents or guardians to promote their child's success in and out of school	1	-1	2	2	0	0	-2	-1	0
Establishing organizational routines, procedures & strategies to maximize time available for student learning	0	1	-1	1	1	-1	1	0	-2
Providing verbal & written feedback to students to help them improve their academic work	0	0	2	0	-1	-1	-2	1	-2
Reflecting on & analyzing my instruction in order to improve its effectiveness	-2	1	1	-1	-1	0	-1	1	2
Recognizing common patterns of student thinking in a particular subject	1	-2	-1	0	-1	-2	0	0	-1
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1	-1	0	-1	1	1	0	-1	-1
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	0	0	-2	-2	0	1	1	-1	1
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	-2	-2	-1	-1	0	-1	0	2	0
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	0	-1	0	-1	-2	-2	-1	-2	-2

At least one factor from pre-service and in-service teacher groups positively ranked three teaching practices, whereas at least one factor from pre-service teacher and educational psychology instructor group factor positively ranked two teaching practices. On the other

hand, at least one factor from in-service teacher and educational psychology instructor factor positively ranked one teaching practice. These teaching practices are explored in-depth in the next two sections.

Similarities Between Pre-Service Teachers and Other Educator Groups

Q sorts of at least one factor from each educator group showed agreement in the positive value of knowledge of individual/group differences for teaching practices that involve facilitating opportunities for students to engage with one another around academic content. These teaching practices include not only implementing specific strategies for facilitating students' discourse with one another, but also for building a learning environment that fosters collaborative work: establishing norms and routines that guide students' discourse and interaction with one another around academic content (PS-1, PS-2; IS-1, IS-2, IS-4; EPI-2), leading whole class discussions that promote students' ability to share and respond to one another's thinking (PS-1, PS-2; IS-1, IS-3, IS-4; EPI-2), and setting up and managing small group work (PS-1, PS-3; IS-1, IS-3, IS-4; EPI-2). This points to the recognition of the importance of teachers' understanding of issues around diversity to create an environment and opportunities for students to participate in collaborative discourse supporting relationships within which learning takes place (Banks et al., 2005).

Furthermore, Q sorts across all educator groups showed belief that the same knowledge would be as helpful in developing and selecting both formative and summative assessments. As scholars note (e.g., Darling-Hammond, 1996), assessments that are sensitive to children's differences are important for not only gaining an understanding of what and how students are learning, but also for informing them about their own approaches to teaching and its effectiveness. Their understanding of various factors that impact diverse learners in the classrooms can help develop such sensitivity that would enable them to consider and implement various forms of assessments depending on their aims and goals for student learning. Educator groups appear to have recognized this connection based on the positive ranking of items corresponding to these teaching practices. In-service teachers in particular appeared to value their knowledge for selecting questions and tasks that elicit student thinking throughout instruction (PS-1; IS-1, IS-3, IS-4; EPI-2), which can help capitalize on students' diverse beliefs, knowledge,

and experiences as well as their learning needs. Their experience in the classroom may have increased their awareness of the ways in which various experiences, interests, knowledge, and perspectives students bring to class can impact the dynamics of classroom discourse and learning. This in turn may have strengthened the beliefs that such awareness can inform them in choosing from a range of meaningful questions or learning tasks that can effectively surface students' thinking and ideas that could contribute to classroom engagement with the content or inform them in modifying their instruction to address students' misconceptions, clarify confusions, or expand upon students' understanding of the content at hand.

Relatedly, at least one Q sort from each educator group factor showed agreement in the beliefs that an understanding of individual/group differences would enhance the ability to set short- and long-term learning goals (PS-2; IS-2, IS-4; EPI-1) and to design and sequence their lessons according to those goals (PS-2; IS-2; EPI-1). Several in-service teachers and educational psychology instructors appear to reinforce some of the pre-service teachers in recognizing that their knowledge of issues around student diversity would guide them in setting expectations that are neither too low nor too high for their students. And in accordance with the goals, psychological knowledge was perceived to further enhance one's ability to sequence and design lessons in ways that not only provide every student plentiful opportunities for success but also allow them to set achievable goals for themselves that are focused on long-term improvement in their knowledge and skills.

Differences Between Pre-Service Teachers and Other Educator Groups

In comparing the positive rankings of items across the Q sorts of pre-service teacher factors, in-service teacher factors and educational psychology instructor factors, there were greater number of items that were positively ranked by pre-service teachers' and in-service teachers' Q sorts. These teaching practices that were positively ranked by at least one Q sort across pre-service teacher and in-service teacher factors but not by educational psychology instructors related to building relationships with students and parents as well as creating a learning environment conducive to students' learning. Two of the three pre-service teacher factor's Q sorts (PS-1, PS-3) and three of the four in-service teacher factor's Q sorts (IS-1, IS-2, IS-3) positively ranked purposefully engaging

in non-academic conversations with individual students. The same Q sorts of pre-service teacher factors and one of the three in-service teacher factors' Q sorts (IS-1) also positively ranked communicating effectively with students' parents or guardians to promote children's success both in and out of the school context. Positive rankings of these items bring to light the perceived value of the knowledge of individual/group differences for effectively building relationship with individual students and their families. Parental involvement has shown to contribute to student success in schools in various ways: positive academic achievement, higher attendance rate, better preparation for class, etc. (Epstein, 2005). Teachers thus play a crucial role in encouraging parental involvement in their students' learning, and must invest in establishing a relationship with students and their families to ensure active participation in students' learning. Building an effective relationship between students and parents requires teachers' sensitivity to and awareness of different cultures and their various attitudes and values for schooling as well as perceived roles of students, parents, peers, and teachers in the students' learning. Pre-service teachers and in-service teachers appear to have highlighted the role of this understanding of individual and group differences enhancing such awareness and sensitivity that lead to developing effective methods for communicating with students and parents and building meaningful relationship with them in ways that help them tap into and build upon students' strengths, needs, and interests.

Several pre-service teachers and in-service teachers also expanded on their beliefs that their understanding of individual/group differences would be helpful in establishing norms and routines that promote students' learning. In addition to establishing norms and routines for students' discourse and interaction with one another to foster collaborative learning, pre-service teachers and in-service teachers believed their knowledge would be as useful in establishing norms and routines for organizing classroom space and time to help maximize opportunities for individual learning as well (PS-2; IS-1, IS-2, IS-3). This emphasis suggests teachers' recognition that student diversity calls for providing various means for students to process information and demonstrate their mastery of the content. An effective use of such differentiated instruction requires a safe learning environment in which students feel safe and willing to take risks; teachers must provide a safe and quiet space to complete their work, set clear guidelines and expectations for students, provide

access to diverse materials and resources that reflect students' diverse backgrounds, etc. (Darling-Hammond & Bransford, 2005). Because various means for learning and demonstrating their mastery leads to active student involvement in their learning process, teachers' openness to movement and noise is necessary (Moore & Hansen, 2012). This can be done productively with teachers' active and consistent monitoring and awareness of what is going on. Pre-service teachers' and in-service teachers' positive ranking of establishing and implementing specific norms and routines indicate their beliefs that their understanding of issues around student diversity as they relate to learning can contribute to their ability to successfully establish and articulate specific guidelines that help students understand teachers' expectations of them and organize classroom space and time to ensure productive learning takes place.

Pre-service teachers and educational psychology instructors, however, shared in the belief that this knowledge would be helpful for analyzing and communicating to students about their learning (PS-3; EPI-1) as well as for analyzing their instruction (PS-2, PS-3; EPI-1, EPI-2), which were teaching practices that were not positively ranked by any of the in-service teacher factors. Educational psychology instructors' Q sorts thus appear to reinforce pre-service teachers' Q sorts that point to the critical role teachers' reflection of their own attitudes have in terms of respecting all students and their experiences, the confidence they show in their students' abilities to succeed in the classroom, and willingness to challenge their own approaches toward their efforts to adapt their instruction to be effective in helping all students learn (Banks et al., 2005). Teachers' awareness of the various forms of diversity and their effect on how students respond to teachers' pedagogy can facilitate these efforts to examine their instruction and approaches to communicating with students.

On the other hand, in-service teachers and educational psychology instructors, but not pre-service teachers, showed a greater consideration of the role of knowledge of individual/group differences for teaching practices that involve preparing and modifying their instruction. For one, two Q sorts from in-service teacher factors (IS-3, IS-4) and one Q sort from educational psychology instructor factors (EPI-2) positively ranked modifying their instruction during class in response to their recognition of students' thinking. In-service teachers (IS-2, IS-3), but not pre-service teachers and educational

psychology instructors, elaborated on this by also positively ranking making academic content clear through their consideration and selection of specific explanations, demonstrations, illustrations or examples. This points to McDiarmid's (1991) argument that teachers' ability to evaluate and determine the appropriateness of different representations of the content at hand depends on their view of their students and their awareness of the students' relationship with the content. On the other hand, educational psychology instructors, but not pre-service teachers and in-service teachers added to their viewpoint by also positively ranking teaching practice around evaluating, choosing and modifying curriculum materials. This positive ranking reinforces Darling-Hammond & Bransford's (2005) notion that culturally responsive teachers' efforts to develop and modify their curriculum must take into account students' diverse perspectives and address their varying interests, abilities, and values to ensure students can meaningfully connect to the content; effective teachers must be able to analyze and adjust resources and curriculum according to students' differences rather than taking a one-size-fits all approach in their instruction and expecting students to adapt. In-service teachers' and educational psychology instructors' positive ranking of the aforementioned items altogether show their beliefs that teachers' understanding of individual/group differences can be instrumental for their teaching, as it can increase their sensitivity to students' diverse and unique experiences and interests and readily seek, select and provide instructional and learning materials that reflect students' backgrounds.

APPENDIX D
STUDY 2.3 FINDINGS: EXPLORING BELIEFS ABOUT THE VALUE OF
PSYCHOLOGICAL KNOWLEDGE OF HUMAN DEVELOPMENT

Findings 2.3a: Changes in Pre-Service Teachers' Beliefs about the Value of their Psychological Knowledge of Human Development

Pre-Service Teachers' Beliefs: PRE-Term

Out of a total of 30 pre-service teachers, 23 pre-service teachers' Q sorts loaded significantly onto one of the three factors that emerged at the beginning of the term. Seven remaining pre-service teachers' Q sorts either did not load significantly onto any of the groups ($n = 6$) or were confounding sorts ($n = 1$). The three factors accounted for 49% of the variance. Table D.1 below shows a distribution of the number of elementary and secondary pre-service teachers whose Q sorts loaded onto each of the factors that emerged.

Table D.1 Pre-Service Teacher PRE Group Matrix for Human Development

	Factor A	Factor B	Factor C	Non-Sig	Confounding
Elementary Pre-service	5	3	3	2	1
Secondary Pre-service	7	3	2	4	0
Total Pre-Service	12	6	5	6	1
Variance	25%	13%	11%	-	-

Factor A accounted for 25% of the variance, with 12 participants' Q sorts significantly associated with this factor: five elementary pre-service teachers and seven secondary pre-service teachers. Factor B accounted for 13% of the variance, with six participants' Q sorts associating significantly with this factor: three elementary pre-service teachers and three secondary pre-service teachers. Factor C accounted for 11% of the variance, with five participants' Q sorts associating significantly with this factor: three elementary pre-service teachers and two secondary pre-service teachers. Table D.2 shows the ranking assigned to each of the statements of the factors' representative Q sorts.

Table D.2 PRE: By-Factor Ranking of Statements Corresponding to the Statement, “My Knowledge of Human Development Would be Helpful For...”

Statement	Factor Arrays		
	A	B	C
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*2	1	1
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	1	1	1
Establishing organizational routines, procedures & strategies to maximize time available for student learning	**1	** -1	**2
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	** -1	2	2
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	2	** -2	2
Using appropriate methods to check for student understanding and monitor student learning	1	1	** -1
Providing verbal & written feedback to students to help them improve their academic work	** -1	1	1
Purposefully engaging in non-academic conversations with individual students to build relationships	0	**2	0
Recognizing common patterns of student thinking in a particular subject	**0	**2	** -1
Communicating with parents or guardians to promote their child’s success in and out of school	* -2	* -1	**1
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1	0	** -2
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	**2	-1	-2
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0	0	-1
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	0	* -1	0
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	*0	-1
Designing a sequence of lessons toward specific goals	-1	** -2	0
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-2	*0
Setting up & managing small group work to promote individual and group learning	-2	**0	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement

Consensus Statements

The single positively ranked consensus statement indicates pre-service teachers’ agreement in their beliefs that their knowledge of human development would be helpful for establishing norms and routines that guide students in understanding how to appropriately construct knowledge together through classroom discourse around one another’s ideas and thinking (see Table D.3). According to the other consensus statement,

even though they believed their knowledge would inform them in establishing norms and routines for discourse, pre-service teachers showed less value of the knowledge for selecting specific strategies for facilitating whole class discussion.

Table D.3 Development PRE: Consensus Statements

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0	-0.24	0	-0.05	-1	-0.56
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	1	0.65	1	0.54	1	0.54

Though not identified as a consensus statement, further comparison between the Q sorts across the three factors shows general agreement in pre-service teachers' beliefs that the knowledge would be helpful in using appropriate instructional strategies in response to their identification of common patterns of student thinking.

Distinguishing Statements

PS-A: Evaluating methods for assessing and responding to student learning

The Q sorts of PS-A's pre-service teachers were distinguished from other Q sorts based on the emphasis of the value of their knowledge of human development for aspects of teaching practices around developing and responding to assessment of student learning (see Tables D.4 and D.5). Distinguishing statements point to the belief that the knowledge would be particularly helpful for developing summative assessments that effectively provide rich information about student learning in ways that inform their future instruction; this was an aspect of practice that was positively ranked by PS-A while PS-A and PS-B negatively ranked this item. Distinguishing statements also point to PS-A's value of the understanding of human development for following up on the assessment and recognition of common patterns of student thinking through modification of instructional strategies – more so than for providing appropriate feedback to students – that aim to challenge, support or extend their thinking. In fact, PS-A was the only factor to place less value of the knowledge for enhancing the ability to provide focused

feedback based on the assessment of student thinking to help them understand their strengths and focus on areas for improvement in their learning.

Table D.4 Human Development PS-A Q Sort Configuration

	Statement	PS-A
<i>Knowledge of human development is more helpful for...</i>	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	**2
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*2
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	2
	Using appropriate methods to check for student understanding and monitor student learning	1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	**1
<i>Knowledge of human development is neither helpful nor unhelpful for...</i>	Recognizing common patterns of student thinking in a particular subject	**0
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	0
	Purposefully engaging in non-academic conversations with individual students to build relationships	0
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0
<i>Knowledge of human development is less helpful for...</i>	Designing a sequence of lessons toward specific goals	-1
	Providing verbal & written feedback to students to help them improve their academic work	** -1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	** -1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	-1
	Setting up & managing small group work to promote individual and group learning	-2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2
Communicating with parents or guardians to promote their child's success in and out of school	*-2	

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

It also showed the belief that it would be less helpful for communicating with students' parents and other professionals in education about students and their learning needs to ensure they are given the appropriate support and opportunities to succeed in the school. In other words, PS-A's pre-service teachers did not believe their understanding of

human development would be as helpful for communicating with students, their parents and other professionals in education about issues around student learning as it would be fore attending to and responding to student learning during instruction. Additionally, while they believed that their understanding of human development would be more helpful for analyzing student learning, they did not believe it would be as helpful for analyzing their own instruction.

Table D.5 Distinguishing Statements for PS-A

Statement	Factor Q sort value and Z-score					
	A		B		C	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	*2	1.57	-1	-0.98	-2	-1.50
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2	1.42	1	0.92	1	0.54
Establishing organizational routines, procedures & strategies to maximize time available for student learning	*1	0.59	-1	-0.79	2	1.27
Recognizing common patterns of student thinking in a particular subject	*0	0.27	2	1.96	-1	-1.01
Providing verbal & written feedback to students to help them improve their academic work	*-1	-0.69	1	0.85	1	1.22
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	*-1	-0.78	2	1.03	2	1.31
Communicating with parents or guardians to promote their child's success in and out of school	-2	-1.57	-1	-0.96	1	1.10

NOTE: * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

Another distinguishing statement suggests their value of their knowledge for establishing organizational routines and strategies that help organize their classroom time and space; understanding of human development would inform them in considering ways to develop a classroom environment conducive to students' learning and overall development as members of a learning community.

PS-B: Providing opportunities for student interaction

PS-B's Q sort emphasizes the value of knowledge of human development for attending to students' collective learning and relationship-building (see Tables D.6 and D.7)

Table D.6 Human Development PS-B Q Sort Configuration

	Statement	PS-B
<i>Knowledge of human development is more helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	**2
	Purposefully engaging in non-academic conversations with individual students to build relationships	**2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Providing verbal & written feedback to students to help them improve their academic work	1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	1
	Using appropriate methods to check for student understanding and monitor student learning	1
<i>Knowledge of human development is neither helpful nor unhelpful for...</i>	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	0
	Setting up & managing small group work to promote individual and group learning	**0
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0
	Reflecting on & analyzing my instruction in order to improve its effectiveness	*0
<i>Knowledge of human development is less helpful for...</i>	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	*-1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	** -1
	Communicating with parents or guardians to promote their child's success in and out of school	*-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2
	Designing a sequence of lessons toward specific goals	** -2
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Their understanding of human development was positively valued for eliciting and evaluating student thinking by encouraging them to share their thinking with one another

during classroom discussion, more so than for selecting and using more formal, summative forms of assessment; this strategy of informal assessment of student thinking combined with their knowledge could in turn help in anticipating and identifying common patterns of student thinking during their teaching. The second positive distinguishing statement also suggests their beliefs that understanding human development would be helpful in their efforts to engage in individual non-academic conversations with their students to build meaningful relationships with them with the goal of addressing students' learning and developmental needs.

Table D.7 Distinguishing statements for PS-B

Statement	Factor Q sort value and Z-score					
	A		B		C	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Recognizing common patterns of student thinking in a particular subject	0	0.27	*2	1.96	-1	-1.01
Purposefully engaging in non-academic conversations with individual students to build relationships	0	-0.17	*2	1.24	0	-0.22
Setting up & managing small group work to promote individual and group learning	-2	-1.22	*0	0.17	-2	-1.06
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	-0.94	0	-0.25	-1	-0.96
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	0	0.23	-1	-0.33	0	0.43
Establishing organizational routines, procedures & strategies to maximize time available for student learning	1	0.59	*-1	-0.79	2	1.27
Communicating with parents or guardians to promote their child's success in and out of school	-2	-1.58	-1	-0.96	1	1.10
Designing a sequence of lessons toward specific goals	-1	-0.41	*-2	-1.45	0	0.08
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	2	1.32	*-2	-1.53	2	1.41

NOTE: * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

PS-B's pre-service teachers' emphasis on the value of their knowledge for aspects of teaching practices around fostering interaction with students above all else is also made apparent in their more negative value of the same knowledge for interacting with their students' parents (and other professionals in education). Given the focus of their value of their psychological knowledge of human development for aspects of practices around assessing and addressing collective understanding of academic content between

students, there was less value for aspects of teaching practices that involve planning and designing lessons; more specifically, they believed their knowledge would be less helpful for setting long- and short-term learning goals for students, designing and sequencing lessons that align with and address the lessons goals, and evaluating, selecting and modifying their curriculum materials and learning tasks. Additionally, unlike PS-A and PS-C, PS-B's pre-service teachers showed less value of their knowledge for establishing organizational routines and procedures that help organize classroom time and space to maximize opportunities for student learning.

PS-C: Establishing a productive learning environment and communicating with parents

Distinguishing statements for PS-C's Q sort emphasized the value of the knowledge of human development for providing a classroom conducive to learning and for communicating with parents to ensure students' learning and developmental needs are met both in and out of the classroom context (see Tables D.8 and D.9). Similar to PS-A, PS-C's pre-service teachers believed their knowledge of human development would be more helpful for establishing norms and routines that not only set guidelines for how students are to communicate with one another to construct a shared knowledge of academic content but also serve to help organize classroom time and space to maximize learning and minimize disruptions. Additionally, compared to the other two groups, PS-C's pre-service teachers believed their knowledge could inform their quality of interaction with their students' parents in their joint efforts to foster students' learning and overall development. This suggests their consideration of how their understanding of individual differences might enhance their ability to communicate with professionals and parents to tap into and attain rich information about students' different needs and interests and how they could integrate that into their teaching.

On the other hand, unlike the other two groups, they believed that their knowledge of human development would be less helpful for other forms of informal assessments through the use of specific tasks (e.g., reflection journals) – along with the more formal summative assessments. Furthermore, they did not believe their psychological knowledge would be as helpful in identifying common patterns of student thinking, which suggests that their knowledge was believed to be more helpful for making sense of individual student's progress towards the established goals. Thus more

so than for evaluating assessment and instructional strategies, PS-C differed from PS-A and PS-B for their emphasis on providing an environment conducive to student learning and building relationships with various stakeholders to ensure successful student learning.

Table D.8 Human Development PS-C Q Sort Configuration

	Statement	PS-C
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2
<i>Knowledge of human development is more helpful for...</i>	Establishing organizational routines, procedures & strategies to maximize time available for student learning	**2
	Providing verbal & written feedback to students to help them improve their academic work	1
	Communicating with parents or guardians to promote their child's success in and out of school	**1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	1
		Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal
<i>Knowledge of human development is neither helpful nor unhelpful for...</i>	Designing a sequence of lessons toward specific goals	0
	Purposefully engaging in non-academic conversations with individual students to build relationships	0
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	*0
<i>Knowledge of human development is less helpful for...</i>	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	-1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	-1
	Recognizing common patterns of student thinking in a particular subject	** -1
	Using appropriate methods to check for student understanding and monitor student learning	** -1
	Setting up & managing small group work to promote individual and group learning	-2
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	** -2
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Table D.9 Distinguishing Statements for PS-C

Statement	Factor Q sort value and Z-score					
	A		B		C	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Establishing organizational routines, procedures & strategies to maximize time available for student learning	1	0.59	-1	-0.79	*2	1.27
Communicating with parents or guardians to promote their child's success in and out of school	-2	-1.58	-1	-0.96	*1	1.10
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-1.57	-2	-1.11	0	-0.46
Recognizing common patterns of student thinking in a particular subject	0	0.27	2	1.96	*-1	-1.01
Using appropriate methods to check for student understanding and monitor student learning	1	0.83	1	0.48	*-1	-1.01
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1	0.72	0	0.26	*-2	-1.13

NOTE: * indicates distinguishing statement at $p < .01$, while those without * indicates significance at $p < .05$.

Pre-Service Teachers' Beliefs: POST

By the end of the term, Q sorts of 22 pre-service teachers loaded significantly onto one of the three factors that emerged (see Table D.10).

Table D.10 Pre-Service Teacher POST Group Matrix for Human Development

	Factor 1	Factor 2	Factor 3	Non-Sig	Confounding
Elementary Pre-service	3	2	4	5	0
Secondary Pre-service	7	2	4	2	1
Total Pre-Service	10	4	8	7	1
Variance	18%	11%	14%	-	-

Eight remaining pre-service teachers' Q sorts either did not load significantly onto any of the groups ($n = 7$) or were confounding sorts ($n = 1$). The three factors accounted for 43% of the variance. Factor 1 accounted for 18% of the variance, with 10 pre-service teachers' Q sorts significantly associated with this factor: three elementary pre-service teachers and seven secondary pre-service teachers. Factor 2 accounted for 11% of the variance, with four pre-service teachers' Q sorts significantly associated with the factor: two elementary pre-service teachers and two secondary pre-service teachers. Factor 3 accounted for 14% of the variance, with eight pre-service teachers' Q sorts significantly associated with the

factor: four elementary pre-service teachers and four secondary pre-service teachers.

Table D.11 shows the ranking of statements as represented by each of the three factors.

Table D.11 POST: By-Factor Ranking of Statements Corresponding to the Statement, “My Knowledge of Human Development Would be Helpful for...”

Statement	Factor Arrays		
	1	2	3
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*2	1	1
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1	1	1
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	1	1
Establishing organizational routines, procedures & strategies to maximize time available for student learning	1	0	1
Recognizing common patterns of student thinking in a particular subject	2	2	** -1
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	** -1	2	2
Using appropriate methods to check for student understanding and monitor student learning	**2	0	0
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0	0	**2
Purposefully engaging in non-academic conversations with individual students to build relationships	** -2	0	2
Reflecting on & analyzing my instruction in order to improve its effectiveness	** -1	**2	** -2
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	**1	-1	-1
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	* -2	**1	** -2
Providing verbal & written feedback to students to help them improve their academic work	0	** -2	0
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0	** -2	0
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	0	-1	-1
Setting up & managing small group work to promote individual and group learning	-1	-2	**0
Designing a sequence of lessons toward specific goals	-1	-1	-2
Communicating with parents or guardians to promote their child’s success in and out of school	-2	-1	-1

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement

Consensus Statements

The number of consensus statements across the factors that emerged from PRE and POST Q sorts increased from two to five consensus statements, respectively (see Table

D.12). This appears to point to a greater degree of agreement between pre-service teachers in their beliefs about the teaching practices for which their knowledge of human development is more or less helpful by the end of the term.

Table D.12 Development POST: Consensus Statements

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1	0.73	1	0.71	1	1.02
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	0.45	1	0.82	1	0.68
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2	1.47	1	0.82	1	1.01
Establishing organizational routines, procedures & strategies to maximize time available for student learning	1	0.14	0	-0.24	1	0.39
Communicating with parents or guardians to promote their child's success in and out of school	2	-1.44	-1	-1.12	-1	-1.31

Of the five consensus statements, four were positively ranked statements, indicating that they shared some similarities in their beliefs about ways in which their knowledge of human development would be more helpful. For one, they believed their psychological knowledge would be more helpful for teaching practices related to selecting and using instructional strategies that help make academic content clear to their students as they build their understanding of the content and particularly those that help them extend, support or challenge students' thinking during instruction based on their ability to elicit and interpret students' sharing of their thinking during class. Although to a lesser degree, there also existed a more positive value of their knowledge for establishing organizational routines and procedures that would help maximize opportunities for learning and minimize disruptive behavior. Taken together, pre-service teachers appear to have placed a greater value of their knowledge for creating a learning environment conducive to positive learning and development for students as well as for carrying out instructions that are developmentally appropriate and sensitive to their current understanding of the content at hand.

On the other hand, they held less value of the same knowledge for communicating with parents or guardians about their students' learning and needs in their joint efforts to

help meet those needs and to ensure students have the opportunity to succeed in and out of the classrooms. In addition to this consensus statement, all three groups also negatively ranked designing a sequence of lessons toward specific learning goals.

Distinguishing Statements

PS-1: Assessing various resources for teaching and evaluating student learning

By the end of the term, PS-1's Q sort showed belief that their knowledge of human development would help determine the appropriateness of strategies for eliciting and assessing student thinking and learning, both formatively (e.g., through probing and tasks such as reflection journals) and summatively (see Tables D.13 and D.14). In fact, PS-1's Q sort was the only Q sort to place a greater value of their knowledge for considering and using appropriate methods for formative and summative assessments. They also emphasized the value of their knowledge for modifying their instruction on the spot based on their recognition of student thinking by effectively selecting instructional strategies that help extend on or challenge student thinking.

However, they showed less value of their understanding of human development for evaluating their own practice, indicating that such understanding would be more helpful for attending to students and their learning more so than for their own professional development. This is reflected on another distinguishing statement, skillfully communicating with other professionals about their instruction, which was negatively ranked. In addition to this practice, they placed less value of their knowledge for aspects of practice that involve fostering relationships with and between students. Unlike PS-2 and PS-3, PS-1's negatively ranked effectively establishing norms used to help promote effective classroom discourse leading to shared construction of knowledge. Pre-service teachers also indicated their beliefs that their psychological knowledge would not be as helpful in enhancing their ability to build their own relationship with their students by engaging in non-academic conversations with them.

Table D.13 Human Development PS-1 Q Sort Configuration

	Statement	PS-1
	Using appropriate methods to check for student understanding and monitor student learning	**2
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*2
<i>Knowledge of human development is more helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	2
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	**1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	1
<i>Knowledge of human development is neither helpful nor unhelpful for...</i>	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	0
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0
	Providing verbal & written feedback to students to help them improve their academic work	0
<i>Knowledge of human development is less helpful for...</i>	Reflecting on & analyzing my instruction in order to improve its effectiveness	** -1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	** -1
	Setting up & managing small group work to promote individual and group learning	-1
	Designing a sequence of lessons toward specific goals	-1
	Purposefully engaging in non-academic conversations with individual students to build relationships	** -2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	* -2
	Communicating with parents or guardians to promote their child's success in and out of school	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Table D.14 Distinguishing Statements for PS-1

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Using appropriate methods to check for student understanding and monitor student learning	*2	1.91	0	0.17	0	-0.01
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2	1.47	1	0.82	1	1.01
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	*1	1.09	-1	-0.70	-1	-0.56
Reflecting on & analyzing my instruction in order to improve its effectiveness	*-1	-0.39	2	1.50	-2	-1.61
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	*-1	-0.70	2	1.19	2	1.33
Purposefully engaging in non-academic conversations with individual students to build relationships	*-2	-1.13	0	0.63	2	1.16
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-1.18	1	1.01	-2	-1.74

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

PS-2: Analyzing and communicating about instruction

PS-2 was the only factor whose Q sort highlighted their beliefs that while their knowledge might be less helpful for providing verbal and written feedback to students to effectively communicate with them their strengths and areas for improvement, it might be more helpful for communicating and sharing with other professionals in education about student learning and their needs as well as about their own teaching based on their reflection and analysis of their instruction (see Tables D.15 and D.16). Furthermore, whereas PS-1 valued their knowledge for establishing norms and routines for organizing classroom space and time, PS-2 valued their knowledge more for establishing routines and strategies specifically for guiding students' efforts to share and respond to one another's thinking about academic content.

Table D.15 Human Development PS-2 Q Sort Configuration

	Statement	PS-2
<i>Knowledge of human development is more helpful for...</i>	Reflecting on & analyzing my instruction in order to improve its effectiveness	**2
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2
	Recognizing common patterns of student thinking in a particular subject	2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	**1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1
<i>Knowledge of human development is neither helpful nor unhelpful for...</i>	Purposefully engaging in non-academic conversations with individual students to build relationships	0
	Using appropriate methods to check for student understanding and monitor student learning	0
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	0
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0
<i>Knowledge of human development is less helpful for...</i>	Designing a sequence of lessons toward specific goals	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	-1
	Communicating with parents or guardians to promote their child's success in and out of school	-1
	Providing verbal & written feedback to students to help them improve their academic work	** -2
	Setting up & managing small group work to promote individual and group learning	-2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Although this indicates the perceived helpfulness of the knowledge for establishing a learning environment that encourages students to engage in discourse with one another, they placed less value of such knowledge for practices related to instructional strategies that encourage students to share and respond to one another's thinking such as in leading a whole-class discussion wherein students contribute and use one another's ideas and setting up and managing small group work.

Table D.16 Distinguishing Statements for PS-2

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	-0.39	*2	1.50	-2	-1.61
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-1.18	*1	1.01	-2	-1.74
Providing verbal & written feedback to students to help them improve their academic work	0	-0.23	*-2	-1.19	0	0.16
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0	0.12	*-2	-1.56	0	0.23

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

PS-3: Establishing learning goals for students

PS-3's Q sort highlights its pre-service teachers' value of their knowledge for setting short- and long-term learning goals for their students (see Tables D.17 and D.18). The perceived value of the knowledge for designing lessons and instruction is further supported by positive ranking of items including preparing pedagogical strategies to make content understandable for their students and readily modifying instruction based on students' thinking to effectively challenge or extend upon what students understand. Unlike the previous two groups, PS-3's Q sort placed a higher value (albeit a neutral stance) for setting up and managing small group work. Although neutral, other positively ranked items indicate PS-3's consideration of the role of the knowledge in fostering an environment encouraging students to engage with one another. PS-3's Q sort positively ranked items around establishing norms and routines for students' discourse with one another and eliciting student thinking so that students can share and respond to one another's thinking and build upon one another's understanding of the content at hand. On the other hand, PS-3's Q sort showed less value of their knowledge for assessing students and determining the effectiveness of their instruction; they negatively ranked items related to anticipating and recognizing common patterns of student thinking, designing and implementing summative assessments, and reflecting on and analyzing their own instruction.

Table D.17 Human Development PS-3 Q Sort Configuration

	Statement	PS-3
<i>Knowledge of human development is more helpful for...</i>	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	**2
	Purposefully engaging in non-academic conversations with individual students to build relationships	2
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	1
<i>Knowledge of human development is neither helpful nor unhelpful for...</i>	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0
	Providing verbal & written feedback to students to help them improve their academic work	0
	Using appropriate methods to check for student understanding and monitor student learning	0
	Setting up & managing small group work to promote individual and group learning	**0
<i>Knowledge of human development is less helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	** -1
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
	Communicating with parents or guardians to promote their child's success in and out of school	-1
	Designing a sequence of lessons toward specific goals	-2
	Reflecting on & analyzing my instruction in order to improve its effectiveness	** -2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Table D.18 Distinguishing Statements for PS-3

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0	-0.15	0	-0.42	*2	1.22
Setting up & managing small group work to promote individual and group learning	-1	-1.01	-2	-1.37	*0	-0.07
Recognizing common patterns of student thinking in a particular subject	2	1.31	2	1.12	*-1	-0.20
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	-0.39	2	1.50	*-2	-1.61
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-1.18	1	1.01	-2	-1.74

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Exploring Shifts in Pre-Service Teachers' Beliefs from PRE to POST

Table D.19 shows changes in Q sorts' positive ranking of items from the beginning to the end of the term. Exploration and discussion of shifts in positive rankings will be discussed in the next two sections.

Similarities Across Beginning and End of Term

Changes in Q sorts' positive rankings from PRE- to POST-term show that for the most part, pre-service teachers' beliefs were fairly stable with respect to their value of their psychological knowledge of human development for teaching. Across time, no sub-groups of pre-service teachers positively ranked teaching practices that involve selecting and implementing strategies or tasks to facilitate students' discourse with one another both at the small group and whole-class level; these teaching practices were positively ranked when pre-service teachers considered their knowledge of individual/group differences. Rather, they placed a greater emphasis on their value of their knowledge of human development for adapting and modifying their instruction particularly based on their monitoring of student thinking and learning during class to ensure students successfully develop an understanding of the content at hand. This belief aligns with various scholars (e.g., Daniels, Shumow, 2003; Grimmett & MacKinnon, 1992) who argue that knowledge of child and adolescent development is essential for teachers'

ability to attend to and interpret students’ statement and behavior and subsequently to structure and present constructive learning experiences for their students.

Table D.19 Comparison of Positive Rankings from PRE to POST

Teaching Practice	PRE			POST		
	A	B	C	1	2	3
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2	1	1	2	1	1
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	1	1	1	-1	2	2
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	-1	2	2	1	1	1
Establishing organizational routines, procedures & strategies to maximize time available for student learning	1	-1	2	1	0	1
Using appropriate methods to check for student understanding and monitor student learning	1	1	-1	2	0	0
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	2	-2	2	0	0	2
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1	0	-2	1	1	1
Recognizing common patterns of student thinking in a particular subject	0	2	-1	2	2	-1
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	2	-1	-2	1	-1	-1
Purposefully engaging in non-academic conversations with individual students to build relationships	0	2	0	-2	0	2
Providing verbal & written feedback to students to help them improve their academic work	-1	1	1	0	-2	0
Communicating with parents or guardians to promote their child’s success in and out of school	-2	-1	1	-2	-1	-1
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	0	-1	-1	2	-2
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-2	0	-2	1	-2
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0	0	-1	0	-2	0
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	0	-1	0	0	-1	-1
Setting up & managing small group work to promote individual and group learning	-2	0	-2	-1	-2	0
Designing a sequence of lessons toward specific goals	-1	-2	0	-1	-1	-2

Note. Green indicates positive rankings assigned to corresponding teaching practices by respective factor. Grey indicates teaching practices that have been negatively ranked by all factors.

Based on the Q sorts’ positive rankings, there was an emphasis on the perceived importance of understanding and activating students’ previous experiences, knowledge, and skills (PS-B, PS-C; PS-1, PS-2, PS-3), upon which they can present new information

and materials in a context that enables students to effectively engage with and learn the content at hand (PS-A; PS-1, PS-2, PS-3). Such a perspective could serve as a framework with which they could tap into students' background knowledge and needs by inquiring sensitively through appropriate questioning, listening, and considering students' responses and their work (Grimmett & MacKinnon, 1992). Based on students' feedback and sharing of their understanding of the content at hand, teachers can readily prepare or modify their instruction to ensure students have the opportunity to learn and achieve in the classroom (PS-A, PS-B, PS-C; PS-1, PS-2, PS-3). These connections appear to have been recognized by pre-service teachers at both time points.

Second, Q sorts showed value of psychological knowledge for effectively establishing and orchestrating classroom environment allowing for and fostering both collaborative and individual learning through implementation of discourse norms (PS-A, PS-B, PS-C; PS-2, PS-3) and organizational routines (PS-B, PS-C; PS-1, PS-2, PS-3) at both time points. Positive ranking of teaching practices around establishing organizational and discourse norms at both time points indicate recognition of student development as a complex interaction between the children and the educational environment they are in, as well as their role in being able to skillfully provide a learning environment conducive to productive collaboration and learning (Daniels & Shumow, 2003). This recognition may have perhaps been influenced by pre-service teachers' exposure to numerous scholars, such as Dewey, Piaget, and Vygotsky, who have been instrumental in education and have made significant contributions in understanding learning and how to effectively maximize learners' potential; they viewed learning as a process that comprises of the coordination between students' individual skills, abilities and predispositions and the learning environment in which new skills and information are made available to them. Their contributions have spurred a shift in focus from teachers and their teaching to learners. From this perspective of a student-centered teaching, classrooms serve as an important context that not only consists of the physical space in which students engage in academic work but also include organization and use of social and academic resources wherein students not only gain academic knowledge but also develop socially and emotionally. Teachers thus play a critical role in creating and managing such a learner-centered classroom. They must design a spatial environment

designed to facilitate both individual and group learning (e.g., arrange seating such that students have multiple opportunities to work with peers, work in individual and small groups, or work in a private space; arrange desks to maximize face-to-face interaction between students), arrange classroom space to make readily available various resources such as peers, teachers, and other information sources (e.g., computers, texts), make effective and efficient use of time (e.g., by minimizing transitions and maximizing and structuring time for learning), and carefully orchestrate classroom management by establishing, implementing and reinforcing norms and expectations throughout the academic year. Pre-service teachers throughout the term appear to have continued to consider the role of their understanding of human development in effectively navigating their complex role in fulfilling the responsibility of creating classroom environments that maximize both collective and individual learning.

To a lesser degree, Q sort of one factor from beginning and end of the term showed positive value of the knowledge for building relationships with their students by engaging in non-academic conversations with their students (PS-B; PS-3). Numerous studies have demonstrated that teacher-student relationships are related to various important student outcomes that include academic motivation and achievement, and socioemotional well-being in schools (Eccles & Roeser, 2013). Given that students spend more time in schools than other settings, teachers have a unique and important opportunity to support students' cognitive and social development at all levels of schooling (Bronfenbrenner, 1979). Their ability to show social support, communicate trust and caring, and instill a sense that all students are valuable members of a learning community is critical for students' engagement in classrooms and their overall well-being as well. Though only one factor from both time points showed value of their knowledge of human development for engaging in non-academic conversations with students, some prospective teachers have begun to consider their role in building relationships with students that extend beyond interacting around academic content; their understanding of various factors that impact learning and human development can help them to engage and interact with their students in ways that communicate trust, care and interest in their students that could in turn positively impact their engagement in the classroom both with the content and other members of the learning community.

Difference Across Time Points

Despite the similarities across time, there were a few noteworthy changes in the ways pre-service teachers believed their understanding of human development would enhance their teaching practice. At the beginning of the term, at least one Q sort from PRE factors showed belief that the psychological knowledge would be helpful for effectively communicating with their students (PS-B, PS-C) as well as with their students' parents (PS-C) about student learning. These were not positively ranked at the end of the term. Rather, the Q sort of one particular factor from the end of the term showed value of the knowledge for professional development (PS-2); more specifically, this Q sort showed belief that the knowledge would be helpful for reflecting on and analyzing one's own instruction as well as for skillfully communicating with other professionals in education, such as other teachers, administrators, and school psychologists, in their efforts to think about and support student learning. This is not to say that pre-service teachers at the beginning of the term showed less value of the knowledge for communicating with students and parents. Rather, by the end of the course there may have begun to be a shift in their focus on considering how their understanding could inform their efforts to make sense of their own teaching and communicate with other professionals about learning and teaching. The need for a collaborative community for students to develop and learn applies to teachers and their own development; teachers learn through reflection and analysis of their own instruction, collaboration and communication with their colleagues about their teaching as well as students' behavior and learning (Darling-Hammond, 1998). Some of the pre-service teachers, particularly those whose Q sorts loaded onto PS-2, may have begun to consider their understanding of human development as a rich lens through which they can not only interpret students and their own behaviors, information, and classroom situations but also communicate and learn from sharing one another's thoughts and experiences. By understanding the complexities of learning as intertwined with all domains of students' development (e.g., emotional, social, physical) and context in which their development occurs, teachers can better attend to and discuss these needs with one another and with other professionals in education in their joint efforts to ensure students' needs are effectively met.

Findings 2.3b: Comparing Pre-service Teachers' Beliefs to Educational Psychology Instructors and In-Service Teachers

Educational Psychology Instructors

Table D.20 Educational Psychology Instructors: By-Factor Ranking of Teaching Practices Corresponding to, “Teachers’ Knowledge of Human Development Would be Helpful For...”

Teaching Practice	Factor Arrays	
	1	2
Purposefully engaging in non-academic conversations with individual students to build relationships	1	2
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	1
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	**2	0
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	**0	2
Setting up & managing small group work to promote individual and group learning	0	1
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	**2	-1
Recognizing common patterns of student thinking in a particular subject	**2	-2
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	**1	-1
Using appropriate methods to check for student understanding and monitor student learning	**1	-2
Establishing organizational routines, procedures & strategies to maximize time available for student learning	** -1	1
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	** -1	1
Communicating with parents or guardians to promote their child’s success in and out of school	** -1	2
Reflecting on & analyzing my instruction in order to improve its effectiveness	0	0
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	0	-2
Providing verbal & written feedback to students to help them improve their academic work	** -1	0
Designing a sequence of lessons toward specific goals	** -2	0
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-2	-1
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-1
Number of educational psychology instructors loading onto factor	4	3
Variance	26%	23%

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement

Table D.20 shows the positive rankings assigned to each teaching practice by the representative Q sorts. Out of a total of 10 educational psychology instructors, Q sorts of seven educational psychology instructors loaded significantly onto one of the two factors that emerged from analysis. Three remaining instructors' Q sorts either did not load significantly onto any of the groups ($n = 2$) or were confounding sorts ($n = 1$). The two factors accounted for 49% of the variance. Factor 1 accounted for 26% of the variance, and Factor 2 accounted for 23% of the variance.

Consensus Statements

Consensus statements indicate shared beliefs among the instructors that knowledge of human development would be more helpful for teaching practices around fostering student discourse and collective work in ways that encourage students to share their thinking, respond to, and contribute to one another's thinking (see Table D.21). Furthermore, they showed value of their knowledge for their own interaction with students, though more so at a personal level to communicate care and interest in students' lives outside of the classroom context. On the other hand they placed less value of the knowledge for teaching practices around planning, analyzing and communicating about their instruction with other professionals in education.

Table D.21 Development EPI: Consensus Statements

Statement	Factor Q Sort and Z-value			
	1		2	
	Q	Z-scr	Q	Z-scr
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	0	-0.34	-2	-1.03
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	0.63	1	0.50
Setting up & managing small group work to promote individual and group learning	0	-0.26	1	0.53
Purposefully engaging in non-academic conversations with individual students to build relationships	1	0.90	2	1.60
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-2	-1.49	-1	-0.95
Reflecting on & analyzing my instruction in order to improve its effectiveness	0	-0.23	0	-0.58
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-1.50	-1	-0.68

Distinguishing Statements

EPI-1: Selecting resources for learning and assessing students

EPI-1's Q sort (see Table D.22) highlights its educational psychology instructors' beliefs.

Table D.22 Human Development EPI-1 Q Sort Configuration

	Statement	EPI-1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	**2
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	**2
<i>Knowledge of human development is more helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	**2
	Using appropriate methods to check for student understanding and monitor student learning	**1
	Purposefully engaging in non-academic conversations with individual students to build relationships	1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	**1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1
		Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content
<i>Knowledge of human development is neither helpful nor unhelpful for...</i>	Reflecting on & analyzing my instruction in order to improve its effectiveness	0
	Setting up & managing small group work to promote individual and group learning	0
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	0
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	** -1
	Communicating with parents or guardians to promote their child's success in and out of school	** -1
<i>Knowledge of human development is less helpful for...</i>	Establishing organizational routines, procedures & strategies to maximize time available for student learning	** -1
	Providing verbal & written feedback to students to help them improve their academic work	** -1
	Designing a sequence of lessons toward specific goals	** -2
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

EPI-1 indicated that teachers' knowledge of human development would be more helpful for selecting resources for learning and determining its effectiveness by assessing student learning. Even though both EPI-1 and EPI-2 were similar in that they believed their knowledge of human development would be helpful in eliciting student thinking, EPI-1 also valued this knowledge for recognizing common patterns of knowledge while valuing it less for leading a whole class discussion in ways that engage students with one another. This appears to suggest that they placed a greater emphasis on eliciting student thinking through appropriate questioning, probing or other tasks for the purpose of recognizing and evaluating student thinking about academic content and, in particular, common patterns of student thinking. Based on their identification of common patterns of student thinking, the instructors believed teachers' knowledge would enable them to respond to their assessment through their instruction by considering and selecting instructional strategies that would effectively challenge, support or extend their students' thinking.

In addition to using appropriate methods to check for and monitor student understanding of academic content through informal assessment, educational psychology instructors also believed teachers' knowledge would inform their ability to develop and implement summative assessments in ways that provide rich information about what students have learned and how they could improve upon their instruction. In turn, teachers would be able to better prepare and provide resources for learning by effectively evaluating, selecting and modifying curriculum materials or learning tasks, which was perceived to be enhanced by their understanding of human development. While they believed their knowledge of human development would guide them in determining the appropriateness of teaching and learning resources, they believed it would be less helpful for other aspects of designing instruction such as setting long- and short-term learning goals for students and sequencing their lessons according to the learning goals. Lastly, their knowledge was valued more for their ability to build meaningful relationships with individual students through their non-academic conversations than for communicating with students, parents, as well as other professionals in education about student learning and teaching.

EPI-2: Establishing relationships with students and parents

EPI-2's Q sort (see D.23), similar to EPI-1's Q sort, suggests that its educational psychology instructor valued psychological knowledge of human development for teachers' ability to build relationships with students outside of the classroom context by engaging in non-academic conversations with them.

Table D.23 Human Development EPI-2 Q Sort Configuration

	Statement	EPI-
		2
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2
	Purposefully engaging in non-academic conversations with individual students to build relationships	2
<i>Knowledge of human development is more helpful for...</i>	Communicating with parents or guardians to promote their child's success in and out of school	2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	1
	Setting up & managing small group work to promote individual and group learning	1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	1
<i>Knowledge of human development is neither helpful nor unhelpful for...</i>	Providing verbal & written feedback to students to help them improve their academic work	0
	Designing a sequence of lessons toward specific goals	0
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	0
	Reflecting on & analyzing my instruction in order to improve its effectiveness	0
<i>Knowledge of human development is less helpful for...</i>	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	-1
	Recognizing common patterns of student thinking in a particular subject	-2
	Using appropriate methods to check for student understanding and monitor student learning	-2
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

However they also valued the same knowledge for building relationships with their students' parents by communicating with them about student learning in their joint efforts to promote student learning. In addition to teachers' own ability to build meaningful relationships with their students, EPI-2's Q sort also showed value of teachers' understanding of human for fostering students' relationship with one another around academic content. Like EPI-1, EPI-2 positively valued the knowledge for eliciting student thinking. But given its positive ranking for establishing norms and routines for how students should talk and work with one another, leading a whole class discussion that encourages students to listen and respond to one another, and establishing and managing small group work, it appears that their value of the knowledge for eliciting student thinking pertains to their efforts to use appropriate instructional strategies that enable students to benefit from one another's sharing of ideas to enhance one another's learning.

On the other hand, they did not believe their knowledge would be as helpful for developing summative assessments or other means for informal assessment. Nor did they believe their knowledge would be as helpful for determining appropriate means to respond to their recognition of common patterns of student thinking, which were aspects of teaching practices that were positively ranked by EPI-1. EPI-2 also showed the belief that teachers' knowledge of human development would be less helpful for aspects of lesson planning, which includes setting long- and short-term learning goals for students as well as to prepare lessons for presenting new content clearly by considering and selecting instructional strategies, such as models, examples, demonstrations and representation of content that would make it understandable for all their students.

Lastly, unlike EPI-1, who negatively ranked establishing organizational norms and routines that maximizes student learning, EPI-2 believed the knowledge would be somewhat helpful for creating a learning environment that is conducive to learning through effective management of classroom time and space through appropriate norms and routines. Together this shows that educational psychology instructors in this group showed greater value of their knowledge of human development for establishing relationships as well as for promoting students' efforts to build relationships with one

another in class, while showing less value for aspects of teaching practices that involve designing, selecting and modifying resources and assessments of learning.

In-Service Teachers

Out of a total of 29 in-service teachers, Q sorts of 26 in-service teachers loaded significantly onto one of the three factors that emerged from analysis (see Table D.24).

Table D.24 In-Service Teacher Group Matrix Human Development

	Factor 1	Factor 2	Factor 3	Non-Sig	Confounding
Elementary In-service	2	4	3	0	1
Secondary In-service	9	5	4	1	1
Total Pre-Service	11	9	6	1	2
Variance	21%	16%	13%	-	-

Three remaining in-service teachers' Q sorts either did not load significantly onto any of the groups ($n = 1$) or were confounding sorts ($n = 2$) wherein their Q sorts loaded onto more than one factor. The three factors accounted for 50% of the variance. Factor A accounted for 21% of the variance, with 11 participants' Q sorts significantly associated with this factor: two elementary in-service teachers and nine secondary in-service teachers. Factor B accounted for 16% of the variance, with nine participants' Q sorts significantly associated with this factor: four elementary in-service teachers and five secondary in-service teachers. Factor C accounted for 13% of the variance, with seven participants' Q sorts significantly associated with this factor: three elementary in-service teachers and four secondary in-service teachers. Table D.25 shows the ranking assigned to each of the statements of the factors' representative Q sorts.

Consensus Statements

In-service teachers had less consensus statements than pre-service teachers (see Table D.26), indicating that they had greater variation in their beliefs about how their knowledge of human development would be more or less helpful for their teaching practices. Furthermore, consensus statements were those that were negatively ranked or neutral; they believed that their knowledge would be neither helpful nor unhelpful for making academic content clear for their students through appropriate use of

representations, demonstrations, or examples and they believed their knowledge would be less helpful for setting long- and short-term learning goals for students.

Table D.25 In-Service Teachers: By-Factor Ranking of Teaching Practices Corresponding to the Statement, “My Knowledge of Human Development Would be Helpful For...”

Statement	Factor Arrays		
	1	2	3
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	**2	1
Setting up & managing small group work to promote individual and group learning	*1	*2	**0
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0	1	**1
Purposefully engaging in non-academic conversations with individual students to build relationships	2	** -1	2
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2	2	** -2
Communicating with parents or guardians to promote their child’s success in and out of school	2	** -2	2
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	**0	0	1
Providing verbal & written feedback to students to help them improve their academic work	**1	**0	** -1
Recognizing common patterns of student thinking in a particular subject	** -1	1	0
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	** -2	**0	**1
Designing a sequence of lessons toward specific goals	** -2	**1	**0
Using appropriate methods to check for student understanding and monitor student learning	-1	**1	-1
Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1	-1	**2
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	**1	-2	-2
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	0	0	0
Reflecting on & analyzing my instruction in order to improve its effectiveness	**0	-1	-1
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1	-1	-2
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-2	-2	-1

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement.

In addition to these consensus statements, all three groups placed a more negative value of their knowledge for developing and selecting summative assessments. Despite the

consensus statements that were neutral or negatively ranked, all three groups shared in their beliefs that their knowledge of human development would be more helpful for encouraging students to share and use one another's thinking as resources for learning.

Table D.26 Human Development IS: Consensus Statements

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	0	-0.12	0	0.12	0	0.13
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1	-0.75	-1	-0.38	-2	-0.93

Distinguishing Statements

IS-1: Effectively communicating with students, parents and professionals

IS-1's Q sort's distinguishing statement highlighted its in-service teachers' value of their knowledge of human development for communicating with students and other professionals in education about student learning (see Tables D.27 and D.28). Another aspect of teaching practices for which the in-service teachers believed their knowledge would be more helpful for teaching practices involve fostering collective work, one of which includes setting up and managing small group work. On the other hand, in contrast to other groups, IS-1's in-service teachers believed their knowledge would be less helpful for aspects of practice that involved designing, evaluating and modifying resources and strategies for supporting student learning; they negatively ranked items representing teaching practices such as designing a sequence of lessons in ways that align with learning goals, evaluating, selecting and modifying curriculum materials and learning tasks to use in order to support student learning as well as for selecting strategies during instruction that would help challenge, support or extend on student learning based on their recognition of common patterns of student thinking.

Table D.27 Human Development IS-1 Q Sort Configuration

	Statement	IS-1
<i>Knowledge of human development is more helpful for...</i>	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2
	Communicating with parents or guardians to promote their child's success in and out of school	2
	Purposefully engaging in non-academic conversations with individual students to build relationships	2
	Providing verbal & written feedback to students to help them improve their academic work	**1
	Setting up & managing small group work to promote individual and group learning	*1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	**1
<i>Knowledge of human development is neither helpful nor unhelpful for...</i>	Reflecting on & analyzing my instruction in order to improve its effectiveness	**0
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	0
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	**0
<i>Knowledge of human development is less helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	** -1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1
	Using appropriate methods to check for student understanding and monitor student learning	-1
	Designing a sequence of lessons toward specific goals	** -2
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	** -2
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Table D.28 Distinguishing Statements for IS-1

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Providing verbal & written feedback to students to help them improve their academic work	*1	1.08	0	-0.04	-1	-0.77
Setting up & managing small group work to promote individual and group learning	1	0.71	2	1.28	0	-0.34
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	*1	0.63	-2	-1.74	-2	-1.87
Reflecting on & analyzing my instruction in order to improve its effectiveness	*0	0.53	-1	-0.85	-1	-0.64
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*0	-0.70	0	0.43	1	0.61
Recognizing common patterns of student thinking in a particular subject	*-1	-0.71	1	0.61	0	0.15
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	*-2	-1.17	0	-0.36	1	0.71
Designing a sequence of lessons toward specific goals	*-2	-1.23	1	0.57	0	-0.39

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

IS-2: Fostering and evaluating students' individual and collective learning

In contrast to IS-1, IS-2's Q sort negatively ranked items related to teaching practices involving communicating with students, parents and professionals about student learning (see Tables D.29 and D.30). However, like IS-1, IS-2's in-service teachers believed their knowledge of human development would be useful for promoting students' ability to communicate with one another through their ability to lead whole class discussion, elicit student thinking through questions or tasks and set up and manage small group work. One of IS-2's positive distinguishing statements elaborate on this aspect of teaching practice around providing opportunities to engage in discourse and collaborative work and place a particular emphasis on the value of their knowledge for monitoring their work and ultimately their progress in learning; other groups' Q sorts negatively ranked this aspect of teaching. Another positive distinguishing statement shows that IS-2's in-service teachers also believed their understanding of human development would guide them in designing lessons in ways that are appropriately sequenced such that students

have opportunities to master specific topics and skills before progressing to more advanced ones.

Table D.29 Human Development IS-2 Q Sort Configuration

	Statement	IS-2
<i>Knowledge of human development is more helpful for...</i>	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	**2
	Setting up & managing small group work to promote individual and group learning	*2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2
	Using appropriate methods to check for student understanding and monitor student learning	**1
	Recognizing common patterns of student thinking in a particular subject	1
	Designing a sequence of lessons toward specific goals	**1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	1
<i>Knowledge of human development is neither helpful nor unhelpful for...</i>	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	0
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	0
	Providing verbal & written feedback to students to help them improve their academic work	**0
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	**0
<i>Knowledge of human development is less helpful for...</i>	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1
	Purposefully engaging in non-academic conversations with individual students to build relationships	** -1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-2
	Communicating with parents or guardians to promote their child's success in and out of school	** -2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Altogether, IS-2's Q sort represents beliefs that its in-service teachers valued their knowledge for attending to and evaluating students' progress in their learning through designing a sequence of lessons that provide opportunities for students to collaborate and

engage in discourse with one another such that teachers can monitor their progress and ensure all students can engage in both individual and collaborative learning.

Table D.30 Distinguishing Statements for IS-2

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	0.68	*2	1.76	1	0.56
Setting up & managing small group work to promote individual and group learning	1	0.71	2	1.28	0	-0.34
Using appropriate methods to check for student understanding and monitor student learning	-1	-1.02	*1	1.09	-1	-0.90
Designing a sequence of lessons toward specific goals	-2	-1.23	*1	0.57	0	-0.39
Providing verbal & written feedback to students to help them improve their academic work	1	1.08	*0	-0.04	-1	-0.77
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	-2	-1.17	*0	-0.36	1	0.71
Purposefully engaging in non-academic conversations with individual students to build relationships	2	1.29	*-1	-0.71	2	1.40
Communicating with parents or guardians to promote their child's success in and out of school	2	1.31	*-2	-1.50	2	1.39

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

IS-3: Establishing classroom norms, planning lessons and communicating with students and parents

IS-3's distinguishing statements highlight its pre-service teachers' value of their knowledge for establishing classroom norms and routines that not only help organize classroom space and time but also guide how students are to engage with one another around academic content to ensure students' opportunity to engage in their learning both individually and collectively is maximized (see Tables D.31 and D.32). The last positively ranked distinguishing statement emphasizes their value of knowledge of human development particularly for aspects of teaching practices that relate to designing lessons by evaluating, selecting or modifying curriculum materials and learning tasks that ensure students make progress towards learning goals.

Table D.31 Human Development IS-3 Q Sort Configuration

	Statement	IS-3
<i>Knowledge of human development is more helpful for...</i>	Establishing organizational routines, procedures & strategies to maximize time available for student learning	**2
	Purposefully engaging in non-academic conversations with individual students to build relationships	2
	Communicating with parents or guardians to promote their child's success in and out of school	2
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	**1
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	**1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1
<i>Knowledge of human development is neither helpful nor unhelpful for...</i>	Recognizing common patterns of student thinking in a particular subject	0
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	0
	Setting up & managing small group work to promote individual and group learning	**0
	Designing a sequence of lessons toward specific goals	**0
<i>Knowledge of human development is less helpful for...</i>	Reflecting on & analyzing my instruction in order to improve its effectiveness	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
	Providing verbal & written feedback to students to help them improve their academic work	** -1
	Using appropriate methods to check for student understanding and monitor student learning	-1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	** -2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

On the other hand, they did not believe their knowledge would be as useful for setting long- and short-term learning goals, developing and using both informal and summative assessments, or analyzing their own instruction. Lastly, IS-3 was the only group to believe that their knowledge of human development would be less helpful for leading whole-class discussion that consists of students actively sharing and responding to one another's thinking.

Table D.32 Distinguishing Statements for IS-3

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1	-0.75	-1	-0.60	*2	1.50
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0	0.24	1	0.44	*1	1.22
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	-2	-1.17	0	-0.36	*1	0.71
Setting up & managing small group work to promote individual and group learning	1	0.71	2	1.28	*0	-0.34
Designing a sequence of lessons toward specific goals	-2	-1.23	1	0.57	*0	-0.39
Providing verbal & written feedback to students to help them improve their academic work	1	1.08	0	-0.04	*-1	-0.77
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2	1.52	2	1.14	*-2	-1.07

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Comparing Pre-Service Teachers', In-Service Teachers' and Educational Psychology Instructors' Beliefs

Table D.33 shows positive rankings of Q sorts representing factors that emerged for each educator groups: pre-service teachers, in-service teachers and educational psychology instructors. At least one factor from all educator groups positively ranked seven of the eighteen teaching practices. Of these teaching practices, all factors across all educator groups positively ranked one teaching practice – eliciting student thinking to not only evaluate their understanding of academic content but to also help students use one another’s ideas as resources for their learning. While pre-service teachers and educational psychology instructors positively ranked a total of twelve items across their factors – eight of which represent the same teaching practices, in-service teachers positively ranked fourteen teaching practices across its factors. This suggests a greater range of teaching practices for which in-service teachers as a group believed their knowledge of human development would be particularly helpful.

Table D.33 Comparison of Positive Rankings Between Educator Groups

Statement	PRE			IN			TE	
	1	2	3	1	2	3	1	2
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	1	1	1	2	1	1	1
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2	1	1	0	0	1	2	-1
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	-1	2	2	0	1	1	0	2
Recognizing common patterns of student thinking in a particular subject	2	2	-1	-1	1	0	2	-2
Establishing organizational routines, procedures & strategies to maximize time available for student learning	1	0	1	-1	-1	2	-1	1
Purposefully engaging in non-academic conversations with individual students to build relationships	-2	0	2	2	-1	2	1	2
Using appropriate methods to check for student understanding and monitor student learning	2	0	0	-1	1	-1	1	-2
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	1	-2	1	-2	-2	-2	-1
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	-1	-1	-2	-2	-1	1	-1
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1	1	1	0	0	0	0	-2
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	2	-2	0	-1	-1	0	0
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0	0	2	-1	-1	-2	-2	-1
Designing a sequence of lessons toward specific goals	-1	-1	-2	-2	1	0	-2	0
Providing verbal & written feedback to students to help them improve their academic work	0	-2	0	1	0	-1	-1	0
Communicating with parents or guardians to promote their child's success in and out of school	-2	-1	-1	2	-2	2	-1	2
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0	-2	0	2	2	-2	-1	1
Setting up & managing small group work to promote individual and group learning	-1	-2	0	1	2	0	0	1
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	0	-1	-1	-2	0	1	2	0

Note. Green indicates positive rankings assigned to corresponding teaching practices by respective factor. Grey indicates teaching practices that have been negatively ranked by all factors.

Furthermore, in-service teachers and educational psychology instructors positively ranked a greater number of the same items compared to pre-service teachers and in-service teachers as well as pre-service teachers and educational psychology instructors. These teaching practices are discussed in-depth in the next two sections.

Similarities Between Pre-Service Teachers and Other Educator Groups

Of the teaching practices that were positively ranked, Q sorts of at least one factor from each educator groups showed value of the knowledge of human development for teaching practices that were positively ranked by pre-service teacher factors both at the beginning and end of the term. For one, at least one factor from each educator group positively ranked teaching items around using formative assessment to monitor student learning, recognizing and responding to student thinking: eliciting student thinking to evaluate their understanding (PS-1, PS-2, PS-3; IS-1, IS-2, IS-3; EPI-1, EPI-2), using appropriate methods to check for and monitor student thinking and understanding (PS-1; IS-2; EPI-1), recognizing common patterns of student thinking (PS-1, PS-2; IS-2; EPI-1), and using appropriate instructional strategies during instruction in response to their recognition of student thinking to challenge, support or extend on what students know (PS-1, PS-2, PS-3; IS-3; EPI-1). A group of pre-service teachers and educational psychology instructors, but not in-service teachers, expanded on this aspect of teaching practice, and showed value of their knowledge for developing and selecting appropriate summative assessments as well (PS-1; EPI-1). They also positively ranked teaching items representing establishing and effectively implementing various routines and norms to organize classroom time and space (PS-1, PS-3; IS-3; EPI-2) and to foster students' discourse with one another (PS-2, PS-3; IS-2, IS-3; EPI-2). Lastly, they showed value of the knowledge for building relationships with students by engaging in non-academic conversations with them (PS-3; IS-1, IS-3; EPI-1, EPI-2).

Differences Between Pre-Service Teachers and Other Educator Groups

Despite the similarities, educator groups showed some considerable differences in the ways in which they valued their psychological knowledge of human development. In-service teachers and educational psychology instructors shared greater similarities in their positive rankings compared to pre-service teachers. In the case of pre-service teachers they expanded on their beliefs that their understanding of human development would be helpful for informing their practice. At least one pre-service teacher factor's Q sort positively ranked teaching practices around planning, implementing and analyzing instruction whereas no factors from in-service teachers and educational psychology instructors did so. In fact, all three pre-service teacher factors positively valued their

knowledge for selecting instructional strategies for making new content clear through appropriate use of representations, demonstrations and/or examples. In addition, one of the factors believed understanding human development would enhance the ability to set long- and short-term learning goals that would guide instruction (PS-3), while another factor positively ranked item around reflecting on and analyzing instruction (PS-2). This strengthens the viewpoint that understanding various factors of students' development could enhance their ability to plan, carry out and evaluate their instruction, as it could provide a lens through which they could consider the interaction between teaching and learning a particular content. Taken together, items that were ranked positively by pre-service teachers point to their focus on the role of their psychological knowledge of human development in implementing teaching that is developmentally appropriate for their students.

In-service teachers and educational psychology instructors in contrast showed value of the knowledge more for designing, evaluating, selecting and modifying curriculum materials (IS-3; EPI-1) than for selecting instructional strategies for presenting content. Despite this positive ranking, they placed a greater emphasis on teaching practices around fostering positive relationships and promoting students' overall well being. More so than showing value of the knowledge for aforementioned teaching practices that primarily involve preparing, carrying out and assessing teaching and student learning, at least two in-service teacher factor and one educational psychology instructor factor showed positive value of their psychological knowledge for teaching practices that involve fostering relationship-building at several levels.

For one, two Q sorts from in-service teacher factor and one Q sort from educational psychology instructor factor showed value of their knowledge for building relationships with their students' parents (IS-1, IS-3; EPI-2) whereas no Q sorts from pre-service teacher factor did so. In-service teachers further expanded on their value of the knowledge for building relationships with students as one of the two Q sorts from in-service teacher factor who positively ranked the aforementioned items also positively ranked providing feedback to students in ways that support students' learning (IS-1). This positive ranking, in addition to their positive ranking of item around engaging in non-academic relationship with students, is in line with developmental theorists, influenced

by Bronfenbrenner (1979), who point to the importance of the greater context in which children live to promote their learning and development. Children are embedded in a complex system of relationships with their families and the community, which affect their behavior and engagement in schools. Taking this ecological perspective of children as influenced by these various relationships could provide a great range of possibly ways to flexibly adapt instruction in ways that respond to and meet children's social and emotional needs in addition to their intellectual needs (Daniels & Shumow, 2003). For in-service teachers and educational psychology instructors, understanding this relationship, whether it be through research or opportunities to interact with students and parents, may have shed light to the role of teachers' psychological knowledge of human development in fostering a respectful teacher-parent relationship and inviting students' parents to become actively involved in schools and their children's learning. By creating an understanding of how knowledge, behavior and socialization within the students' families and the greater community can contribute to their students' ability to function in the classrooms, teachers can effectively guide students' learning through their instructional decisions in terms of promoting students' participation and positive socialization in the classroom.

In addition to building teacher-student and teacher-parent relationship, in-service teachers and educational psychology instructors also showed value of their knowledge of human development for fostering students' relationship with their peers through their ability to facilitate both whole class discussion and small group work (IS-1, IS-2; EPI-2), practices that were not positively ranked by pre-service teachers. Social constructivists highlight the importance of children's interaction with peers and teachers in their development more so than in working independently; it is through these interactions that students adapt the language that mediate their participation and understanding of academic content (Vygotsky, 1978). Thus in-service teachers and educational psychology instructors appear to indicate that teachers' understanding of human development can shed light to an understanding of the function, process, and role of collaborative discourse and interaction in their learning and overall development. This is an important step that can impact whether and the degree to which they can successfully coordinate whole class and small group work wherein students can engage in purposeful and

meaningful collaborative learning. Taken together, in-service teachers and educational psychology instructors, more so than pre-service teachers, showed their consideration for a broader and more expansive framework of human development with which they can make various instructional decisions. More specifically, their positive ranking of items corresponding to communicating with parents and students and fostering students' discourse with one another particularly indicate a value of Bronfenbrenner's (1979) ecological view of development (e.g., importance of settings and circumstances in which students live for understanding their behavior and subsequently establishing a productive environment and instruction that addresses and promotes students' intellectual, social and emotional needs) as a framework with which teachers plan, adapt and modify their instruction.

APPENDIX E
STUDY 2.4 FINDINGS: EXPLORING BELIEFS ABOUT THE VALUE OF
PSYCHOLOGICAL KNOWLEDGE OF MOTIVATION

Findings 2.4a: Changes in Pre-Service Teachers’ Beliefs About the Value of their Psychological Knowledge of Motivation

Pre-Service Teachers’ Beliefs: PRE

Out of a total of 30 pre-service teachers 24 pre-service teachers’ Q sorts loaded significantly onto one of the four factors that emerged at the beginning of the term (see Table E.1). Six remaining pre-service teachers’ Q sorts either did not load significantly onto any of the factors ($n = 3$) or were confounding sorts ($n = 3$). The four factors accounted for 54% of the variance. Factor A accounted for 13% of the variance with seven participants’ Q sorts significantly associated with the factor: one elementary pre-service teacher and six secondary pre-service teachers.

Table E.1 Pre-Service Teacher PRE Group Matrix for Motivation

	Factor A	Factor B	Factor C	Factor D	Non-Sig	Confounding
Elementary Pre-service	1	5	1	3	2	1
Secondary Pre-service	6	1	3	3	1	2
Total Pre-Service	7	6	4	6	3	3
Variance	13%	13%	11%	17%	-	-

Factor B accounted for 13% of the variance, with six Q sorts significantly associated with the factor: five elementary pre-service teachers and one secondary pre-service teacher. Factor C accounted for 11% of the variance, with four Q sorts significantly associated with the factor: one elementary pre-service teacher and three secondary pre-service teachers. Factor D accounted for 17% of the variance, with six participants’ Q sorts significantly associated with the factor: three elementary pre-service teachers and three secondary pre-service teachers.

Consensus Statement

The single consensus statement shows all four factors’ neutral stance with respect to the value of their knowledge of motivation for establishing norms and routines for classroom discourse leading to a shared construction of knowledge. Comparison between the four factors however points to a general agreement in their value of this psychological knowledge for setting up and managing small group work.

Table E.2 PRE: By-Factor Ranking of Statements Corresponding to the Statement, "My Knowledge of Motivation Would be Helpful For..."

Statement	Factor Arrays			
	A	B	C	D
Setting up & managing small group work to promote individual and group learning	**2	1	1	1
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	** -1	2	2	2
Purposefully engaging in non-academic conversations with individual students to build relationships	** -2	2	2	**1
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	1	1	** -1	2
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1	1	** -2	1
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1	-1	2	-1
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	-1	-1	1
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	**2	0	*0	-1
Providing verbal & written feedback to students to help them improve their academic work	0	-1	0	**2
Designing a sequence of lessons toward specific goals	**2	**0	** -2	** -1
Using appropriate methods to check for student understanding and monitor student learning	0	1	0	** -2
Communicating with parents or guardians to promote their child's success in and out of school	-2	0	1	-2
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1	**2	** -2	-1
Recognizing common patterns of student thinking in a particular subject	** -1	** -2	**1	**0
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-2	**1	-2
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0	0	0	0
Establishing organizational routines, procedures & strategies to maximize time available for student learning	0	-1	-1	0
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	-2	-1	**0

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement

This appears to suggest the belief that while knowledge of motivation may be neither helpful nor unhelpful in establishing norms and routines for how students are to communicate with one another around content, it might better serve their efforts to use

specific strategies to set up and manage small group work that keeps students accountable for both collective and individual learning through their ability to select and implement appropriate tasks that keep students engaged.

Table E.3 Motivation PRE: Consensus Statement

Statement	Factor Q sort value and Z-score							
	A		B		C		D	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0	-0.60	0	-0.15	0	-0.06	0	-0.29

Distinguishing Statements

PS-A: Designing lessons and facilitating whole group and small group discussions

Table E.4 shows PS-A's Q sort configuration. PS-A's Q sort represented the belief that the knowledge of motivation would be more helpful in the efforts to plan and design lessons that are well-sequenced and could effectively engage students in their learning towards larger learning goals – though the knowledge was not perceived to be as necessary for establishing the learning goals themselves. This included the ability to evaluate and select appropriate examples and representations of academic content that support and extend student learning as well as curriculum materials and learning tasks that engage students with the content. The Q sort also showed the belief that their knowledge would inform one's ability to lead and facilitate discussions and activities during whole class and small group work such that students could successfully contribute to both collective and individual learning. Lastly, its positive ranking pointed to the value of the knowledge more for designing, implementing and using summative assessments (and less for using informal assessments) that help gain an understanding of student learning and inform future instruction. An understanding of motivation on the other hand was believed to be less helpful for eliciting student thinking through questions or tasks to assess and recognize common patterns of student thinking. Furthermore, it showed less value for out-of-class aspects of teaching practices, particularly those that involve analyzing instruction and communicating with their students, parents and other professionals in education.

Table E.4 Motivation PS-A Q Sort Configuration

	Statement	PS-A
<i>Knowledge of motivation is more helpful for...</i>	Setting up & managing small group work to promote individual and group learning	**2
	Designing a sequence of lessons toward specific goals	**2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	**2
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Using appropriate methods to check for student understanding and monitor student learning	0
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	0
	Providing verbal & written feedback to students to help them improve their academic work	0
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0
<i>Knowledge of motivation is less helpful for...</i>	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	** -1
	Recognizing common patterns of student thinking in a particular subject	** -1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	-1
	Purposefully engaging in non-academic conversations with individual students to build relationships	** -2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2
	Communicating with parents or guardians to promote their child's success in and out of school	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Table E.5 Distinguishing Statements for PS-A

Statement	Factor Q sort value and Z-score							
	A		B		C		D	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Setting up & managing small group work to promote individual and group learning	*2	1.62	1	0.40	1	0.58	1	0.40
Designing a sequence of lessons toward specific goals	*2	1.25	0	0.34	-2	-1.33	-1	-0.43
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	*2	1.21	0	-0.33	0	0.36	-1	-0.54
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	*-1	-0.73	2	1.36	2	1.09	2	1.69
Recognizing common patterns of student thinking in a particular subject	*-1	-0.84	-2	-1.56	1	0.92	0	-0.12
Purposefully engaging in non-academic conversations with individual students to build relationships	*-2	-1.18	2	1.28	2	1.47	1	0.49

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

PS-B: Planning for and attending to student learning

PS-B's Q sort shared some similarities to that of PS-A's Q sort with respect to designing lessons by evaluating and selecting appropriate curriculum materials and learning tasks, choosing demonstrations, examples or representations that help support and extend student thinking, and using methods to set up and manage small group work (see Tables E.6 and E.7). Unlike PS-A's Q sort as well as those of the rest of the factors, PS-B's Q sort showed value of the knowledge for setting long- and short-term learning goals that would guide in designing and sequencing of lessons to ensure students meet those goals.

Additionally, the same knowledge was believed to be useful for attending to student thinking and engagement in their learning during instruction through effective use of formative assessments such as questioning, journals and performance tasks, a teaching practice that was not positively ranked by other factors. It did not however show the same value for recognizing common patterns of student thinking based on their informal assessment. Lastly, the Q sort showed value of the knowledge of motivation for communicating care and interest to individual students by engaging in non-academic

conversations gaining understanding of students’ interests and goals as they relate to their learning goals and developmental needs.

Table E.6 Motivation PS-B Q Sort Configuration

	Statement	PS-B
<i>Knowledge of motivation is more helpful for...</i>	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	**2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2
	Purposefully engaging in non-academic conversations with individual students to build relationships	2
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	1
	Using appropriate methods to check for student understanding and monitor student learning	1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Setting up & managing small group work to promote individual and group learning	1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Communicating with parents or guardians to promote their child’s success in and out of school	0
	Designing a sequence of lessons toward specific goals	**0
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0
<i>Knowledge of motivation is less helpful for...</i>	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1
	Providing verbal & written feedback to students to help them improve their academic work	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	-2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2
	Recognizing common patterns of student thinking in a particular subject	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

On the other hand, knowledge of motivation was perceived to be less helpful in designing and implementing summative assessments and subsequently providing appropriate verbal or written feedback to students about their learning. Similar to PS-A, PS-B’s Q sort showed less value of their knowledge for reflecting on and analyzing their

own instruction as well as for communicating with other professionals about teaching and learning. Other aspects of teaching practices for which they placed less value of their knowledge include establishing routines and procedures for organizing classroom time and space as well as for making new content explicit through explanation, modeling, representations and examples.

Table E.7 Distinguishing Statements for PS-B

Statement	Factor Q sort value and Z-score							
	A		B		C		D	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1	-0.86	*2	1.73	-2	-2.02	-1	-0.95
Designing a sequence of lessons toward specific goals	2	1.25	*0	0.34	-2	-1.33	-1	-0.43
Recognizing common patterns of student thinking in a particular subject	-1	-0.84	*-2	-1.56	1	0.92	0	-0.12

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

PS-C: Assessing and communicating about student learning with professionals

Though PS-C's Q sort showed belief that the knowledge would be helpful for engaging in non-academic conversations with students, it was distinguished for a greater emphasis on the value of the knowledge for communicating with students' parents and with other professionals in education in their joint efforts to meet students' interests and needs to successfully engage in their learning (see Tables E.8 and E.9). To a lesser degree, PS-C's Q sort also showed value of the knowledge for fostering small group work that engages students in collaborative work toward collective and individual learning. Aspects of teaching practices for which PS-c's pre-service teachers believed their knowledge of motivation would be less helpful involved designing and evaluating their lessons and assessments of student learning.

Table E.8 Motivation PS-C Q Sort Configuration

	Statement	PS-C
<i>Knowledge of motivation is more helpful for...</i>	Purposefully engaging in non-academic conversations with individual students to build relationships	2
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2
	Recognizing common patterns of student thinking in a particular subject	**1
	Communicating with parents or guardians to promote their child's success in and out of school	1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	**1
	Setting up & managing small group work to promote individual and group learning	1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	*0
	Using appropriate methods to check for student understanding and monitor student learning	0
	Providing verbal & written feedback to students to help them improve their academic work	0
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0
<i>Knowledge of motivation is less helpful for...</i>	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	** -1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	-1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	** -2
	Designing a sequence of lessons toward specific goals	** -2
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Table E.9 Distinguishing Statements for PS-C

Statement	Factor Q sort value and Z-score							
	A		B		C		D	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Recognizing common patterns of student thinking in a particular subject	-1	-0.84	-2	-1.56	*1	0.92	0	-0.12
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-1.20	-2	-1.54	*1	0.77	-2	-1.68
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2	1.21	0	-0.33	0	0.36	-1	-0.54
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	1	0.71	1	1.07	*-1	-0.53	2	1.23
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1	1.01	1	0.50	*-2	-1.04	1	1.05
Designing a sequence of lessons toward specific goals	2	1.25	0	0.34	*-2	-1.33	-1	-0.43
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1	-0.86	2	1.73	*-2	-2.02	-1	-0.95

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

PS-D: Responding to student learning through feedback and instruction

PS-D's Q sort emphasized the value of knowledge of motivation for teaching practices that involve communicating with students and facilitating students' interaction with one another, while showing less value of the knowledge for communicating with parents and other professionals in education (see Tables E.10 and E.11). First, PS-D's pre-service teachers believed their knowledge of motivation would guide their efforts and ability to communicate effectively with their students in various ways. The knowledge was considered to be useful for engaging not only in non-academic conversations with students to gain insight into students' interests and goals as they relate to their learning, but also in academic communications that involve providing appropriate verbal or written feedback that helps students understand their strengths and focus on areas for improvement, the latter of which was positively ranked only by PS-D's Q sort.

Table E.10 Motivation PS-D Q Sort Configuration

	Statement	PS-D
<i>Knowledge of motivation is more helpful for...</i>	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2
	Providing verbal & written feedback to students to help them improve their academic work	**2
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	2
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1
	Purposefully engaging in non-academic conversations with individual students to build relationships	**1
	Setting up & managing small group work to promote individual and group learning	1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Establishing organizational routines, procedures & strategies to maximize time available for student learning	0
	Reflecting on & analyzing my instruction in order to improve its effectiveness	**0
	Recognizing common patterns of student thinking in a particular subject	**0
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0
<i>Knowledge of motivation is less helpful for...</i>	Designing a sequence of lessons toward specific goals	** -1
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	-1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1
	Using appropriate methods to check for student understanding and monitor student learning	** -2
	Communicating with parents or guardians to promote their child's success in and out of school	-2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

In addition to providing feedback on student learning particularly based on summative assessment of student thinking and learning, PS-D's Q sort also showed belief that the knowledge would enable them to respond to student learning through their instruction by evaluating and using appropriate instructional strategies that support, extend, or change student thinking as well as curriculum materials and learning tasks that challenge students

to achieve their learning goals. Second, the Q sort pointed to value of the knowledge for fostering opportunities for students to work collaboratively in small groups through the ability to establish and manage small groups that involve choosing appropriate tasks and providing guidelines that keep students accountable for one another's learning.

Table E.11 Distinguishing Statements for PS-D

Statement	Factor Q sort value and Z-score							
	A		B		C		D	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Providing verbal & written feedback to students to help them improve their academic work	0	-0.28	-1	-0.63	0	-0.02	*2	1.41
Purposefully engaging in non-academic conversations with individual students to build relationships	-2	-1.18	2	1.28	2	1.47	*1	0.49
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	-1.09	-2	-1.08	-1	-0.92	*0	0.39
Recognizing common patterns of student thinking in a particular subject	-1	-0.84	-2	-1.56	1	0.92	*0	-0.12
Designing a sequence of lessons toward specific goals	2	1.25	0	0.34	-2	-1.33	*-1	-0.43
Using appropriate methods to check for student understanding and monitor student learning	0	0.38	1	0.56	0	0.13	*-2	-1.23

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$

PS-D's pre-service teachers also appeared to have begun to consider its potential value for engaging students during whole-class discussion, though there were conflicting rankings in items that pertain to whole group work; although they positively valued their knowledge for eliciting student thinking such that their students could share their thinking with one another, they negatively ranked item related to leading whole class discussion in ways that encourage students to use one another's ideas as resources. Other aspects of teaching practices that were negatively ranked involve designing and sequencing lessons as informed by the long- and short-term learning goals they develop, preparing instructional strategies for presenting content clearly for their students, and considering and using appropriate methods for informal assessment of student learning that could be used during instruction.

Pre-Service Teachers' Beliefs: POST

Out of a total of 30 pre-service teachers, 23 of their Q sorts loaded significantly onto one of the four factors that emerged at the end of the term (see Table E.12). Seven remaining pre-service teachers' Q sorts either did not load significantly onto any of the groups ($n = 5$) or were confounding sorts ($n = 2$). The four factors accounted for 51% of the variance.

Table E.12 Pre-Service POST Group Matrix for Motivation

	Factor 1	Factor 2	Factor 3	Factor 4	Non-Sig	Confounding
Elementary Pre-service	3	3	1	3	2	2
Secondary Pre-service	6	2	5	0	3	0
Total Pre-Service	9	5	6	3	5	2
Variance	15%	13%	12%	11%	-	-

Factor 1 accounted for 15% of the variance with nine participants' Q sorts significantly associated with the factor: three elementary pre-service teachers and six secondary pre-service teachers. Factor 2 accounted for 13% of the variance, with five Q sorts significantly associated with the factor: three elementary pre-service teachers and two secondary pre-service teachers. Factor 3 accounted for 12% of the variance, with six Q sorts significantly associated with the factor: one elementary pre-service teacher and five secondary pre-service teachers. Factor 4 accounted for 11% of the variance, with three elementary pre-service teachers' Q sorts significantly associated with the factor. Table E.13 shows the ranking of teaching practices assigned by each of the four factors.

Consensus Statements

By the end of the course, pre-service teachers appeared to show a more diverse set of beliefs about the ways in which their knowledge of motivation could enhance their teaching practices. The single consensus statement indicates the four factors' shared beliefs that the knowledge of motivation is less helpful in reflecting on and analyzing the effectiveness of their instruction. Comparison across the four factors showed agreement in the beliefs that knowledge would also be less helpful for skillfully communicating with other professionals in education. Although there were no consensus statements that were positively ranked, there were several statements that were positively ranked by two or

more of the four factors: establishing norms and routines for how students should talk, modifying instructional strategies during instruction, and providing verbal and written feedback to students.

Table E.13 POST: By-Factor Ranking of Statements Corresponding to the Statement, "My Knowledge of Motivation Would be Helpful For..."

Statement	Factor Arrays			
	1	2	3	4
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2	*0	1	1
Providing verbal & written feedback to students to help them improve their academic work	**0	2	1	2
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2	** -1	2	*1
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0	2	0	1
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	1	1	0	-1
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0	1	**2	** -2
Using appropriate methods to check for student understanding and monitor student learning	**0	1	** -2	2
Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1	1	1	0
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1	-2	1	-1
Purposefully engaging in non-academic conversations with individual students to build relationships	**1	0	0	0
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	**2	0	** -1	0
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1	**2	0	-1
Setting up & managing small group work to promote individual and group learning	-1	-1	**2	*0
Recognizing common patterns of student thinking in a particular subject	** -2	*0	* -1	**2
Designing a sequence of lessons toward specific goals	**1	-1	-1	** -2
Communicating with parents or guardians to promote their child's success in and out of school	-2	-2	-2	**1
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	-1	-2	-2
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-2	-1	-1

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement.

Table E.14 Motivation POST: Consensus Statement

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	-0.91	-1	-0.89	-2	-1.42	-2	-1.64

Distinguishing Statements

PS-1: Building relationships and designing lessons to engage students

PS-1’s Q sort highlighted the value of motivation for teaching practices that involve designing lessons and interacting with students (see Tables E.15 and E.16). The Q sort showed its pre-service teachers’ belief that their understanding of student motivation would inform them in establishing long- and short-term learning goals. Setting learning goals, combined with their knowledge of motivation, was perceived to guide them in designing a sequence of lessons that keep students engaged in their learning, selecting and using examples and representations of content that help make content clear to the students, and selecting and modifying curriculum materials and learning tasks that challenge and engage their students in their learning. They also believed their knowledge would be of value during instruction, particularly when trying to elicit student thinking to evaluate their understanding of content and to respond accordingly by implementing appropriate instructional strategies that would support or change student thinking.

Lastly, they believed their understanding of student motivation would enhance their ability to engage in meaningful non-academic conversations with their individual students that would help gain information about their students’ personal interests and goals, which would in turn guide their efforts to address their learning and developmental needs. Altogether, this indicates their beliefs that understanding of motivation would be more helpful in incorporating students’ interests and goals, as they relate to the larger learning goals, to ensure students engage in successful learning. In contrast, PS-1’s Q sort showed less value of knowledge for communicating with parents and other professionals in education, reflecting on and analyzing their own instruction, designing summative assessments, and identifying common patterns of student thinking, setting up small group

work, and establishing organizational norms and routines to maximize learning opportunities.

Table E.15 Motivation PS-1 Q Sort Configuration

	Statement	PS-1
<i>Knowledge of motivation is more helpful for...</i>	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	**2
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2
	Purposefully engaging in non-academic conversations with individual students to build relationships	**1
	Designing a sequence of lessons toward specific goals	**1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0
	Using appropriate methods to check for student understanding and monitor student learning	**0
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0
	Providing verbal & written feedback to students to help them improve their academic work	**0
<i>Knowledge of motivation is less helpful for...</i>	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
	Setting up & managing small group work to promote individual and group learning	-1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	-1
	Recognizing common patterns of student thinking in a particular subject	** -2
	Communicating with parents or guardians to promote their child's success in and out of school	-2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Table E.16 Distinguishing Statements for PS-1

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	*2	1.60	0	0.15	-1	-1.06	0	0.15
Purposefully engaging in non-academic conversations with individual students to build relationships	*1	1.26	0	-0.45	0	0.06	0	0.28
Designing a sequence of lessons toward specific goals	*1	0.76	-1	-0.46	-1	-0.96	-2	-1.64
Using appropriate methods to check for student understanding and monitor student learning	*0	-0.04	1	0.86	-2	-1.18	2	1.22
Providing verbal & written feedback to students to help them improve their academic work	*0	-0.46	2	1.70	1	0.62	2	1.17
Recognizing common patterns of student thinking in a particular subject	*-2	-1.00	0	0.30	-1	-0.31	2	1.35

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$

PS-2: Assessing and establishing norms for student learning

Table E.17 illustrates PS-2's Q sort. PS-2's Q sort represents its pre-service teachers' beliefs that their knowledge of motivation would enhance their ability to create and use both informal and summative assessments that would provide useful information about students' progress and struggles in their efforts to assist specific students and ensure they make progress towards the short- and long-term learning goals they establish for their students (Table E.18). Their ability to use various assessments in conjunction with their knowledge of motivation was believed to be as helpful for providing appropriate verbal or written feedback to students that would help them focus their attention on the strengths of their work as well as outline ways in which they could engage in their efforts to improve and experience success in their learning. PS-2's pre-service teachers additionally placed positive value of their knowledge for establishing norms and routines that help to both organize time and space to maximize learning and to guide students in constructing and sharing knowledge. In addition to outlining these norms, their knowledge of motivation was valued for modeling the norms for sharing

knowledge by encouraging students, particularly more so during whole-class discussions than small group work, to actively listen and respond to one another's thinking.

Table E.17 Motivation PS-2 Q Sort Configuration

	Statement	PS-2
<i>Knowledge of motivation is more helpful for...</i>	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	**2
	Providing verbal & written feedback to students to help them improve their academic work	2
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	2
	Using appropriate methods to check for student understanding and monitor student learning	1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	1
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Recognizing common patterns of student thinking in a particular subject	*0
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	0
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*0
	Purposefully engaging in non-academic conversations with individual students to build relationships	0
<i>Knowledge of motivation is less helpful for...</i>	Designing a sequence of lessons toward specific goals	-1
	Setting up & managing small group work to promote individual and group learning	-1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	** -1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	-1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-2
	Communicating with parents or guardians to promote their child's success in and out of school	-2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Like PS-1, PS-2's Q sort placed less value of their knowledge for communicating about student learning with parents and other professionals in education and for managing small group work. PS-2's Q sort, however, differed from that of PS-1 in that it placed less value

of knowledge for making academic content clear for students or for eliciting student thinking.

Table E.18 Distinguishing Statements for PS-2

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1	-0.48	*2	1.72	0	0.02	-1	-0.80
Recognizing common patterns of student thinking in a particular subject	-2	-1.00	0	0.30	-1	-0.31	2	1.35
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2	1.48	0	-0.23	1	0.48	1	1.10
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2	1.38	*-1	-0.74	2	1.45	1	0.61

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

PS-3: Providing opportunities for student interaction around academic content

PS-3's Q sort emphasized the value of knowledge of motivation for encouraging students to engage in collaborative work and to share their thinking during both whole-class discussion and small group work, the latter of which only PS-3 ranked positively (see Tables E.19 and E.20). PS-3's pre-service teachers also believed their ability to encourage students to share their thinking with one another through questions and tasks that would enable them to evaluate students' understanding and subsequently modify their instruction based on their recognition of student thinking to ensure they can continue to engage and challenge their own knowledge and skills. In addition to responding to student thinking through instructional strategies that make content explicit through appropriate examples, demonstrations and representations of academic content, providing verbal and written feedback that guides students' attention to areas for improvement was another teaching practice for which they believed their knowledge of motivation would be useful.

Table E.19 Motivation PS-3 Q Sort Configuration

	Statement	PS-3
<i>Knowledge of motivation is more helpful for...</i>	Setting up & managing small group work to promote individual and group learning	**2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	**2
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1
	Providing verbal & written feedback to students to help them improve their academic work	1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Purposefully engaging in non-academic conversations with individual students to build relationships	0
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	0
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0
<i>Knowledge of motivation is less helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	*-1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1
	Designing a sequence of lessons toward specific goals	-1
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	** -1
	Using appropriate methods to check for student understanding and monitor student learning	** -2
	Reflecting on & analyzing my instruction in order to improve its effectiveness	-2
	Communicating with parents or guardians to promote their child's success in and out of school	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Lastly, similar to PS-2, PS-3's Q sort also positively valued knowledge for establishing norms and routines specifically for organizing classroom time and space to ensure students have maximum opportunities to engage in their learning and minimize disruptions. On the other hand, PS-3's Q sort suggested the belief that the same knowledge would not be as helpful for designing and reflecting on various aspects of

their instruction, which include designing a sequence of lessons that lead students to larger goals and evaluating and selecting curriculum materials and tasks that aim to support student learning and aid in teachers' informal assessment and recognition of common patterns of student thinking. And like the previous two groups, PS-3's Q sort placed less value of their knowledge of motivation for communicating with their students' parents and other professionals in education.

Table E.20 Distinguishing Statements for PS-3

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Setting up & managing small group work to promote individual and group learning	-1	-0.60	-1	-0.54	*2	1.85	0	0.22
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0	0.10	1	0.33	*2	1.38	-2	-0.94
Recognizing common patterns of student thinking in a particular subject	-2	-1.00	0	0.30	-1	-0.31	2	1.35
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	2	1.60	0	0.15	*-1	-1.06	0	0.15
Using appropriate methods to check for student understanding and monitor student learning	0	-0.04	1	0.86	*-2	-1.18	2	1.22

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

PS-4: Using strategies to elicit, evaluate and communicate about student learning with parents

PS-4's Q sort points to its pre-service teachers' beliefs that their knowledge would be more helpful for eliciting and monitoring student thinking to evaluate, respond to and communicate about student thinking, with both students and parents (see Tables E.21 and E.22). This could perhaps be accomplished by using their knowledge of motivation to first establish norms and routines to maximize opportunities for classroom discourse, paired with their ability to elicit student thinking through their ability to select and use appropriate questions or tasks with which students could share their thinking.

Table E.21 Motivation PS-4 Q Sort Configuration

	Statement	PS-4
<i>Knowledge of motivation is more helpful for...</i>	Recognizing common patterns of student thinking in a particular subject	**2
	Using appropriate methods to check for student understanding and monitor student learning	2
	Providing verbal & written feedback to students to help them improve their academic work	2
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Communicating with parents or guardians to promote their child's success in and out of school	**1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	1
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	*1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Purposefully engaging in non-academic conversations with individual students to build relationships	0
	Setting up & managing small group work to promote individual and group learning	*0
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	0
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	0
<i>Knowledge of motivation is less helpful for...</i>	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	** -2
	Reflecting on & analyzing my instruction in order to improve its effectiveness	-2
	Designing a sequence of lessons toward specific goals	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Students' sharing of their thinking would in turn enable them to monitor student learning and recognize common patterns of student thinking during class. Further indication of their value of motivation for encouraging students to share their thinking for the purpose of attending to their learning can be strengthened by less value they placed for leading whole-class discussion to encourage them to listen to, respond to and use one another's

thinking as resources for their learning; their knowledge of motivation was believed to be more helpful in attending to the degree to which students were engaged with the content more so than with one another. In response to their assessment of student thinking in class, PS-4’s pre-service teachers believed they could continue to use their knowledge of motivation to guide their selection and modification of instructional strategies that could challenge, support or extend student thinking. Their ability to attend to student thinking coupled with their knowledge was believed to also enhance their ability to effectively communicate with students and their parents by providing the appropriate verbal or written feedback that could inform them of their students’ strengths and highlight areas for improvement in ways that would effectively keep them engaged in their efforts to succeed in and out of the school.

Table E.22 Distinguishing Statements for PS-4

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Recognizing common patterns of student thinking in a particular subject	-2	-1.00	0	0.30	-1	-0.31	*2	1.35
Communicating with parents or guardians to promote their child’s success in and out of school	-2	-1.46	-2	-1.49	-2	-1.48	*1	1.05
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2	1.38	-1	-0.74	2	1.45	1	0.61
Setting up & managing small group work to promote individual and group learning	-1	-0.60	-1	-0.54	2	1.85	0	0.22
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0	0.10	1	0.33	2	1.38	*-2	-1.64
Designing a sequence of lessons toward specific goals	1	0.76	-1	-0.46	-1	-0.96	-2	-1.64

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

PS-4’s pre-service teachers believed their knowledge of motivation would be less helpful for teaching practices that involve preparing and analyzing their instruction. Elements of teaching practices for which they believed their knowledge would be less helpful include: setting long- and short-term learning goals to ensure students’ steady progress toward larger goal, designing a sequence of lessons that align with these

learning goals, analyzing and selecting instructional strategies for presenting content in ways that are understandable to their students, and designing summative assessments that help gain information about students' learning at the end of each unit. In addition to assessing their students' learning they believed their knowledge would not be as helpful in reflecting on and analyzing their own instruction as well as in communicating with other professionals in education about issues of learning and teaching. Given these negative rankings, PS-4's pre-service teachers emphasized the value of their knowledge of motivation for attending to and responding to students' learning particularly during instruction more so than for elements of teaching that involve preparing and analyzing their instruction.

Exploring Shifts in Pre-Service Teachers' Beliefs from PRE to POST

Table E.23 shows changes in Q sorts' positive ranking of items from the beginning to the end of the term. Exploration and discussion of shifts in positive rankings are discussed in the next two sections.

Similarities Across Beginning and End of Term

Pre-service teachers' Q sorts showed varying shifts from the beginning to the end of the term in their beliefs about the ways in which their knowledge of motivation would be helpful for their teaching practices. More specifically, emphases on the teaching practices for which they believed their psychological knowledge would be helpful varied. Despite these variations, at least two pre-service teacher factors from beginning and end of the term showed value of their knowledge for encouraging students to share their thinking with one another in class by eliciting student thinking (PS-B, PS-C, PS-D; PS-1, PS-3, PS-4) and subsequently responding to students' thinking through appropriate implementation and modification of instructional strategies (PS-A, PS-B, PS-D; PS-1, PS-3, PS-4). This suggests that teaching practices around attending to and responding to student thinking were consistently considered to be positively influenced by teachers' understanding of student motivation. One of the factors from each time point further expanded on the perceived value of knowledge of motivation for eliciting student thinking by positively ranking item around recognizing common patterns of student thinking as well (PS-C; PS-4).

Table E.23 Comparison of Positive Rankings from PRE to POST

Statement	A	B	C	D	1	2	3	4
Setting up & managing small group work to promote individual and group learning	2	1	1	1	-1	-1	2	0
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	-1	2	2	2	2	-1	2	1
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1	1	-2	1	2	0	1	1
Purposefully engaging in non-academic conversations with individual students to build relationships	-2	2	2	1	1	0	0	0
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	1	1	-1	2	2	0	-1	0
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1	-1	2	-1	1	-2	1	-1
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	1	-1	-1	1	-1	2	0	-1
Providing verbal & written feedback to students to help them improve their academic work	0	-1	0	2	0	2	1	2
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2	0	0	-1	0	1	2	-2
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1	2	-2	-1	1	1	0	-1
Using appropriate methods to check for student understanding and monitor student learning	0	1	0	-2	0	1	-2	2
Recognizing common patterns of student thinking in a particular subject	-1	-2	1	0	-2	0	-1	2
Designing a sequence of lessons toward specific goals	2	0	-2	-1	1	-1	-1	-2
Communicating with parents or guardians to promote their child's success in and out of school	-2	0	1	-2	-2	-2	-2	1
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-2	1	-2	-2	-2	-1	-1
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0	0	0	0	0	2	0	1
Establishing organizational routines, procedures & strategies to maximize time available for student learning	0	-1	-1	0	-1	1	1	0
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	-2	-1	0	-1	-1	-2	-2

Note. Green indicates positive rankings assigned to corresponding teaching practices by respective factor. Grey indicates teaching practices that have been negatively ranked by all factors.

This is in line with motivation research showing that teachers' instructional practices that support student autonomy promote student motivation and learning. These instructional

practices include teachers' willingness to not only listen to students, but to also respond to students' comments and incorporate their understanding, beliefs and interests into the lesson (Reeve & Jang, 2006). In this sense, pre-service teachers' positive ranking suggests their belief that teachers' understanding of the ways in which their instruction affects students' motivation can inform teachers' instructional decisions with respect to specific questions or languages to use that effectively communicate to their students that they welcome their perspectives or ways of thinking about the content at hand (Reeve, 2009). In a similar vein, their ability to surface students' thinking about and understanding of the content, in combination with their understanding of students' academic motivation, was perceived to enable them to respond to students' engagement through modification of instructional strategies that would encourage students to further engage with the content at hand.

To a lesser degree, at least one pre-service teacher factor from both time points showed value of knowledge of motivation for a range of teaching practices that involve designing carefully-sequenced lessons that provide rich opportunities for student inquiry and achievement of learning goals (PS-A; PS-1), engaging in regular conversations with their students' parents or guardians about progress in their learning (PS-C; PS-4), and anticipating and identifying common patterns of student thinking about academic content (PS-C; PS-4). The connection that some of the factors made between knowledge of motivation and designing carefully sequenced lessons sheds light to the role of planning well-sequenced goals in promoting students' self-efficacy, a belief that one can perform a specific task. Students' self-efficacy is a critical component of motivation that influences students' selection of tasks, willingness to persist on more challenging tasks, and eventually their performance in the classroom (Ames, 1990). Their self-efficacy increases when teachers not only set learning goals that are realistic but also ensure students experience and see their progress toward these goals. Understanding the important role of sequencing lessons in ways that help students achieve short-term goals and eventually more challenging long-term learning goals such that students gain self-efficacy can help teachers attend to their decisions and approaches in designing a well-sequenced set of lessons, a connection some of the pre-service teachers appear to have recognized both at the beginning and end of the term.

Some of the pre-service teachers at the beginning and end of the term also showed value of the connection between parental involvement (PS-C; PS-4) and student motivation and learning. Parents play a vital role in increasing students' feelings of competence and positive attitudes toward learning by communicating their own beliefs in their children's abilities and high expectations for them, showing value of tasks students are engaged in, and promoting a sense of autonomy by supporting their children's problem-solving (Grolnick, Friendly, & Bellas, 2009). Furthermore, parents' active involvement in students' learning their ability to provide a positive learning environment in the homes contributes to students' self-efficacy, interest, sense of autonomy and positive beliefs about academic learning. However, various factors exist that make it difficult for parents to provide the support necessary to foster students' motivation for learning: external stressors, lack of time or resources, and lack of knowledge about their role and opportunities for involvement in students' learning. Given these challenges, some pre-service teachers may have begun to consider their role in engaging with students' parents and encouraging their involvement in student learning by using their understanding of motivation to help parents effectively communicate with their children at home to show interest and value for learning and help them develop self-efficacy and greater interest in their learning and involvement in schools.

Differences Across Time Points

While there were similarities in the value of their knowledge of motivation across both time points as previously discussed, there were also differences in the emphasis they placed in the ways in which pre-service teachers made connections between their knowledge and teaching. At the beginning of the term, while multiple factors showed positive value of knowledge of motivation for teaching practices that involve selecting curriculum materials (PS-A, PS-B, PS-D; PS-1) and summative assessments (PS-A, PS-D; PS-2), building relationships with students (PS-B, PS-C, PS-D; PS-1) and fostering small group work (PS-A, PS-B, PS-C, PS-D; PS-3) by the end of the term these teaching practices were positively ranked by only one of the four factors. Additionally, one factor from the beginning of the term positively ranked teaching practice around communicating with other professionals in education (PS-C) while no factor at the end of the term did so. Rather, pre-service teachers' factors by the end of the term showed a

greater value of their knowledge for establishing norms and routines for classroom discourse (PS-2, PS-4) and for maximizing opportunities for learning (PS-2, PS-3), which was not positively ranked by any of the factors at the beginning of the term. A greater number of pre-service teachers at the end of the term, compared to one factor at the beginning, also placed a greater emphasis on the value of knowledge for providing verbal and written feedback to students (PS-D; PS-2, PS-3, PS-4), leading a whole class discussion (PS-A; PS-2, PS-3), setting short- and long-term learning goals (PS-B; PS-1, PS-2), and using appropriate methods to check for and monitor student thinking during instruction (PS-B; PS-2, PS-4).

The previous section discussed positive ranking by one factor across time points that involves communicating with students' parents or guardians about student learning. Pre-service teachers at the beginning of the term expanded on their value of their knowledge of motivation for building meaningful relationships. In addition to building relationships with parents and guardians, a greater number of pre-service teacher factors at the beginning of the term also positively ranked engaging in conversations that extend beyond communicating about academic learning and for communicating with other professionals in education; this is in contrast to one pre-service teacher factor and no factors, respectively, that positively ranked these teaching practices at the end of the term. Furthermore, all factors' Q sorts at the beginning of the term emphasized on the value of their knowledge for setting up and managing small group work while only one factor's Q sort did so at the end of the term. Various theories of motivation emphasize the importance of relationships in fostering student motivation and engagement in their learning; relationships between teachers and students create a context that enables teachers to use strategies for motivating students in their classrooms (Brophy, 2004). Maslow's hierarchy of needs, for example, indicates that lower level needs must be met before higher level needs can be met. Students' motivation is not only affected by the type of work and the reward it might produce, it is also impacted by the environment, students' relationships with peers, as well as their relationships and feelings about their teachers. Similarly, relatedness, or the desire to interact and feel belongingness and connected to others, is considered essential for enhancing intrinsic motivation and one's overall well-being (Ryan & Deci, 2000a). Establishing positive relationships with

teachers leads to positive attitude about their classrooms and schools, and subsequently fosters motivation for learning and academic achievement (Brophy, 2004). Establishing meaningful relationships with students also help teachers; it enables them to understand students' different perspectives, various personal experiences and issues they face, and their interests with respect to learning, which can be integrated into their teaching in ways that align with their learning goals as well as in ways that are interesting and relevant to students. In this sense, teachers' understanding of how students' motivation is fostered and sustained can inform them in appropriately engaging with students such that they can openly and genuinely engage with them while maintaining their respect for the teachers. Pre-service teachers may have recognized early on and thus focused on these multiple benefits of establishing relationships with students as they relate to motivating students to learn and engage in classrooms early on in the term.

In a similar vein, students' need for belongingness also has implications for opportunities for students to engage with their peers. Furthermore, just as self-efficacy, or individual's beliefs about his/her ability to successfully perform a specific task, is essential for fostering one's motivation and learning, research in motivation has also pointed to the importance of collective efficacy, or belief that one's *group* can successfully achieve a desired goal in classrooms (Bandura, 1997). Positive ranking of items indicate pre-service teachers' consideration of this relationship between motivation and collective efficacy, though they emphasized on different levels of collective work at the beginning and end of the term. This was recognized by all factors at the beginning of the term, specifically in the form of engaging students in small groups through their ability to be purposeful and meaningful in selecting members of the group, tasks around which students would work collaboratively, and managing them in ways that make each student accountable for the success of both individual and group learning. While only one factor positively ranked this teaching practice at the end of the term, two factors positively ranked teaching practice around leading whole-class discussion, one of which also positively ranked managing small group. Though pre-service teachers across time emphasized on different aspects of teaching practices that show their value of their motivation for peer interaction, they nonetheless recognized the importance of their role in facilitating students' interaction with one another in ways that influence their

motivation and engagement in learning, and showed their beliefs that the understanding of student motivation would help inform their teaching practices around fostering student interaction and collaboration.

By the end of the term, there was a fewer number of factors made the same connection between knowledge of motivation and building relationships with students. Rather, more factors showed greater consideration of the role of the understanding of motivation for interacting with students around academic content. In contrast to only one factor's Q sort that positively ranked engaging in non-academic conversation with students (PS-1), the other three factors focused on the value of the same knowledge for engaging in conversations with students around their learning through appropriate forms of feedback (PS-2, PS-3, PS-4). For two of these factors (PS-2, PS-4), this positive ranking was paired with positive ranking of teaching practices around selecting and implementing formative assessments as well. This is in accordance with studies demonstrating that formative assessments can serve as a powerful tool to promote student motivation and learning if used effectively. Features of assessments that positively influence students' motivation include the purpose of the assessment and how students are evaluated on their assessment (Cauley & McMillan, 2010; Stipek, 1996). Assessments that focus on performance and intelligence compared to peers, as well as assessments perceived by students to be too difficult have shown to undermine students' intrinsic motivation and interest in not only the assessment task but also in their future learning. On the other hand assessments that serve to help students monitor their learning by providing rich information about their progress have shown to be important in fostering students' intrinsic motivation. Recognizing how such characteristics of formative assessment can impact students' interest in and decision to engage in present and future tasks can therefore inform teachers in their design and implementation of assessments during instruction, which appears to have been recognized by a greater number of pre-service teachers at the end of the term.

The latter feature of effective assessment, providing students rich information about their progress, additionally indicates the importance of teachers' ability to follow up on their assessment of student learning by providing feedback to students in ways that help them identify their strengths and areas for improvement. There exists a great range in the

types of feedback teachers provide to their students and can impact students' motivation both negatively and positively (e.g., offering solicited versus unsolicited help, offering praise when succeeding on an easy versus challenging task). Motivation research has shed light to the critical importance of teachers' feedback in fostering students' perceptions of themselves and their abilities as a learner and their motivation for learning. Attribution theory, for one, explains that students' motivation to achieve their goals is affected by conclusions they make about the sources of their successes and/or failures (Weiner, 1985). These conclusions can be greatly impacted by teachers' feedback and the reasons they provide for students' successes or failures in two ways: the reasons provided by teachers can serve as cues for how students should feel about the outcome of their performance, and it can determine how students should feel about the outcome of their performance and how they decide to engage in a specific task in the future (Anderman et al., 2013). According to the theory, then, teachers' feedbacks play a critical role in improving students' motivation and achievement by helping students attribute failure to controllable factors (such as effort and motivation), rather than to uncontrollable factors (such as intelligence or ability) that can improve students' motivation and achievement (e.g., Dweck, 1975).

Teachers' use of feedback and rewards can also foster feelings of competence, and therefore facilitate their intrinsic motivation (wherein students engage in an activity because it is enjoyable or satisfies their curiosity or inherent desire to improve) rather than extrinsic motivation (wherein students engage in an activity merely for external reasons such as grades or attention; Ryan & Deci, 2000b). Thus understanding various factors of student motivation can help teachers consider when and how they can purposefully, appropriately, and meaningfully communicate about student learning in ways that will increase students' self-efficacy and interest, and support students' desire to improve their learning. Three factors representing pre-service teachers' beliefs by the end of the term appear to have recognized such connection between their understanding of motivation and practices around providing feedback based on their appropriate implementation and interpretation of formative assessments to students after having taken the course.

In considering the relationship between motivation and designing or planning instruction, belief that understanding of motivation would be helpful for selecting strategies to present content in ways that are engaging and understandable for students continued to exist across the two time points. At the beginning of the term, numerous pre-service teacher factors elaborated on this by also showing value of knowledge for evaluating, selecting and modifying curriculum materials and learning tasks (PS-A, PS-B, PS-D). Only one factor at the end of the term showed this same value (PS-1). Pre-service teachers' initial recognition of the connection between their selection and implementation of curriculum materials and students' motivation and learning sheds light to the idea that effective learning tasks and materials can shape and foster students' interests, values, attributions, and goals, all of which are important elements of motivation, in significant and long-lasting ways (Anderman et al., 2013). Many motivational theorists such as Ames (1992) have argued for the need to consider the motivational implications of the choices teachers make with respect to classroom tasks and materials by making them meaningful and relevant to students' personal experiences and interests. For example, teachers' ability to effectively communicate why a particular task is important or useful for individual students and thus help them see the value of the task promotes student motivation and future engagement with similar activities (Durik, Vida, & Eccles, 2006; Wigfield & Eccles, 1992). Additionally, designing tasks that are challenging yet attainable, paired with teachers' expression of confidence in their students' ability to successfully accomplish the tasks also fosters students' expectancy for success and therefore predict their future engagement in similar tasks or academic domain (Green, 2002; Palmer, 2005). Pre-service teachers' positive ranking suggests that they may have already recognized the important relationship between their selection and use of appropriate curriculum materials and learning tasks, and student motivation.

While fewer factors at the end of the term showed value of their knowledge of motivation for teaching practices around selecting curriculum materials, a greater number of factors showed value of its pre-service teachers' knowledge for a more overarching teaching practice that inform their instruction: setting long- and short-term learning goals that help ensure students learn and progress toward greater goals. Setting appropriate goals in classrooms is important, as they inform instructional strategies and evaluation

standards used to evaluate students' progress and achievement. In turn, they impact students' own development of goals, values, behavior, and development or demonstration of their knowledge and skills (Meece, Anderman & Anderman, 2006). Teachers' selection of tasks emphasizing mastery goals, or goals that focus on developing skills and gaining conceptual understanding, rather than performance goals, or goals that focus on external reinforcement such as grades, lead students to invest more effort and engagement in the task and use adaptive learning strategies that foster creativity and higher-order thinking (Kaplan & Maehr, 1999).

Studies have also shown that the goal structures of classrooms can foster individual student's development of specific goals, which affect their behavior and learning. Students who perceived their school environment as one that focused on competition for grades and ability were more likely to adopt performance-orientated goals, whereas students who perceived their school environment as one that focused on trying and developing understanding of academic content were more likely to develop mastery-oriented goals and thus lead to more adaptive behaviors (e.g., Anderman & Midgley, 1997; Urdan, 2004). Motivational theories examining the complex relationship between motivation, teaching, and learning, have additionally pointed to the importance of modeling and helping students not only set short-term goals that lead to larger goals, but to also provide strategies for successfully achieving those goals. An emphasis on the development of goals and the specific strategies used to achieve their goals, rather than the outcome itself, supports students' development of confidence in their abilities to be successful in the classroom, leading to increased investment in their learning (Ames, 1990). By the end of the course, two factors representing pre-service teachers' beliefs, compared to one factor at the beginning of the term, appear to have recognized this complex and important role of classroom goals, which can have a wide range of influence on their own instructional decisions and their students' perceptions, behavior and achievement.

By the end of the term, pre-service teachers identified the role of their understanding of motivation in establishing and managing a classroom environment conducive to student learning and discourse (PS-2, PS-3, PS-4). This was not considered by any of the pre-service teacher factor at the beginning of the term. Establishing and

sustaining an environment in which students feel safe, comfortable, and valued facilitates student motivation, as such an environment fosters a positive bond between students and teachers and ultimately a positive attitude toward school and learning (Brophy, 2004). Fostering a learning environment entails creating a predictable classroom structure. Furthermore, social environments foster students' intrinsic motivation when they meet three basic psychological needs: autonomy, competence, and relatedness. Based on this, building a successful and engaging environment involves developing procedures that becomes routinized (e.g., for clearing workspace, locating necessary materials, transitioning from one activity to the next) so that distractions can be minimized and students can focus on important activities, soliciting input from students in developing and clarifying expectations and rules, communicating expectations in ways that show care and respect for the students, explaining rationales for the expectations, and modeling norms and routines that have been set. Teachers' ability to communicate and reinforce clear routines and expectations of behavior has been perceived by students as interest and care for their success and well-being (Cabello & Terrell, 1994; Hayes, Ryan & Zsellar, 1994). Pre-service teachers' understanding of motivation as it relates to the role of classroom environment in strengthening students' interest and motivation for learning may be represented by the positive ranking of teaching practices around establishing routines and norms for organizing classroom class and time as well as for engaging in discourse with their peers around academic content.

Findings 2.4b: Comparing Pre-Service Teachers' Beliefs to Educational Psychology Instructors and In-Service Teachers

Educational Psychology Instructors

Nine of ten educational psychology instructors' Q sorts loaded significantly onto one of the three factors that emerged from analysis (see Table E.24). One remaining Q sort did not load significantly onto any of the factors. The three factors accounted for 66% of the variance. Factor 1 accounted for 24% of the variance, with three educational psychology instructors' Q sorts significantly associated with this factor. Factor 2 accounted for 20% of the variance, with three educational psychology instructors' Q sorts

significantly associated with the factor. Factor 3 accounted for 22% of the variance, with three educational psychology instructors' Q sorts significantly associated with the factor.

Table E.24 Educational Psychology Instructors: By-Factor Rankings of Statements Corresponding to the Statement, "Teachers' Knowledge of Motivation Would Be Helpful For..."

Statement	Factor Arrays		
	1	2	3
Providing verbal & written feedback to students to help them improve their academic work	1	1	1
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2	**0	2
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2	1	**0
Purposefully engaging in non-academic conversations with individual students to build relationships	1	2	*0
Setting up & managing small group work to promote individual and group learning	*0	2	1
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*1	** -1	*2
Establishing organizational routines, procedures & strategies to maximize time available for student learning	2	** -2	1
Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	** -2	1	2
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	**1	0
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1	0	**1
Communicating with parents or guardians to promote their child's success in and out of school	1	0	** -2
Designing a sequence of lessons toward specific goals	-2	**1	-1
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0	0	** -2
Using appropriate methods to check for student understanding and monitor student learning	0	-1	0
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0	-2	-1
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1	-1	-1
Recognizing common patterns of student thinking in a particular subject	-2	-2	-1
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1	-2	-2
Number of educational psychology instructors loading onto factor	3	3	3
Variance	24%	20%	22%

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement

Consensus Statements

Although educational psychology instructors showed the greatest variation in their beliefs about teaching practices for which their knowledge of motivation would be more helpful compared to other domains in educational psychology, the three instructor groups shared a large number of consensus statements, particularly those that were ranked negatively (see Table E.25). One, they negatively ranked setting long- and short-term learning goals for students that they can all achieve. Second, they believed it would be less helpful for presenting content in ways that are understandable for all students through appropriate use of models, examples, or representations of content. Third, they placed less value of knowledge for attending to and recognizing students' thinking during instruction. Lastly, they believed understanding student motivation would not be as helpful for their ability to communicate with other professionals in education. On the other hand, they believed their knowledge would be more helpful for providing verbal and/or written feedback in ways that encourage students to focus on areas for improvement.

Table E.25 Motivation EPI: Consensus Statements

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1	-0.82	-1	-0.60	-1	-0.57
Recognizing common patterns of student thinking in a particular subject	-2	-1.68	-2	-1.33	-1	-0.91
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0	-0.22	-2	-1.14	-1	-0.59
Using appropriate methods to check for student understanding and monitor student learning	0	-0.44	-1	-0.76	0	-0.25
Providing verbal & written feedback to students to help them improve their academic work	1	0.86	1	0.74	1	1.08
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1	-0.84	-2	-1.14	-2	-1.77

Distinguishing Statements

EPI-1: Eliciting and responding to student thinking and communicating with students and parents about their learning

EPI-1's Q sort indicates the belief that teachers' understanding of student motivation would enable them to encourage students to share their thinking with one another during whole-class discussion (see Tables E.26 and E.27).

Table E.26 Motivation EPI-1 Q Sort Configuration

	Statement	EPI-1
<i>Knowledge of motivation is more helpful for...</i>	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	2
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*1
	Providing verbal & written feedback to students to help them improve their academic work	1
	Purposefully engaging in non-academic conversations with individual students to build relationships	1
	Communicating with parents or guardians to promote their child's success in and out of school	1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0
	Setting up & managing small group work to promote individual and group learning	*0
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	0
	Using appropriate methods to check for student understanding and monitor student learning	0
<i>Knowledge of motivation is less helpful for...</i>	Reflecting on & analyzing my instruction in order to improve its effectiveness	-1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	** -2
	Designing a sequence of lessons toward specific goals	-2
	Recognizing common patterns of student thinking in a particular subject	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

This would in turn enable them to respond to their assessment through appropriate verbal and written feedback and modification of their instruction to challenge or support their students' thinking. EPI-1's Q sort also showed value of knowledge for communicating

with both students and their parents outside of the classroom context to express care and interest in their students and to work collaboratively to ensure students' success in the classroom. Lastly, EPI-1's Q sort positively ranked teaching practice around establishing organizational routines and procedures that maximize opportunities for students to engage in their learning while potential distractions are minimized.

Table E.27 Distinguishing Statements for EPI-1

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1	0.89	-1	-1.06	2	1.68
Setting up & managing small group work to promote individual and group learning	0	0.02	2	1.35	1	0.79
Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	*-2	-0.87	1	1.19	2	1.29

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Although EPI-1's Q sort emphasized on the role of knowledge of motivation for responding to their recognition of student thinking, it placed less of an emphasis on its role for actual assessment of student thinking. It placed a more negative ranking on items representing practices around designing and selecting summative assessments as well as anticipating and identifying common patterns of student thinking about content at hand. In addition to assessing students' learning, EPI-1 identified reflecting and analyzing learning as teaching practice for which the same knowledge would be less helpful. Negatively ranked distinguishing statement suggests that compared to modifying instruction during class to respond to students' thinking, teachers' knowledge of motivation was considered to be less helpful in designing and preparing lessons in the following ways: designing and sequencing lessons that help students make progress towards larger goals and evaluating, selecting and modifying curriculum materials and instructional strategies for presenting content to ensure students understand the content and meet the goals towards mastery of academic content. Lastly, educational psychology instructors in this group believed teachers' knowledge of motivation would be less

helpful in communicating with other professionals in education than in interacting with students and their parents.

EPI-2: Designing and analyzing instruction

In contrast to EPI-1, EPI-2's Q sort represents beliefs that teachers' knowledge of motivation would enable teachers to design and evaluate their instruction with respect to how students engage in individual and collaborative learning (see Tables E.28 and E.29). While the Q sort showed less emphasis on the value of understanding of motivation for setting short- and long-term learning goals, it placed greater value of knowledge for designing and sequencing lessons in ways that ensure students master foundational understanding and skills that help them make progress toward larger goals. It also showed belief that understanding student motivation would guide them in evaluating, selecting and modifying curriculum materials and learning tasks that would challenge students and keep them engaged in their learning. On the other hand, its educational psychology instructors showed less value of knowledge for evaluating and selecting instructional strategies for presenting new content or for supporting students' understanding of the content. Similar to EPI-1, EPI-2's instructors believed their knowledge would help teachers engage in collective learning through their ability to lead whole class discussions that encourage students to attend to and respond to one another's thinking. They additionally believed it would guide their efforts to manage small group work through their consideration and selection of tasks that promote successful collaborative work toward learning. This indicates EPI-2's greater value of the knowledge of student motivation for evaluating resources and tools with which students could engage in the content more so than for implementing specific strategies for presenting content.

Although EPI-2's educational psychology instructors did not believe their knowledge of motivation would be as helpful in assessing and providing instructional response based on student thinking during instruction, they believed this understanding of motivation would guide them in offering students verbal or written feedback that would not only help students understand their strengths but also support students' efforts to focus on improving the quality of their work.

Table E.28 Motivation EPI-2 Q Sort Configuration

	Statement	EPI-2
	Purposefully engaging in non-academic conversations with individual students to build relationships	2
	Setting up & managing small group work to promote individual and group learning	2
<i>Knowledge of motivation is more helpful for...</i>	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	**1
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	1
	Providing verbal & written feedback to students to help them improve their academic work	1
	Designing a sequence of lessons toward specific goals	**1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0
	Communicating with parents or guardians to promote their child's success in and out of school	0
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	**0
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	0
<i>Knowledge of motivation is less helpful for...</i>	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1
	Using appropriate methods to check for student understanding and monitor student learning	-1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	** -1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	** -2
	Recognizing common patterns of student thinking in a particular subject	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

They also believed this knowledge would enhance teachers' ability to engage with students in non-academic conversations such that they could attend to and ensure students' learning and other developmental needs are met. While they showed less value of knowledge for formatively assessing student thinking, teachers' understanding of motivation was considered to be useful at the end of each lesson or unit wherein it could serve as a lens through which they could analyze their own instruction as they consider

the level and quality of students' interest and engagement in their learning. another aspect of teaching practice that often takes place outside of the classroom context for which knowledge was valued included purposefully engaging in non-academic conversations with students to attend to and ensure students' various needs are met.

Table E.29 Distinguishing Statements for EPI-2

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	-0.62	*1	1.19	0	-0.23
Designing a sequence of lessons toward specific goals	-2	-1.47	*1	0.69	-1	-0.77
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2	1.68	*0	-0.15	2	1.15
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1	0.89	*-1	-1.06	2	1.68
Establishing organizational routines, procedures & strategies to maximize time available for student learning	2	1.04	*-2	-1.17	1	0.88

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

EPI-3: Designing assessments and responding to assessment of student learning

EPI-1 and EPI-3 shared more similarities in that their Q sorts positively ranked attending to student learning in ways that help them to subsequently modify their instruction in response to their recognition of what students do or do not know (see Tables E.30 and E.31). Though it placed less value of knowledge for actually recognizing common patterns of student knowledge or misconceptions, EPI-3, like EPI-1, placed positive value of knowledge for eliciting student thinking through the use of probing and other tasks that surface student thinking to evaluate their understanding of the academic content during instruction. This in turn would help provide appropriate feedback to give students' insights about their learning and to choose appropriate instructional strategies in response to their evaluation of student thinking to support or challenge students' understanding of the content.

In addition to these practices, however, EPI-3's Q sort indicated the belief that the same knowledge would guide them in designing and implementing appropriate

summative assessments that could be used at the end of each learning unit to gain a greater, more overarching view of how successfully students have engaged in their learning.

Table E.30 Motivation EPI-3 Q Sort Configuration

	Statement	EPI-3
<i>Knowledge of motivation is more helpful for...</i>	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*2
	Evaluating, choosing & modifying curriculum materials & learning tasks to accomplish a specific learning goal	2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2
	Providing verbal & written feedback to students to help them improve their academic work	1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	**1
	Setting up & managing small group work to promote individual and group learning	1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Purposefully engaging in non-academic conversations with individual students to build relationships	*0
	Reflecting on & analyzing my instruction in order to improve its effectiveness	0
	Using appropriate methods to check for student understanding and monitor student learning	0
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	**0
<i>Knowledge of motivation is less helpful for...</i>	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	-1
	Designing a sequence of lessons toward specific goals	-1
	Recognizing common patterns of student thinking in a particular subject	-1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	** -2
	Communicating with parents or guardians to promote their child's success in and out of school	** -2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Their summative assessment of student thinking, combined with their knowledge, would guide them in evaluating, selecting and modifying curriculum materials and learning

tasks for both individual and small group work that build on their current knowledge and make new content understandable and engaging. Lastly, the Q sort showed value of knowledge for establishing and modeling organizational routines and procedures that maximize opportunities for students to engage in their learning and minimize potential distractions, though it placed less value for establishing norms that guide student discourse.

Table E.31 Distinguishing Statements for EPI-3

Statement	Factor Q sort value and Z-score					
	1		2		3	
	Q	Z-scr	Q	Z-scr	Q	Z-scr
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1	0.89	-1	-1.06	2	1.68
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1	-0.86	0	-0.45	*1	0.82
Purposefully engaging in non-academic conversations with individual students to build relationships	1	0.82	2	1.45	0	-0.10
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2	1.27	1	1.02	*0	-0.31
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0	0.62	0	0.31	*-2	-0.96
Communicating with parents or guardians to promote their child's success in and out of school	1	0.62	0	-0.14	*-2	-1.24

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

On the other hand, EPI-3's educational psychology instructors did not believe knowledge of motivation would be as helpful for aspects of teaching practices related to designing lessons, such as setting long- and short-term learning goals for students, designing and sequencing lessons to ensure students make steady progress towards these goals, and preparing and implementing appropriate instructional strategies (e.g., examples, demonstrations, modeling, and other representations of content) to make academic content clear to their students. Another element of teaching practice that was negatively ranked involved building relationships and communicating with students and their parents about students' personal interests, goals and needs in their efforts to ensure these needs are met both in the classrooms and at home.

In-Service Teachers

22 of the 29 in-service teachers' Q sorts loaded significantly onto one of the four factors that emerged from analysis (see Table E.32).

Table E.32 In-Service Teacher Group Matrix for Motivation

	Factor 1	Factor 2	Factor 3	Factor 4	Non-Sig	Confounding
Elementary In-service	4	0	1	3	1	0
Secondary In-service	3	5	4	2	5	1
Total In-Service	7	5	5	5	6	1
Variance	16%	14%	13%	13%	-	-

Seven remaining in-service teachers' Q sorts either did not load significantly onto any of the groups ($n = 6$) or were confounding sorts ($n = 1$). The four factors accounted for 56% of the variance. Factor 1 accounted for 16% of the variance, with seven participants' Q sorts significantly associated with this factor: four elementary in-service teachers and three secondary in-service teachers. Factor 2 accounted for 14% of the variance, with five secondary pre-service teachers' Q sorts significantly associated with the factor. Factor 3 accounted for 13% of the variance, with five participants' Q sorts significantly associated with the factor: one elementary in-service teacher and four secondary in-service teachers. Factor 4 accounted for 13% of the variance, with five participants' Q sorts significantly associated with this factor: three elementary pre-service teachers and two secondary pre-service teachers. Table E.33 shows the ranking assigned to each of the statements of the factors' representative Q sorts.

Consensus Statements

In-service teachers' single consensus statement shows overall agreement in their neutral viewpoint that their knowledge of motivation would be neither helpful nor unhelpful for monitoring and checking for student understanding of academic content (see Table E.34). In addition to the consensus statement, comparison between the four factors showed similarities in the beliefs that their knowledge of motivation would be less helpful for developing and selecting appropriate summative assessments as well as skillfully communicating with other professionals in education about their teaching and students' learning and resources for learning.

Table E.33 In-Service Teachers: By-Factor Ranking of Statements Corresponding to the Statement, "My Knowledge of Motivation Would be Helpful For..."

Statement	Factor Arrays			
	1	2	3	4
Providing verbal & written feedback to students to help them improve their academic work	**2	1	1	0
Purposefully engaging in non-academic conversations with individual students to build relationships	2	1	**0	2
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	*2	** -2	2	1
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	*1	2	1	** -1
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1	0	0	2
Reflecting on & analyzing my instruction in order to improve its effectiveness	*0	1	2	* -2
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	* -2	1	2	*0
Designing a sequence of lessons toward specific goals	1	** -1	1	** -2
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-2	-1	1	1
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	**0	2	** -2	1
Recognizing common patterns of student thinking in a particular subject	* -2	* -1	0	1
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	-1	0	-1	**2
Communicating with parents or guardians to promote their child's success in and out of school	**1	0	** -2	-1
Setting up & managing small group work to promote individual and group learning	-1	**2	-1	-1
Using appropriate methods to check for student understanding and monitor student learning	0	0	0	0
Establishing organizational routines, procedures & strategies to maximize time available for student learning	0	** -2	-1	0
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1	-1	-1	-2
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1	-2	-2	-1

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$. Green indicates consensus statement.

Table E.34 Motivation IS: Consensus Statement

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Using appropriate methods to check for student understanding and monitor student learning	0	0.20	0	-0.10	0	0.34	0	0.25

Distinguishing Statements

IS-1: Designing lessons and communicating with students and parents

IS-1's Q sort highlighted the value of their knowledge of motivation for two aspects of teaching practices (see Tables E.35 and E.36). One, it showed value of knowledge for engaging in meaningful communications with both students and their parents in ways that help students maintain their focus on their progress towards learning and overall development. This involves not only providing feedback about students' learning that inform them of specific areas for improvement along with their strengths but also engaging in non-academic conversations to attend to and address their personal interests, goals, and needs. The Q sort however showed less value for communicating skillfully with other professionals in education. Second, knowledge of motivation was believed to be useful for elements of designing and preparing lessons. This involves setting long- and short-term learning goals and using them to design lessons that are well-sequenced such that student could be challenge and experience success in making progress toward larger goals of mastering important concepts and skills. These learning goals would set the standard for determining the ways in which the teachers could provide opportunities for student inquiry and learning through their appropriate evaluation, selection and modification of curriculum materials and learning tasks that are likely to challenge and engage students in their learning, and preparing and implementing strategies for eliciting student thinking throughout their lessons to ensure students can engage in sharing their knowledge with one another while teachers can evaluate what students do or do not understand.

Table E.35 Motivation IS-1 Q Sort Configuration

	Statement	IS-1
<i>Knowledge of motivation is more helpful for...</i>	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	*2
	Purposefully engaging in non-academic conversations with individual students to build relationships	2
	Providing verbal & written feedback to students to help them improve their academic work	**2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	1
	Communicating with parents or guardians to promote their child's success in and out of school	**1
	Designing a sequence of lessons toward specific goals	1
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	*1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Using appropriate methods to check for student understanding and monitor student learning	0
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	**0
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	0
	Reflecting on & analyzing my instruction in order to improve its effectiveness	*0
<i>Knowledge of motivation is less helpful for...</i>	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	-1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1
	Setting up & managing small group work to promote individual and group learning	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*-2
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-2
	Recognizing common patterns of student thinking in a particular subject	*-2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

On the other hand, IS-1's Q sort identified their knowledge of motivation as less helpful for determining methods for assessing and responding to student learning, such as through their development and selection of summative assessments, recognition of common patterns of student learning and selection of appropriate instruction response to their identification of the common patterns of student learning to clarify academic content, challenge students' misconception or support and extend student' thinking.

Table E.36 Distinguishing Statements for IS-1

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	2	1.68	-2	-0.50	2	1.00	1	0.80
Providing verbal & written feedback to students to help them improve their academic work	*2	1.52	1	0.22	1	0.40	0	0.53
Communicating with parents or guardians to promote their child’s success in and out of school	*1	0.84	0	-0.41	-2	-1.83	-1	-0.66
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	1	0.24	2	1.24	1	0.95	-1	-1.18
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	*0	-0.20	2	1.29	-2	-1.91	1	0.88
Reflecting on & analyzing my instruction in order to improve its effectiveness	0	-0.62	1	1.21	2	0.96	-2	-1.26
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	-2	-1.03	1	1.19	2	1.16	0	-0.41
Recognizing common patterns of student thinking in a particular subject	-2	-1.17	-1	-0.58	0	0.30	1	0.69

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Furthermore, although its in-service teachers valued their knowledge for communicating with students outside of the classroom context, they showed less value of their knowledge for teaching practices that involve fostering students’ opportunities to communicate with one another through their ability to establish norms and routines for how students should interact with one another around academic content and to set up and manage small group work that keeps all students accountable for both individual and collective learning.

IS-2: Facilitating opportunities for interaction with students

In contrast to IS-1, IS-2’s Q sort represented the beliefs that knowledge of motivation would be helpful particularly for fostering opportunities for students to engage in collaborative work and to share and respond to one another’s thinking about academic content (see Tables E.37 and E.38); the Q sort positively ranked teaching practices around facilitating whole-class discussion wherein teachers prompt students to

listen and respond to one another's contribution and organizing and managing small group work wherein they purposefully select tasks and assessing appropriate members to each group to ensure each student is hold accountable for both collective and individual work.

Table E.37 Motivation IS-2 Q Sort Configuration

	Statement	IS-2
<i>Knowledge of motivation is more helpful for...</i>	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	2
	Setting up & managing small group work to promote individual and group learning	**2
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	2
	Reflecting on & analyzing my instruction in order to improve its effectiveness	1
	Purposefully engaging in non-academic conversations with individual students to build relationships	1
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	1
	Providing verbal & written feedback to students to help them improve their academic work	1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Using appropriate methods to check for student understanding and monitor student learning	0
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	0
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0
	Communicating with parents or guardians to promote their child's success in and out of school	0
<i>Knowledge of motivation is less helpful for...</i>	Designing a sequence of lessons toward specific goals	** -1
	Recognizing common patterns of student thinking in a particular subject	* -1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	** -2
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	** -2	

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Similar to IS-1, IS-2's Q sort also showed value of knowledge for building their own individual relationships with students through non-academic conversations to communicate care and interest in helping students meet their learning and other needs.

Table E.38 Distinguishing Statements for IS-2

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Setting up & managing small group work to promote individual and group learning	-1	-0.88	*2	1.27	-1	-0.48	-1	-0.70
Designing a sequence of lessons toward specific goals	1	0.51	*-1	-0.44	1	0.78	-2	-1.53
Recognizing common patterns of student thinking in a particular subject	-2	-1.17	-1	-0.58	0	0.30	1	0.69
Establishing organizational routines, procedures & strategies to maximize time available for student learning	0	-0.36	*-2	-1.30	-1	-0.09	0	0.15
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	2	1.68	*-2	-1.50	2	1.00	1	0.80

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

In addition to engaging in non-academic conversations, its in-service teachers also believed their knowledge of motivation would help them communicate their care and interest through appropriate verbal and written feedback aimed to help students focus on improving towards their learning goals based on their assessment of student learning. These positively ranked statements appear to represent several in-service teachers' emphasis on their beliefs that their knowledge is primarily helpful for interacting with students, as the statement referring to communicating with other professionals in education was negatively ranked.

IS-2's Q sort also showed belief that their knowledge would be equally useful for responding to their assessment of student learning through instruction by considering and choosing appropriate instructional strategies that challenge or extend student learning. While they valued their knowledge for responding to their assessment of student learning through feedback and instruction, they valued it less for designing assessments – both informal and summative assessments – that provide teachers access to students' level of engagement and learning. Their final positive value of their knowledge pertained to

teaching practices that involve analyzing resources for student learning (e.g., curriculum materials, learning tasks) as well as their own instruction. This indicates that their understanding of student motivation could inform them in considering the ways in which learning resources and their teaching can promote level and quality of students' interest and engagement in their learning. On the other hand, they believed their knowledge would be less helpful in guiding their development of short- and long-term learning goals, designing and sequencing of their lessons towards these goals, evaluation and use of instructional strategies used to make academic content clear to their students, and implementation of organizational routines and procedures to manage and maximize opportunities for student learning.

IS-3: Designing and evaluating instruction

IS-3's Q sort represents a combination of IS-1 and IS-2's Q sort representing beliefs about ways in which one's knowledge of motivation would be helpful (see Tables E.39 and E.40). Similar to IS-1, IS-3's Q sort showed value of knowledge for aspects of teaching practices that mainly involve preparing and analyzing instruction. Its in-service teachers believed their knowledge would guide them in establishing long- and short-term learning goals that are appropriate for their students and would ensure students can steadily progress toward larger goals, which would in turn serve as a guideline for sequencing lessons that align with these goals and challenge students in ways that help them gain an appreciation of the content they learn.

Additionally knowledge was perceived to inform them in evaluating, selecting and modifying curriculum materials and learning tasks and in considering, selecting and implementing instructional strategies and representations that make content clear and engaging for their students. Similar to IS-2, IS-3's Q sort also showed positive value of knowledge for preparing and providing verbal and written feedback as well as instructional strategies that help students focus on improving and extending on their current understanding of academic content. In addition to designing their instruction and guiding students' learning through feedback and instruction, IS-3's pre-service teachers believed their knowledge of motivation could serve as a means through which they could analyze and determine the effectiveness of their instruction, possibly by attending to the level of students' engagement in their learning in relation to their interests and goals.

Table E.39 Motivation IS-3 Q Sort Configuration

	Statement	IS-3
<i>Knowledge of motivation is more helpful for...</i>	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	2
	Reflecting on & analyzing my instruction in order to improve its effectiveness	2
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1
	Designing a sequence of lessons toward specific goals	1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Providing verbal & written feedback to students to help them improve their academic work	1
	Using appropriate methods to check for student understanding and monitor student learning	0
	Recognizing common patterns of student thinking in a particular subject	0
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	0
<i>Knowledge of motivation is less helpful for...</i>	Purposefully engaging in non-academic conversations with individual students to build relationships	**0
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1
	Setting up & managing small group work to promote individual and group learning	-1
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	-1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2
	Communicating with parents or guardians to promote their child's success in and out of school	** -2
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	** -2	

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

Despite the similarity of IS-3's positive rankings of their statements to those of IS-1 and IS-2's positive rankings, IS-3 distinguished itself from the first two factors through its negative rankings. It was the only factor indicating the belief that knowledge of motivation would be less helpful for their ability to lead whole-class discussions in ways that encourage students in active classroom discourse. To further support this, IS-3 also negatively ranked items related to establishing norms and routines for how students

are to engage with one another around academic content in addition to norms that help organize classroom time and space, and setting up and managing small group work to keep students accountable for their individual and collective learning.

Table E.40 Distinguishing Statements for IS-3

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Purposefully engaging in non-academic conversations with individual students to build relationships	2	1.59	1	1.21	*0	0.23	2	1.52
Communicating with parents or guardians to promote their child's success in and out of school	1	0.84	0	-0.41	*-2	-1.83	-1	-0.66
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0	-0.20	2	1.29	*-2	-1.91	1	0.88

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

IS-3 also differed from the previous two factors in the belief that the knowledge was less helpful for communicating with students' parents or guardians to talk about student learning and ensure students could be successful both in and out of school. However, they, like the other two factors, also showed less value of knowledge for communicating with other professionals in education and for developing and selecting appropriate summative assessments.

IS-4: Providing opportunities for students to share their thinking to assess their learning

According to IS-4's Q sort, while there was a positive value of knowledge for planning instruction with respect to setting long- and short-term learning goals, they placed a greater emphasis on the value of knowledge for aspects of teaching practices that take place during instruction, with a particular focus on creating an environment conducive to student interaction with one another (see Tables E.41 and E.42). For one, its in-service teachers believed it would help inform their ability to explain and model norms and routines for constructing and sharing knowledge with one another through discourse and to lead whole-class discussions that encourage students to listen and respond to one another's thinking through their careful selection of questions and tasks.

The value of knowledge for fostering students' interaction with one another appears to have applied primarily to whole-class contexts, as there was less value of knowledge for setting up and managing small group work.

Table E.41 Motivation IS-4 Q Sort Configuration

	Statement	IS-4
<i>Knowledge of motivation is more helpful for...</i>	Purposefully engaging in non-academic conversations with individual students to build relationships	2
	Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	**2
	Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2
	Leading a whole class discussion about academic content that encourages students to listen and respond to one another	1
	Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	1
	Recognizing common patterns of student thinking in a particular subject	1
	Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1
<i>Knowledge of motivation is neither helpful nor unhelpful for...</i>	Providing verbal & written feedback to students to help them improve their academic work	0
	Using appropriate methods to check for student understanding and monitor student learning	0
	Establishing organizational routines, procedures & strategies to maximize time available for student learning	0
	Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	*0
<i>Knowledge of motivation is less helpful for...</i>	Communicating with parents or guardians to promote their child's success in and out of school	-1
	Setting up & managing small group work to promote individual and group learning	-1
	Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-1
	Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	** -1
	Reflecting on & analyzing my instruction in order to improve its effectiveness	* -2
	Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-2
	Designing a sequence of lessons toward specific goals	** -2

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

In addition to fostering student communication with one another, the ability to elicit student thinking, combined with knowledge of student motivation, was perceived to enhance their ability to elicit student thinking, evaluate student understanding based on

what they share in class, and recognize common patterns of student thinking. These in turn would impact the teachers' decision-making with respect to selecting and using appropriate representations, examples and languages that make content more understandable and engaging for their students.

Table E.42 Distinguishing Statements for IS-4

Statement	Factor Q sort value and Z-score							
	1		2		3		4	
	Q	Z-scr	Q	Z-scr	Q	Z-scr	Q	Z-scr
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	-1	-0.65	0	-0.30	-1	-0.74	*2	1.27
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	-2	-1.03	1	1.19	2	1.16	0	-0.41
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	1	0.24	2	1.24	1	0.95	*-1	-1.18
Reflecting on & analyzing my instruction in order to improve its effectiveness	0	-0.62	1	1.21	2	0.96	-2	-1.26
Designing a sequence of lessons toward specific goals	1	0.51	-1	-0.44	1	0.78	*-2	-1.53

NOTE: * denotes distinguishing statement at $p < .05$, ** denotes distinguishing statement at $p < .01$.

An aspect of teaching practice that often takes place outside of the classroom context for which IS-4's in-service teachers believed their knowledge would be more helpful involved their ability to engage in non-academic conversations with individual students to communicate care and interest in their students and to address their students' learning and social needs. Similar to IS-3, on the other hand, IS-4 showed less value of knowledge for communicating with their students' parents and other professionals in education. Furthermore IS-4's Q sort negatively ranked aspects of teaching practices that involve designing and analyzing instruction: designing a sequence of lessons that align with their learning goals, evaluating and implementing curriculum materials and learning tasks used to support students' engagement with the content, developing summative assessments to gain information about student learning, and reflecting on and analyzing their instruction.

Similarities between Pre-Service Teachers and Other Educator Groups

Q sorts of at least one factor from each educator group showed agreement in the belief that teachers' knowledge of motivation would be helpful for various aspects of teaching practices (see Table E.43). The greatest emphasis was placed on the role of knowledge of motivation for attending to and responding to student understanding of the content. At least two factors from each educator group positively ranked leading classroom discussion (PS-2, PS-3; IS-2, IS-4; EPI-1, EPI-2) and eliciting students to share their thinking to evaluate their understanding (PS-1, PS-3, PS-4; IS-1, IS-4; EPI-1, EPI-3), providing verbal or written feedback to students (PS-2, PS-3, PS-4; IS-1, IS-2, IS-3; EPI-1, EPI-2, EPI-3), and using appropriate strategies to modify their instruction in response to their students' understanding of the content (PS-1, PS-3, PS-4; IS-2, IS-3; EPI-1, EPI-3).

The greatest number of factors across the three groups showed particular value of knowledge for providing feedback to students. This emphasis highlights feedback as an essential feature of enhancing students' motivation to further engage and maintaining students' interest in the topic or task at hand. Providing positive feedback before offering productive critique that helps students focus on specific areas for improvement has shown to promote students' motivation because it increases their metacognitive attentiveness of their learning progress; it helps them to readily identify their own strengths and understanding, and pinpoint areas that they need to work on (Shepard, Hammerness, Darling-Hammond, Rust, Baratz Snowden, Gordon, Gutierrez, & Pacheco, 2005). More so than the frequency of feedback of feedback provide, the *types* of statements teachers make with respect to causes for students' outcome represent their beliefs about students' ability to succeed and can therefore influence students' own expectations and beliefs about themselves and their abilities, which in turn impact their motivation and persistence in their learning (Ames, 1990; Bandura, 1991; Stipek, 1996). The importance of different facets of feedback that effectively supports students' interests, strengths, and motivation appear to have been recognized by all educator groups. In addition to responding to students through feedback that fosters' students' continued efforts and engagement in their learning, understanding motivation has been perceived to be just as helpful in responding to students through their instruction.

Table E.43 Comparison of Positive Rankings Between Educator Groups

Teaching Practice	PS				IS				EPI		
	1	2	3	4	1	2	3	4	1	2	3
Providing verbal & written feedback to students to help them improve their academic work	0	2	1	2	2	1	1	0	1	1	1
Encouraging students to share their thinking and using that information to evaluate their understanding of academic content	2	-1	2	1	1	0	0	2	2	0	2
Using appropriate instructional strategies to support, extend, or change common patterns of student thinking	2	0	1	1	-2	1	2	0	1	-1	2
Leading a whole class discussion about academic content that encourages students to listen and respond to one another	0	1	2	-2	0	2	-2	1	2	1	0
Setting up & managing small group work to promote individual and group learning	-1	-1	2	0	-1	2	-1	-1	0	2	1
Purposefully engaging in non-academic conversations with individual students to build relationships	1	0	0	0	2	1	0	2	1	2	0
Evaluating, choosing & modifying curriculum materials and learning tasks to accomplish a specific learning goal	2	0	-1	0	1	2	1	-1	-2	1	2
Designing a sequence of lessons toward specific goals	1	-1	-1	-2	1	-1	1	-2	-2	1	-1
Communicating with parents or guardians to promote their child's success in and out of school	-2	-2	-2	1	1	0	-2	-1	1	0	-2
Setting long- & short-term learning goals for students that are appropriately sequenced and aligned with district standards	1	1	0	-1	2	-2	2	1	0	-2	-1
Making academic content clear through the use of explanation, demonstrations, illustrations and examples	1	-2	1	-1	-2	-1	1	1	-1	-1	-1
Establishing norms & routines for how students should talk and work with each other to build knowledge of academic content	0	2	0	1	-1	0	-1	2	0	0	-2
Recognizing common patterns of student thinking in a particular subject	-2	0	-1	2	-2	-1	0	1	-2	-2	-1
Establishing organizational routines, procedures & strategies to maximize time available for student learning	-1	1	1	0	0	-2	-1	0	2	-2	1
Developing & selecting appropriate assessments (i.e., quizzes, tests, projects), & interpreting results of the assessment to inform future instruction	-1	2	0	-1	-1	-1	-1	-2	-1	0	1
Using appropriate methods to check for student understanding and monitor student learning	0	1	-2	2	0	0	0	0	0	-1	0
Reflecting on & analyzing my instruction in order to improve its effectiveness	-1	-1	-2	-2	0	1	2	-2	-1	1	0
Skillfully communicating with other professionals in education (i.e., other teachers, administrators, counselors, school psychologists)	-2	-2	-1	-1	-1	-2	-2	-1	-1	-2	-2

Thus not only were different theories of motivation believed to inform them in offering effective and helpful feedback to students but they were also perceived to guide them in selecting instructional strategies that incorporate students' inputs in ways that support or challenge students and encourage them to push themselves towards building a more complex set of knowledge and skills (Reeve & Jang, 2006).

To a lesser degree, at least one factor across educator groups showed positive value of their knowledge of motivation for teaching practices that involve fostering student interactions with one another around content and developing their own ability to communicate and build relationships with students and parents. At least one factor from each educator group positively ranked setting up and managing small group work (PS-3; IS-2; EPI-2, EPI-3), communicating with parents to promote their students' success (PS-4; IS-1; EPI-1), and engaging in non-academic conversations with students to build relationships (PS-1; IS-1, IS-2, IS-4; EPI-1, EPI-2). Thus members of each educator group recognized the importance of helping students build relationships with peers to foster a sense of belongingness and enhance their intrinsic motivation (Ryan & Deci, 2000b), as well as involving parents in their children's learning to help build their sense of autonomy, self-efficacy, interests, and beliefs about learning (Grolnick, Friendly & Bellas, 2009). The latter teaching practice, however, was positively ranked by a greater number of in-service teacher and educational psychology instructor factors compared to pre-service teachers; in-service teachers and educational psychology instructors generally placed a greater value of knowledge of motivation for enabling them to build positive teacher-student relationships. This reinforces research indicating that students' beliefs about their teachers as well as their relationship with teachers are essential in motivating students to engage in and improve their learning. Teachers' interaction with their students communicates their care, expectations, interests, and beliefs in their students' ability to succeed. This in turn has shown to impact various aspects of students' motivation, including self-esteem, self-efficacy, confidence, peer interactions, attendance, and long-term academic aspirations (e.g., Hamre & Pianta, 2001; Murray & Malmgren, 2005; Ryan, Stiller & Lynch, 1994).

Differences Between Pre-Service Teachers and Other Educator Groups

Although there existed some degree of agreement between the educator groups in their beliefs about the value of knowledge of motivation for teaching practices that involve preparing lessons and assessing students, there were variations in the emphasis of the connection between their knowledge and these teaching practices. At least one factor from each educator group positively ranked teaching practices that involve designing and preparing lessons: designing a sequence of lessons toward specific goals (PS-1; IS-1, IS-3; EPI-2) and evaluating, choosing, and modifying curriculum materials and tasks to accomplish specific goals (PS-1; IS-1, IS-2, IS-3; EPI-2, EPI-3). In-service teachers and educational psychology instructors, however, appeared to have emphasized on the value of knowledge of motivation for the latter of these teaching practices. This points to their recognition of the notion that motivation theories can serve as a useful framework with which they could determine the effectiveness of curriculum materials and tasks in the following ways: the degree to which they will sustain students' interest in and engagement with the materials; the degree to which the materials are challenging but achievable; the degree to which they tap into and connect to students' interests and strengths (Stipek, 1996).

Pre-service teachers and in-service teachers on the other hand emphasized on the value of their knowledge of motivation for establishing learning goals and selecting appropriate instructional strategies for effectively demonstrating and representing content in ways that are understandable for their students. At least two pre-service and in-service teacher factors positively ranked the following teaching practices while no educational psychology instructor factor did so: setting long- and short-term learning goals (PS-1, PS-2; IS-1, IS-3, IS-4) and making academic content clear through the use of explanations, demonstrations, illustrations and examples (PS-1, PS-3; IS-3, IS-4). In-service teachers who have had greater opportunities to engage in teaching thus appear to support pre-service teachers' consideration of motivation theories such as goal theory, and its role in guiding their ability to set goals that can support students' own goals that emphasize mastery over performance (Anderman & Midgley, 1997; Kaplan & Maehr, 1999). These goals, as informed by their knowledge of motivation, can guide their consideration and

selection of instructional strategies for presenting content in ways that are engaging and understandable for their students.

Other teaching practices that educator groups connected to their knowledge of motivation in different ways pertained to assessing students. As previously discussed, at least two factors across the educator groups positively ranked eliciting student thinking to evaluate their understanding of content. However, one of those factors from pre-service and in-service teacher factors expanded on this by positively ranking recognizing common patterns of student thinking (PS-4; IS-4), whereas no educational psychology instructor factor did so. Two pre-service teacher factors also positively ranked using appropriate methods to check for and monitor student thinking (PS-2, PS-4) whereas no in-service teacher and educational psychology instructor factors did so. On the other hand another pre-service teacher factor (PS-2) and one educational psychology instructor factor (EPI-3) positively ranked developing and using summative assessments to effectively evaluate student thinking. This suggests pre-service teachers generally placed a greater emphasis on the value of knowledge of motivation for considering and choosing appropriate forms of assessment that not only tap into students' learning but can also influence students' future engagement in their learning. Interestingly, in-service teacher and educational psychology instructor factors that did not place such an emphasis on the role of knowledge of motivation in designing, selecting and evaluating assessments placed a greater emphasis on the value of their knowledge of motivation for evaluating their own teaching (IS-2, IS-3; EPI-2), which was a teaching practice that was not positively ranked by any of the pre-service teacher factors. This suggests their beliefs that theories of motivation could serve as a lens through which they could determine the effectiveness of their instruction with respect to the impact of their instruction, tasks, discussion, and interaction on their students' interest, engagement, and achievement of learning goals. Lastly, while more than one pre-service teacher factors showed value of knowledge for establishing norms and routines for both organizing classroom time and space (PS-2, PS-4) and guiding classroom discourse (PS-2, PS-4), two educational psychology instructor factors emphasized on the first teaching practice (EPI-1, EPI-3) while one in-service teacher factor emphasized on the latter teaching practice (IS-4). This could perhaps be explained by pre-service teachers' recent exposure to the various ways

in which their understanding of motivation could inform their teaching and student learning, including a more holistic consideration for creating a learning environment that is conducive to both individual and collective learning, along with a wider range of teaching practices, compared to in-service teachers and educational psychology instructors, that can have a powerful influence on their students' motivation and learning.

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