Instructional Decision Making and Agency of
Community College Mathematics Faculty

by

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Abstract

This dissertation investigates instructional decision making of full- and part-time community college mathematics instructors. Specifically it examines similarities and differences of reasons discussed for instructional decisions and expressed agency between the two groups of faculty. By drawing on socio-cultural and psychological perspectives to examine teachers' decision making I acknowledge the role that the social context, beyond the immediate instructional context, plays on individual teachers and their decision making.

To investigate the reasons for instructional decisions and the agency expressed from the perspective of the instructors, I analyzed the discourse of professional development sessions using constant comparative methods and Systemic Functional Linguistics. Two concurrent series of professional development sessions were held, one for full-time faculty (N=11) and one for part-time faculty (N=9), to give insight into the interaction between the social context and the individual. In the sessions the instructors discussed animations of a trigonometry lesson in which classroom norms were breached in various ways. This discussion included justifications for actions represented in the animation and actions the instructors would take. The analysis of the justifications demonstrates that these instructors draw on a multitude of rationales—both professional and personal—for the instructional decisions discussed. Professionally, the instructors attend to student learning, the discipline (mathematics), the conducting of the class, and the institution, which support the existence of the professional obligations proposed in the theory of practical rationality of mathematics teaching. Personally, they provide as reasons

personal emotions, beliefs, and experiences. No difference was found in the types of reasons discussed between the full- and part-time faculty, but there was a difference in the agency conveyed by the full- and part-time faculty and in the dynamics of the group discussion. Compared to the full-time faculty, the part-time faculty indicated significantly less agency and more frequently indicated requirement in their instructional decisions. The part-time group positioned themselves more as equals and their discussion was more open and collaborative than that of the full-time faculty.

The results illustrate how the social context, particularly the working environment, influences how instructors position themselves and suggest that the working environment of faculty may influence individual teachers' decision making. Based on these findings, I argue for the need of a theory on why teachers teach the way they do that attends to teachers as individuals *and* the environment in which they teach so that the interaction between the two can be further examined. I also discuss how community colleges can use these findings to promote instructional improvement and the need for further research into the role of agency in instructional decision making and the tensions teachers face when making instructional decisions.

Chapter 1

Introduction

This dissertation investigates decision making of mathematics instructors in a community college setting. Teaching is a complex task driven by planned and in-the-moment decisions of individuals in the role of a teacher. Teachers' decisions are shaped by both the characteristics of individuals and the societal and institutional context. Individual characteristics, such as knowledge, beliefs, and experiences, have been shown to influence teachers' actions and decisions. The societal and institutional context shapes the role of a teacher and establishes norms and obligations. Thus given the nature of teaching, an individual's decisions must take into account the students and the content being taught in a particular context. To examine teachers' decision making, this study focuses on instructional decisions in post-secondary mathematics at community colleges.

Understanding instructional decision making gives insight on why teachers teach the way they do. This knowledge can then be used to effectively implement new reform practices. In order for teachers to take up new practices, they must not only be aware of them and understand how to implement them in the classroom, but they must also decide to use them. The decision to try or not try these new practices is dependent on many factors including teachers' knowledge and beliefs, and the conditions and constraints of the instructional situation.

Most attempts to understand mathematics teaching—including those that look at teachers' decision making—generally look at individual teacher qualities or what occurs in the

classroom rather than the full spectrum of reasons that teachers have for making the decisions they do. For example the work of Deborah Ball and her colleagues looks at the types of knowledge teachers need for teaching mathematics (Ball, Lubienski, & Mewborn, 2001; Ball, Thames, & Phelps, 2008; Hill, Ball, & Schilling, 2008), whereas other researchers observe and analyze teaching in K-12 mathematics classrooms (i.e., Lobato & Ellis, 2002; Nathan & Knuth, 2003) and at the college level (Mesa, 2011; Mesa, Celis, & Lande, 2014; Mesa, & Lande, 2014). The work of Alan Schoenfeld (2011) looks at in-the-moment decision making, concluding that an individual's goals, knowledge, beliefs and preferences can explain these decisions, but does not take into consideration the conditions and constraints or the larger decisions that must be made when teaching such as the planning of a lesson or choice of teaching strategies. Complementing this work that focuses on individual actions and characteristics and views teaching from a psychological perspective is the work of Herbst and Chazan (2003, 2011, 2012) which examines the context in which teaching occurs by examining the norms and professional obligations of high school mathematics teaching.

All of these studies give insight into what occurs in mathematics classrooms and provide some explanation for instructional decisions, but what these studies lack is a holistic examination of why teachers teach the way they do that incorporates both individual (psychological) and contextual (socio-cultural) factors. While these studies account for teachers' knowledge, beliefs, preferences, norms, and professional obligations, they do not examine them together as whole and do not account for the potential effects of the working environment—how faculty are positioned and treated by the college and department—on an individual or the individual beyond their professional role as a teacher. By contextualizing this study in community colleges, which

rely heavily on part-time faculty, I am able to examine the potential effect of the working environment on individual's decision making.

Furthermore, the community college provides a rich context in which to examine teaching. Community colleges play a significant role in preserving the American Dream (Obama, 2010) and educate over 40% of all undergraduates in the U.S. (U.S. Department of Education, 2011), enrolling 51% of all undergraduate students in mathematics (Lutzer, Rodi, Kirkman, & Maxwell, 2007). Moreover, they are seen as instrumental in preparing the next generation of STEM graduates (National Research Council & National Academy of Engineering, 2012) and are also expected to take on the burden of mathematics remediation. This naturally translates into multiple demands on colleges and teachers to increase student success while ensuring a quality education that is affordable. Community colleges and their practitioners are confronting pressures to demonstrate effectiveness from policy makers, the disciplines, and the local communities and students they serve (Baldwin, 2013), but it is unclear how these pressures influence what matters most for the students: the decisions teachers make about what goes on in the classroom. Community colleges emphasize the importance of good teaching and are, in principle, organized to support teaching (e.g., faculty are devoted almost entirely to teaching, and classes are typically small; Cohen & Brawer, 2008), yet there is little empirical research on teaching that occurs in community colleges mathematics classrooms (Mesa, Celis, & Lande, 2014).

Community colleges rely heavily on part-time faculty. Approximately two-thirds of community college faculty across the U.S. are part-time, teaching about one-third of all courses (Townsend & Twombly, 2007). In mathematics departments, 68% of faculty are part-time, teaching 46% of all sections (Blair, Kirkman, & Maxwell, 2012). Much of the literature on

contingent and part-time faculty paints a grim picture and largely takes a deficit view of them (Kezar & Sam, 2011). Studies of contingent faculty show negative effects on students including doing worse in follow-up courses (Carrell & West, 2010), lower retention (Ehrenberg & Zhang, 2005), a lower chance of transferring to a 4-year institution (Eagan & Jaeger, 2009), and lower graduation rates (Bettinger & Long, 2004). Like the studies on student outcomes other measures, such as types of assessments used (Baldwin & Wawrzynski, 2011) and the amount of contact with students (Benjamin, 1998; 2002), also conclude that part-time faculty practices are inferior to those of full-time faculty. However, these studies do not take into account what actually occurs in the classrooms or the poor working conditions of part-time faculty—such as being paid only for classroom contact hours, not for office hours or student advising, lack of job security, and lack of office space (Townsend & Twombly, 2007; Kezar & Sam, 2011). Given the number of part-time mathematics faculty teaching in community colleges, and the potential negative effects on students, it is important to take into account the conditions of their employment and consider the ways this may impact their decision-making process and thus their teaching.

Reform efforts in mathematics teaching are not new (NCTM, 1989; 2001) and have also been addressed specifically to mathematics instruction in community colleges (Cohen, 1995; Blair, 2006). These reform efforts encourage the use of innovative teaching practices and more interactive mathematics classrooms, such as discovery learning and small group work, and have been shown to improve student understanding and success. The large percentage (87%) of pre-calculus level courses in community colleges taught using traditional lecture methods (Blair, Kirkman, & Maxwell, 2012) shows that these reforms have not become widely used. More needs to be understood about why these reform efforts have not been widely taken up by

community college mathematics faculty and about methods for educating instructors about these reform efforts in ways that will actually impact the decisions they make in the classroom.

Motivation for this Study

My interest in instructional decision making and reform efforts in college level mathematics comes from my experience as a part-time mathematics faculty member at a university and community college. Going into this study, my main goal was to better understand why teachers teach the way they do. From my conversations with other faculty at the university and community college where I taught it seemed that their goal was to help students learn, but their focus was on simply presenting the mathematics as clearly and concisely as they could and if the students didn't understand or learn the material, it was the students' fault, not a result of the instruction. I thought perhaps the reason for not focusing on instruction was a combination of teaching the same way you were taught and the lack of resources on how instruction could be improved. I still could not understand the negative attitude towards students, blaming them or their previous education, but thought perhaps it was a way of personally coping with the low passing rates and students' complaints. The big question that hung over my head was, why aren't these instructors figuring out how to fix these problems? Isn't that their job?

My experiences teaching different classes and in different contexts made me aware of the range of influences on how I taught. In much of my teaching at the university, I felt very restricted in what I could do to help students. Many of the classes I taught were hybrid beginning algebra courses. In these courses, the students used an online system to watch published lectures, read the textbook, complete homework, and take quizzes and tests—all of which were set up by the course coordinator. These hybrid courses enrolled 100 students per section and met face-to-face for two hours each week. In that class time, I was expected to give

a 20-30 minute lecture and individually touch base with each student. Much of the time was spent encouraging them to come to the computer lab during the hours I was scheduled for help. In this situation I had little control over my teaching. Despite the praise and requests for help from other instructors and my superiors and the enjoyment of helping those students who came for extra help, it was overall a very disheartening experience with only about 30% of students passing the course. I knew that this course was a requirement for all students to obtain a bachelor's degree and I felt that under these conditions there was nothing more that I could do to decrease the number of students failing or withdrawing from the course.

One semester at the university I was fortunate to be assigned to a pre-calculus course housed within a special program modeled after Uri Treisman's Emerging Scholars Program (see Asera, 2001, for a full description of this program). In this program, discussion sessions of no more than 24 students meet an additional four hours per week. In these discussion sessions, students were given intellectually challenging problems to solve in groups and submit a full written explanation to be graded. In leading this discussion session I could see how much better the students understood the material. I knew that it was possible to help students get a deep understanding of the mathematics through their own discovery by working with others and formally writing up their results of challenging problems.

When I began teaching at the community college, I received a textbook and a syllabus outline that included the chapters of the text to be covered. I now had the freedom to teach how I wanted to, but soon found out that I did not have the resources or freedom to create the type of learning environment I envisioned. My teaching was considered very interactive compared to the teaching of my colleagues—it was lecture and discussion based with students working out problems and presenting their solutions. I wanted to incorporate intellectually challenging

problems like I had used in the pre-calculus course in the Emerging Scholars Program, but ran into two issues. The first was creating challenging, non-routine problems for beginning and intermediate algebra. In the pre-calculus course, there was a data bank of problems that I could select from—I did not have this resource for the beginning or intermediate algebra classes I was teaching and I did not have the background knowledge or creativity to produce my own. The second was the time allotted for the course. There was so much material that I was required to cover that I could not find class time to devote to in-depth group work of any sort. I also thought that having students write up full explanations (rather than just showing all their work) of a few select homework problems each week would help them, but this required a significant amount of grading time on my part for which I was not paid and which I therefore could not afford to invest. In spite of my efforts in this context, I was not satisfied with the results of my teaching. The students' understanding of the mathematics was less than satisfactory to me even if they were able to correctly solve the problems on homework and exams.

Through these experiences I realized how complex teaching is. I became more interested in learning and understanding how others manage teaching given the constraints of the institution and the resources available. I was frustrated and disgusted by the low passing rates and even more by the large number of faculty (both full- and part-time) constantly complaining about students, without offering any practical help or solutions. I really wanted to help the students succeed—I read research and attended professional development and conferences, but did not find any resources that could help me, so I decided to return to school to pursue a Ph.D. in mathematics education.

In addition to my classroom experiences, I also had a variety of experiences as an employee. For the first two years I taught, I was in graduate school pursuing a master's degree

in mathematics. The school's policies (and politics) required that I be employed as a part-time lecturer rather than as a graduate teaching assistant for this time. This translated into lower pay, no benefits, no job security, and no tuition stipend. These conditions made me feel undervalued and unimportant as an employee, but I felt accepted as a professional. I was praised for my teaching and ability to connect with and motivate students, and given assignments of a full-time lecturer, which included training other graduate students and part-time faculty. After completing my master's degree I also worked as a part-time instructor at a community college. I participated in professional development opportunities offered at the community college (as the only part-time faculty member in attendance) and continued to train and support graduate students and part-time faculty at the university.

In reflecting back on my experiences, the conditions of my employment—the low pay, lack of benefits and uncertainty about teaching from semester to semester—were less than satisfactory and gave the impression that a part-time faculty position was not as desirable as or inferior to a full-time position. I felt more accepted as a professional, but still separated from the full-time faculty and the department as a whole. As part-time faculty, I was not invited to participate in department meetings or committees, so I did not have a say in the curriculum or other departmental decisions that influenced or constrained my teaching.

It is clear to me that my own teaching was shaped and constrained by my knowledge and beliefs and the context in which I taught. In working on this study, I have come to question what influences my position as a part-time faculty member had on my decisions and if I would have made different decisions and taught in different ways had I been in a more secure and involved position.

Objectives of this Study

One goal of this study is to acknowledge the role of socio-cultural factors, particularly those beyond the immediate instructional context, on individuals in the role of a teacher and their decision making. To examine this interaction between the context and the individual, I investigate the reasons instructors discuss for instructional decisions and the agency they convey about these decisions. This gives insight, from the perspective of the instructors, into why community college mathematics instructors make the instructional decisions they do and the role of agency in instructional decision making. I examine the similarities and differences between full- and part-time faculty in order to illustrate the potential impact of social and institutional circumstances on individuals and their instructional decision making. Knowledge of what drives and constrains instructors' decisions and the agency they feel they have is needed for improvement of instruction that is likely to have an impact on how they teach. Given the extensive use of part-time faculty in community colleges and the difference in institutional treatment of the part-time faculty compared to full-time faculty, it is important to recognize both similarities and differences between the two groups so the needs of each can be addressed.

To holistically examine decision making of community college mathematics instructors, I build from Herbst and Chazan's (2003, 2011, 2012) theory of practical rationality of mathematics teaching. This theory focuses on the context in which teaching occurs; it recognizes that teaching is part of a "complex system of interrelated agents" (2012, p. 601) and that actions of teaching can be accounted for by norms and professional obligations. Thus this theory provides some insight into why providing instructors with knowledge of what "good teaching" looks like has not significantly changed the way that community college instructors teach. I incorporate into this contextual (socio-cultural) perspective the *individual* in the role of a

teacher. An individual has circumstances and personal reasons that can influence how professional obligations are interpreted and fulfilled. Incorporating an individual (psychological) perspective also allows us to consider the intertwined nature of the profession and the individual—how the working environment of teachers might impact an individual and the reasons for teaching the way they do. In sum, I take the view that an instructor's position includes obligations that they do their best to fulfill, but these obligations may be constrained and influenced by each other, the environment in which faculty work, and the individual.

This view allows me as a researcher to understand why instructors make the decisions they do without questioning the appropriateness of their decisions. An awareness and appreciation of reasons given for instructional decisions from the perspective of instructors contributes to our understanding of the conditions and constraints of teaching mathematics in community colleges. With community colleges' heavy reliance on part-time faculty, and the differing working environment of full- and part-time faculty, I also inquire about the association of faculty status (full- or part-time) with the reasons they give.

In addition to investigating the reasons these faculty discuss, insight can be gained from a better understanding instructors' agency in making instructional decisions. Investigating the instructor's agency contributes to my broader research question of why community college instructors teach the way they do because it may influence their instructional decisions.

Research Questions

Centering my research questions on the instructional decisions discussed and reasons talked about for making them directly contributes to my broader question of why community college mathematics instructors teach the way they do and contributes to my conceptualization of decision making. Specifically, I ask:

1. What reasons do community college mathematics faculty give for the instructional decisions discussed?

2. How is faculty status associated with these reasons?

3. How is faculty status associated with agency in the instructional decisions discussed?

In order to better understand the first research question of the study—*What reasons do community college mathematics faculty give for the decisions discussed?*—working definitions of instructional decisions and reasons in the context of this study are necessary. I define an instructional decision as a choice or selected course of action pertaining to teaching and a reason as a statement that explains why that decision was chosen. To answer this question, I identify and qualitatively analyze the reasons that instructors talk about. Examining these reasons in detail from the perspective of the instructors also gives us a better understanding of how these instructors interpret their professional obligations. In addition, it allows for the exploration of other reasons that may exist beyond the obligations of the profession.

The second research question—*How is faculty status associated with these reasons?*—allows an examination of potential similarities or differences between full- and part-time faculty. Based on the literature comparing full- and part-time faculty, differences in the reasons given would not be a surprise, although similarities in reasons given would offer further evidence in support of the theory of practical rationality and the notion of professional obligations.

The third research question—*How is faculty status associated with agency in the instructional decisions discussed?*—focuses on instructor agency. Agency is a complex concept and often inadequately defined. Here I define agency as the socio-culturally mediated capacity

of an individual to act (adapted from Ahearn, 2010).[1] This question gives insight into the agency conveyed by these instructors and how they position themselves. Examining the ways instructors talk about instructional decisions can further contribute to our understanding about why teachers teach the way they do. The more agency an instructor feels, the more control they feel they have over the way they choose to teach. This agency in combination with the reasons discussed can give a more holistic perspective on teacher decision making. A difference in agency displayed by the full- and part-time faculty could give insight into how the working environment might impact how professional obligations are fulfilled.

To answer these research questions, I use data from two series of professional development—one for full-time community college mathematics faculty and the other for part-time faculty. I chose to use discourse analysis because I wanted to ensure the voice of the participants is heard. I use Systemic Functional Linguistics (SFL) to analyze the discourse where faculty are responding to an animation of a community college trigonometry class. I chose SFL because of its comprehensive and theoretically grounded approach to language. Through the resources provided by SFL I identify and analyze the reasons they give for those instructional decisions and investigate the agency construed in the instructional decisions discussed by the instructors.

Studying teaching in community college has both practical and methodological benefits. The sheer number of students that take mathematics in community colleges, the democratic aims of community colleges along with their focus on teaching, and the lack of research on teaching in the community college setting makes community college mathematics an important setting for research. Many features of community colleges are methodologically beneficial for studying

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[1] Ahearn's definition of agency is the "socioculturally mediated capacity to act" (2010, p. 28). To this definition, I add the individual to also acknowledge the psychological perspective on agency.

decision making in tertiary mathematics teaching—most notably because of the focus on teaching and the diversity of the students.

As previously mentioned, community colleges are known as teaching institutions, which can be seen in the structure of the institution with the faculty's workload devoted almost entirely to teaching. Three interrelated features of community college mathematics classes—small class size, substantive face-to-face interaction, and their highly interactive nature (Mesa, 2010)—make this an ideal setting for studying why teachers teach the way they do in a tertiary setting. These features allow for the professional and individual obligations to be apparent. The small class size and large amount of classroom interaction requires instructors to make decisions based on individuals' feedback within the time constraints of the class time and in ways that are appropriate for the class as a whole. Thus instructional decisions that incorporate multiple obligations are more likely to be discussed and will result in a baseline that could be compared in later studies to other settings (i.e., on-line instruction, large lectures, and selective institutions).

The type of student diversity in community colleges also contributes to why community colleges are an ideal setting to study professional obligations. The diversity is in part because community colleges are open access institutions, offer low-cost credits and flexible hours for courses, and are generally commuter schools. These conditions accommodate students regardless of their level of preparation for college, as well as those with financial constraints and other commitments and responsibilities. Thus the diversity that exists in community colleges is in students' socio-economic status, level of college preparation, age, goals of attending (i.e., transfer to a 4-year institution, obtain a vocational certificate or terminal degree, personal enrichment) and balance of school to other obligations such as work and family. Because there is so much diversity present in these classes the obligations to the individual students and the

class as a whole might be more pronounced—less likely to be overlooked—and can lead to more in-depth and nuanced discussions about meeting the needs of all students.

Two additional features of community colleges faculty contribute to the study design. Faculty are experts in the fields in which they teach and colleges rely heavily on part-time faculty. Unlike K-12 teachers, most community college faculty (81%) are disciplinary experts, holding a master's degree or higher in their field (Palmer, 2002). Mathematics faculty have strong academic backgrounds with 97% of full-time faculty and 78% of part-time faculty holding a master's degree or higher in mathematics or a related field (Blair, Kirkman, & Maxwell, 2013). The stratification of faculty based on employment status is necessary to acknowledge because the opportunities for part-time faculty to engage with their colleagues and to participate in departmental governance and professional development are significantly less than their full-time counterparts. Thus, the community college setting provides a space to investigate the role of the environment (beyond the immediate instructional context) on individuals and their instructional decision making.

Significance and Contributions

This study has both scholarly and practical significance. It articulates the need for research on teaching to integrate psychological and socio-cultural perspectives in order to acknowledge how the context can influence teachers as individuals and impact their teaching. It also contributes to the higher education literature that is largely dominated by quantitative research (Menges & Austin, 2001) and lacks research on teaching in the content areas (Mesa, Celis, & Lande, 2014).

The results of this study also provide insight for practice. The rising pressure for all Americans to have a college education has significantly increased the burden on community

colleges to improve student success with little attention to how instruction is impacted by this increased pressure. Understanding professional obligations, personal reasons, and agency, and the role each play in instructional decision making informs ways that mathematics teaching in the community college can be improved—both at the level of the institution and the instructor. This understanding can help colleges make informed policy decisions about requirements and constraints put on faculty. These range from decisions on curriculum, class time, and teaching load to the working conditions and inclusion of part-time faculty. Recognizing and understanding holistically why instructors teach the way they do can help bridge the gap between research and practice to improve teaching and learning in college mathematics by identifying the factors that may inhibit or encourage the use of reform-oriented teaching methods.

Overview of the Dissertation

In Chapter 2 I review the literature on community college faculty and decision making in mathematics education, discuss some theoretical considerations about decision making, and describe the conceptual framework used in this study and my conceptualization of instructional decision making. Chapter 3 details the design and methods, and Chapter 4 presents the results. In Chapter 5 I discuss and explore possible explanations for the findings and how the findings of this study support my conceptualization of instructional decision making. I conclude in Chapter 6 with implications for practice and research.

Chapter 2

Literature Review and Conceptual Framework

For this study I conceptualize instruction using Cohen, Raudenbush, and Ball's (2003) instructional triangle; instruction is the interaction between the content, the teacher, and the students within the environment. Using this definition allows us to view the decisions that instructors make with attention to their interaction with and between the mathematics and the students in the context in which they teach—the community college. I also bring the notion of the didactical contract—that teachers and students gather not simply because they want to but because being together is part of their role as a teacher and students with the goal of students' mathematical learning (Brousseau, 1997). This understanding of instruction makes clear that teaching and instructional decision making are part of a "complex system of interrelated agents" (Herbst & Chazan, 2012, p. 601), and that the individual teacher impacts and is affected by all of these agents. We must also consider the potential of external influences on teachers—those that are beyond the immediate context of instruction—which may impact their instructional decisions.

I begin this chapter with a review the literature relevant for situating my research. Because my study is of community college mathematics faculty and I inquire about possible differences between full- and part-time faculty, I begin with a review of the literature on community college faculty. I then turn to literature in K-12 mathematics to explore the research pertaining to teacher decision making. I explore some theoretical underpinnings of decision

making, which indicate that there are many different components of and ways to think about decision making not addressed in the literature on teaching. I then describe the theoretical perspectives I bring into this study which is useful in understanding how I came to my research questions and how I interpret the results. I conclude with a description of my conceptualization of instructional decision making, which brings together the different perspectives found in the literature on decision making in education.

Literature on Community College Faculty

As previously mentioned community colleges provide a rich context to examine instructional decision making. Certain attributes of community colleges—having a diverse student body, small classes, and faculty who are experts in their field and devote nearly all their time to teaching—provide a unique space to study instructional decision making in that each aspect of instruction—the teacher, students, and the mathematics—and the interaction between them is prominent in the work of the faculty. In addition, the heavy reliance on part-time faculty and the conditions of their employment provide a space where the working environment is different based on faculty status (full- or part-time) while the immediate instructional context (i.e., the classroom, students, content) is the same. Thus this setting allows for an examination of the potential effects of working environment on individual's decision making.

There is significant research on characteristics of community college faculty. Mathematics faculty have strong academic backgrounds with 97% of full-time faculty holding a master's degree or higher and 14% holding a doctorate. The majority of full-time mathematics faculty are disciplinary experts, with 71% holding their highest degree in mathematics or statistics. Twenty-one percent hold their highest degree in mathematics education, with the remaining 7% holding a degree in another field. The credentials of part-time vary some. The

majority of part-time faculty hold a master's degree or higher (78%), only 5% have a doctoral degree, and a much larger percent (22% compared to 3%) hold only a bachelor's degree. Like full-time faculty, the majority hold degrees in mathematics/statistics or mathematics educations (50% and 26% respectively), but a much larger proportion (24%) hold a degree in another field (Blair, Kirkman, & Maxwell, 2013).

Faculty positions at community colleges are very different than those at research institutions. Unlike faculty at four-year institutions whose time is shared between research and teaching, community college faculty's time is devoted almost entirely to teaching; full-time mathematics faculty teach an average of 15 credit hours per semester (Blair, Kirkman, & Maxwell, 2013).

The role and working environment of part-time faculty in community colleges are well-documented and very different than those of full-time faculty (Banachowski, 1996; Eagan, 2007; Gappa & Leslie, 1993; Grubb & Associates, 1999; Townsend & Twombly, 2007). Unlike their full-time counterparts, part-time faculty assignments are limited to classroom instruction. They are typically only paid for classroom contact hours, not for preparatory time, office hours, staff development, or coordination with other faculty. They are generally not assigned to advise students or be involved in departmental decisions or governance, including departmental meeting or other initiatives such as curricular development. In addition, they are not generally paid for or supported to attend professional development or conferences. The working conditions differ as well. Part-time faculty often lack office space or access to secretarial services, have low salaries, and lack job security and benefits—such as medical insurance, pension, or sick leave. They are hired on a semester-to-semester basis at the discretion of the chair or dean, generally do not have a say in the courses they are assigned, and are sometimes given teaching assignments only days

before classes begin. In addition, part-time faculty are more likely to teach developmental or introductory courses and teach courses in the evenings or on weekends.

There is little empirical research on teaching that occurs in community colleges and those studies that focus on mathematics teaching (i.e., Mesa, 2011; Mesa, Celis, & Lande, 2014; Mesa, & Lande, 2014) do not look at differences based on faculty status. As a result, I review the literature that attempts to link faculty status to practice, which is only done through teacher surveys and student outcomes. While this literature is somewhat distant from my research questions, it situates my work in the higher education literature and emphasizes the need for such work.

Eagan and Jaeger (Eagan & Jaeger, 2009; Jaeger & Eagan, 2009) use quantitative methods to determine the relationship between exposure to part-time faculty and student outcomes. They have conducted two studies—one that looks at transfer and the other on retention. They approach these studies with a deficit view of part-time faculty. Based on previous studies that indicate greater exposure to instruction from part-time faculty results in fewer meaningful interactions, they hypothesize that the use of part-time faculty is detrimental to students. Both studies use student transcripts, faculty employment status, and institutional data from the 2000 and 2001 cohorts of first-time, credit-seeking students in the California community college system and find that exposure to part-time faculty negatively impacts students. Both studies examine the relationship both at the student level and the institutional level using hierarchical generalized linear modeling. This type of study, which is common in the literature, promotes the idea that being taught by part-time faculty will negatively impact students and institutions, yet there is no connection to the quality of teaching or what part-time faculty are or are not doing that might explain the results.

The first study (Eagan & Jaeger, 2009) examines the relationship of exposure to part-time faculty on students' likelihood to transfer to a four-year institution. For this study the outcome variable at the individual level was whether the student transferred to a four-year institution within five years of their initial enrollment. The results of this analysis indicate a significant and negative relationship between exposure to part-time faculty and students' chances of transfer. More specifically, a 10% increase in students' exposure to part-time faculty lead to a 2% reduction in their likelihood to transfer. The authors argue that while this may seem like a small difference, given that on average students received 40% of their instruction from part-time instructors, the average student's chance of transferring is reduced by 8% compared to students who had no exposure to part-time faculty. At the institutional level, the outcome variable was the proportion of students at the institution that transferred to a four-year institution within five years. They found that the overall transfer rate was lower for rural institutions and those with higher proportion of students receiving financial aid, but the proportion of part-time faculty at an institution did not significantly affect the institutions overall transfer rate. That is, they found that an individual student's chances of transferring was negatively related to part-time faculty exposure, but the institution's overall transfer rate was not affected by the proportion of part-time faculty at the institution.

The second study by Eagan and Jaeger (Jaeger & Eagan, 2009) examines the relationship between exposure to part-time faculty and associate's degree completion. For this study the individual level outcome variable was whether or not the student obtained an associate's degree within five years of their initial enrollment. The results of this analysis indicate a significant and negative relationship between exposure to part-time faculty and a student's chances of transferring. The results were very similar to those in the previous study. The effect was

smaller—a 10% increase in students' exposure to part-time faculty led to a 1% reduction in their likelihood to transfer—but the authors still considered it relevant given the high percentage of part-time faculty. At the institutional level, several institutional characteristics, such as percent minority students at the institution, were found to be significantly related to the proportion of students obtaining an associate's degree, but the proportion of part-time faculty at an institution was not. Both of these studies conclude that at the individual student level, part-time faculty negatively impact student outcomes, yet due to the methods, it is unclear if it is even a result of the actions of the faculty themselves. At the institutional level, they did not find a significant effect of the proportion of part-time faculty and student success rates, which suggests that a high proportion of part-time faculty at an institution may not be inherently problematic.

Jacoby (2006) used data from the Integrated Postsecondary Education Data System [IPEDS] to look at the relationship between the use of part-time faculty and graduation rate at the institutional level using multiple regression analysis. Unlike Jaeger and Eagan (Eagan & Jaeger, 2009; Jaeger & Eagan, 2009), Jacoby found that an increase in the proportion of part-time faculty in a community college decreases the college's graduation rates. The discrepancy in the findings is likely a result of using different data sets, controlling for different variables, and using different statistical methods. While this type of research is far removed from the classroom or the actions of part-time faculty, it is a common type of research in higher education and it paints a negative picture of part-time faculty.

A study by Bolt and Charlier (2010) looked more closely at other factors that might explain the negative relationship between part-time faculty and student success by looking at other student characteristics that have been documented to negatively impact success. This study sought to determine if there is a relationship between adjunct instruction, student enrolment

status, and student success. They used institutional data between 2004 and 2007 from one rural community college (n=1424). Students were categorized as having high or low exposure to part-time faculty. Students with 75% of their courses taught by adjunct faculty were defined as high-exposure, and those with up to 25% were defined as low-exposure. A two-way ANOVA test indicated that enrolment status and adjunct exposure had significant effects on student success. Students enrolled full-time and those with low exposure to adjunct faculty had higher GPA. Further hierarchical logistic regressions that controlled for student level variables (enrolling in developmental courses, GPA, and enrolment status) on retention and completion found that the amount of exposure to part-time faculty was not a significant predictor of either retention or completion. Thus they concluded that many of the negative results about part-time faculty found in the research do not take into account that part-time faculty teach a large proportion of developmental courses and evening and weekend classes. This study further emphasizes the need to examine how institutional practices, such as course and class assignment, may result in the perception that part-time faculty are inferior to their full-time counter parts.

As illustrated by these studies, literature on part-time faculty often paints a grim picture and largely takes a deficit view of them. This is consistent with the literature on contingent faculty in higher education (Kezar & Sam, 2011), which commonly comes to the conclusion that contingent and part-time faculty and their practices are inferior to tenured and full-time faculty and their practices. Unfortunately, these studies rarely acknowledge the difference between these groups in their assigned responsibilities or the circumstances in which they work, or examine classroom interactions.

In addition to these quantitative studies relating student outcomes to faculty status, some qualitative studies have examined how the conditions in which part-time faculty teach affect

individuals. They have found that the poor working environment of part-time and contingent faculty, particularly being seen and treated as laborers rather than professionals and the view of some colleagues that they are second-class faculty can lead to a negative self-image (Kezar & Sam, 2011; 2013; Thompson, 2003) and lead others to perceive them as having low morale and lacking commitment, engagement, and satisfaction (Kezar & Sam, 2011). Yet when part-time and contingent faculty are thought of as professionals it can be seen that internal drivers, such "as a love of their discipline, enjoyment of teaching, and positive interactions with colleagues" (Kezar & Sam, 2011, p. 1430) can balance or outweigh the negative conditions in which they work. Surveys of community college faculty show that they are, overall, satisfied with their jobs yet when asked about their satisfaction with their department and institution, their level of satisfaction dropped significantly (Huber, 1998). Part-time faculty are also generally satisfied with their jobs, but have concerns about salary, benefits, and job security (Valdez & Antony, 2001). This indicates that while community college faculty enjoy what they do, institutions' policies and organization might actually play a negative role in their job satisfaction.

Washington (2011) challenges the deficit view of part-time faculty by examining the perceptions of 12 part-time community college instructors. He finds that these faculty see themselves as "as skilled instructors, dedicated educators, and caring mentors," but believe that their institution "treats them as second-class faculty" and does not adequately support or train them for success in the classroom" (p. 129). These findings illuminate what the research on part-time faculty generally overlooks—what drives individuals' to teach and the effects of the context in which they work on individuals.

In addition to these studies there are two books, *The Invisible Faculty: Improving the Status of Part-Timers in Higher Education* (Gappa & Leslie, 1993) and *Honored but Invisible:*

An Inside Look at Teaching in Community Colleges (Grubb & Associates, 1999), which give extraordinary insight into part-time faculty and teaching in a community college. Both books are large qualitative studies that seek to better understand part-time faculty and the conditions in which they work, and what teaching in community colleges is like.

    The Invisible Faculty (Gappa & Leslie, 1993) focuses on the institutional environment for part-time faculty and gives a generous number of recommendations. Because the study is based on 467 interviews with part-time faculty, central administrators, deans, department chairs, and senior faculty leaders, and documents such as written policies, procedures, and handbooks from 18 institutions, it reveals a lot about part-time faculty and the conditions in which they work that are not captured by the quantitative literature on the topic. The institutions in this study range from community colleges to research universities. The sample includes five community colleges and one state college system that includes a community college.

    The authors describe the variation in part-time faculty's demographic characteristics, academic backgrounds, satisfaction or dissatisfaction with their jobs, and the different motivations for teaching part-time. Two major findings of this study not previously documented were the amount of enthusiasm part-time faculty have for teaching and the different categories of how their employment serves them. The authors found that intrinsic satisfaction and enthusiasm for teaching was often more predominant than extrinsic motivation such as money, status, or entry into a full-time position. Despite this enthusiasm for teaching the part-time faculty were very vocal about being "second-class citizens." The authors also defined four types of part-time faculty: *career enders*—those teaching as they transition into retirement; *specialists, experts, and professionals*—those who have full-time employment elsewhere; *aspiring academics*—those seeking full-time, tenured positions; and *freelancers*—those who are primary homemakers or

caretakers, make their livelihood around a series of part-time jobs (both in and out of academia), or for reasons beyond their control.

External and institutional forces are also identified as shaping the environment that part-time faculty work in. The external forces include state laws, collective bargaining contracts, and accrediting agencies. The internal forces include fiscal reasons (part-time faculty are cheaper to employ than full-time faculty) and flexibility needed due to instability in student enrollment. They also found four conditions which affected the integration of the part-time faculty: central administrators and department chairs that helped to establish a climate where the efforts of part-time faculty were appreciated, formal part-time orientations, inviting part-timers to participate in department and institutional decision making, and supporting professional development for part-time faculty. The authors find that the part-time faculty work force is very talented, but largely ignored, and as a result institutions are missing the opportunity to develop this talent. In addition they believe that colleges and universities can strengthen themselves through "the wise use of part-time faculty" (Gappa & Leslie, 1993, p. 277). This research helps to situate part-time faculty both as individuals and as actors fulfilling their role in more or less favorable contexts.

Honored but Invisible (Grubb & Associates, 1999) focuses exclusively on instruction in community colleges with the goal of making instruction, which is largely neglected, visible. The study was based on interviews and classroom observations of over 250 instructors in thirty-two community colleges and supplemented with instructor interviews. The authors illuminate the range of instructor beliefs and practices and how "what happens in the classroom is often quite different than what instructors say goes" (p. 13). Through the classroom observations, the authors were able to document both "wonderful" classroom teaching and "the absolute worst." One recurrent theme is how isolated community college faculty, both full- and part-time are, and

that most changes to teaching practice occurs through trial and error. The most innovative practices they observed were the result of collective efforts.

One drawback of this study was the low number of part-time instructors (25) they were able to interview and observe, yet they were able to document some of the dilemmas that result, not just for the part-time faculty, but also for the full-time faculty and administrators who attempt to integrate the part-time faculty. They conclude that the conditions for part-time faculty are "dreadful" and that part-time faculty are "not part of the community of the college; they are even more isolated from other instructors than their full-time peers" (Grubb & Associates, p. 334). Furthermore, they found no evidence that the instruction of part-time faculty was any worse than that of the full-time faculty.

This research on community college faculty underscores the need for further investigation into how the attitudes toward and conditions of part-time faculty might influence teachers' decision making and thus what occurs in the classroom. I now shift to the research in mathematics education, which explores in detail influences on teaching and teachers' decision making.

Literature in Mathematics Education

There is significant research on teaching mathematics in the K-12 setting. This research varies from examining what occurs in the classroom to individual teacher qualities and often seeks to connect these actions or qualities to reform-oriented practices or student learning. There is little empirical research that openly explores instructional decision making in mathematics or why individual mathematics teachers teach the way they do. Because teachers' actions in the classroom are a result of decision making, the literature that examines how practice is influenced by teacher beliefs and knowledge gives insight into teachers' decision making. I begin with a

review of four empirical studies that make implicit assumptions about decision making by examining teachers' beliefs and knowledge and the impact they have on teaching. I then delve more deeply in two studies closely connected to this research, which explicitly address decision making and why teachers teach the way they do.

The first study I review, Borko and colleagues (Borko, Roberts, & Shavelson, 1992), examines one mathematics teacher's beliefs on student learning and how these beliefs connect to her teaching. By focusing on what influenced the teacher's actions, the authors are implicitly looking at influences on her instructional decisions. This study examines a novice middle school teacher's beliefs and background to understand why the teacher does not give a conceptual explanation or a relevant, practical example for the division of fractions despite her strong beliefs that mathematics should be both meaningful and relevant to students. They found that without better conceptual knowledge of the subject or a greater commitment to finding the answers she needed—either through available resources or by trying to figure things out for herself through hard thinking—she was unable to follow through with her beliefs when teaching.

The researchers' conjectured that the teacher's lack of conceptual knowledge may have been a result of having taking traditional mathematics courses (she successfully completed the first two years of an undergraduate mathematics program) rather than those designed specifically for mathematics teachers. The traditional mathematics courses taken by mathematics majors in the first two years of study emphasize rote learning of computational techniques whereas the courses designed specifically for mathematics teacher explore ways to construct and represent those topics covered in elementary and middle school mathematics and challenge students' understanding of those topics. Given her success in K-12 and university level mathematics, she was not required to take mathematics content courses designed for teachers. It was assumed that

her knowledge and ability in mathematics was sufficient. This may have also indicated to herself that her mathematical knowledge and the ways in which she learned mathematics were sufficient, so she did not see the importance of a good explanation for the students. The authors also speculate that given the demands of the teacher education program and the need for her to plan the next day's lesson, she did not have time to reflect and come up with or find a good explanation.

The authors conclude that the teacher's mathematical experiences, knowledge and time constraints influenced her decision to end the conceptual explanation and not return to it despite her beliefs about teaching and learning. These factors are particularly relevant when examining community college instructors' decision making given their strong mathematics background, the heavy teaching load of full-time faculty, and the lack of pay for class preparation time for part-time faculty. Thus, it is possible that community college faculty strive to give conceptual explanations or use certain teaching methods, but because of individual characteristics (i.e., mathematical knowledge for teaching and mathematical experiences) and the demands and conditions of their positions, they do not.

Nathan and Knuth (2003) examined how classroom interactions can be shaped by a teacher's beliefs and interpretations of educational reform, and found these factors may not play out as expected in practice. This study followed a single middle school mathematics teacher over two years in which she attended professional development the summer before each year of observation. The study examined the flow of information in the classroom (vertical from teacher to students or horizontal between students at a comparable level of expertise) in conjunction with how the teacher perceived her role as a mathematics instructor and her goals and beliefs about student learning and development. The results showed that there was not a significant change in

the teacher's beliefs and goals over the two years, but there were changes in her teaching practice. The summer professional development session before the second year of observation appears to have given her the opportunity to reflect on her instructional practices and revealed to her that her beliefs about student participation and interaction were not compatible with her teaching practices. The analysis of the weekly classroom observations of this teacher indicated that she moved from a role of mathematical authority to providing more space for student-directed discussion that aligned with her beliefs. Based on this study, the authors conclude that changes in teachers' practices can occur within a consistent belief system—that it is not always necessary to change beliefs in order to change practices. This study demonstrates the potential disconnect between beliefs and teachers' actions and how discussions with others about teaching (in this case through professional development) can impact the decisions teachers make in the classroom.

Aguirre and Speer (2000) examine how teachers' beliefs interact with their goals and influence their moment-to-moment actions. They argue that beliefs play a pivotal role in a teacher's choice and prioritization of their goals and actions. This study examines two episodes of teaching by two different high school algebra teachers in which the teacher's goals shift. These shifts were identified by the researchers based on the actions of the teachers. By focusing on the apparent shift in the teachers' goals, the researchers identified the role that different beliefs—both those relating to the nature of mathematics and those pertaining to teaching and learning—play in teachers' actions. This study demonstrates how different beliefs may be more or less prominent at different moments in teaching. One drawback of this study is that the researchers are assuming what the teachers' goals and prominent beliefs are at a specific point in the lesson based on their actions, which Nathan and Knuth (2003) demonstrated do not always

align. What is clear in these studies is that there is not a clear relationship between of beliefs and actions thus other factors influencing decision making must be examined.

Hill and colleagues (Hill et al., 2008) examined how mathematical knowledge for teaching (MKT) is associated with the mathematical quality of instruction. This study revealed a strong correlation between a teachers' MKT and the mathematical quality of their instruction and identified several factors that can mediate the expression of MKT when teaching. The correlation was based on nine teachers' paper-and-pencil MKT assessments and an evaluation of their teaching based on the mathematical quality of instruction instrument (including measures for the mathematical rigor and richness, errors, explanations and justifications, and representations). To better understand this correlation, they did a qualitative analysis of five of these teachers' lessons. They found that teacher beliefs, routines, and curriculum material mediate the relationship between MKT and the quality of their instruction, and that these mediating factors can either improve or reduce the quality of instruction. We can conclude from this study that all the factors identified will play a role in teacher decision making and leaves open the question of how they influence decision making.

All of these studies look at teacher attributes and how these attributes influence practice. They demonstrate that an individual's beliefs may not connect with their practice, that certain beliefs may be pronounced at different times, and that a teacher's mathematical knowledge for teaching is associated with the quality of instruction. Each of these studies began with the assumption that individual teacher characteristics (beliefs or knowledge) primarily drive their decisions, and only as a result of the methods used were other mediating factors sought out to explain the teachers' actions. While the in depth examination of individual characteristics and

how they impact practice gives some insight into decision making, a closer look at how other factors influence decision making is needed.

There have been two major research projects in mathematics education that explicitly focus on teachers' decision making: the work of Alan Schoenfeld and the work of Pat Herbst and Dan Chazan. The work of these scholars exemplifies two different perspectives on why teachers teach the way they do. Schoenfeld's takes a primarily psychological perspective of teaching by focusing on the *teacher* and concludes that teacher action is based on the individual teacher's goals (with the underlying assumption that these goals are formed based on their orientations and the actions are shaped or limited by their knowledge). In contrast, Herbst and Chazan take a more socio-cultural perspective, focusing on the *role of the teacher*. I elaborate on these research projects, including shortcomings and affordances.

Schoenfeld's book, *How We Think* (2011), draws and is based on, his research over the past four decades and examines teaching from a psychological perspective—that how one teaches is a function of an individual, and therefore based on that individual's beliefs and knowledge. In this book he proposes a theory for how and why teachers teach the way they do. He claims:

> If you can understand (a) the teacher's agenda and the routine ways in which the teacher tries to meet the goals that are implicit or explicit in that agenda, and (b) the factors that shape the teacher's prioritizing and goal setting when potentially consequential unforeseen events arise, then you can explain how and why teachers make the moment-by-moment choices they make as they teach. (p. 10)

Thus the way teachers teach is a function of their orientations, goals, and resources. He defines *orientations* as their beliefs, values, biases, dispositions, etc., *goals* as the conscious or

unconscious aims they are trying to achieve, and *resources* as an individual's knowledge in the context of available material and other resources. These elements demonstrate the psychological perspective which Schoenfeld brings to his work.

Schoenfeld claims that if enough is known about these three aspects of an individual, their actions can be explained both at a macro and micro level (both broadly and in-the-moment). He claims that people, particularly teachers, have routines for familiar activities that structure the actions at the macro level, and thus routine choices are "easy and effortless" (p. xiv). He views individuals' routines as a resource which is based on an individual's orientations and uses these routines to explain "unproblematic actions." Through a very detailed analysis of three lessons taught by three different teachers, he claims that actions which may be seen as an unusual or anomalous are a result of in-the-moment decision making and are reasonable if you know enough about the individual's orientations, resources, and goals.

Schoenfeld recognizes that an action may be aligned with certain aspects of an individual's orientations and goals but not with others. As a result, it is necessary to know how an individual weighs the importance of their orientations and goals. In these cases, he assumes that an individual will assess the cost, benefits, and probable outcomes and choose the action they see as the best possible choice. In sum, this theory is based on three very intensive (and time consuming) post-hoc analyses of lessons (as well as other information from the teachers) from which his research group identified the routines, orientations, goals, and limitations on resources—which may or may not be known or in agreement with the individual teachers views.

There are two major shortcomings of Schoenfeld's work: his dismissal of contextual and socio-cultural influences and the underlying assumption that certain features (routines, goals and orientations) of individual teachers are taken as a given rather than as variable or malleable.

Schoenfeld acknowledges that more than an individual's orientations, goals, and resources shape his or her teaching and what a teacher can or cannot do is also dependent on constraints of the situation. Yet the constraints or conditions are not further addressed or included in his theory. When Schoenfeld talks about resources, he only focuses on knowledge. He does note that material and social resources are also drawn upon and must be taken into account, but does not examine or include these resources in his analysis. Thus the socio-cultural influences are largely ignored in his theory—they are only incorporated as side note recognizing that they exist.

Schoenfeld states that routine behavior is largely automatic, but does not explain or explore what shapes this routine behavior. Furthermore, there is no examination of what shapes an individual's orientations or goals beyond their knowledge. Thus his theory explains, post-hoc, a teacher's decisions based on perceived individual characteristics, but it is not a complete theory of decision making or why teachers teach the way they do. In order to explain the decision making of teachers and thus why teachers teach the way they do, the theory would need to account for other factors beyond the individual such as the context in which they teach.

In contrast to Schoenfeld's work, Herbst and Chazan's (2003, 2011, 2012) theory of practical rationality of mathematics teaching examines why teachers make the decisions they do and it situates these reasons in the instructional context in which they occur rather than as an individual or personal decision. By viewing instructional decision making in the context of instruction, the focus is on the context of *teaching* not the individual *teacher*.

The theory of practical rationality assumes that teaching and instructional decision making are part of a "complex system of interrelated agents" rather than as "expressions of free willing individuals" (Herbst & Chazan, 2012, p. 601). This view incorporates the interactions between the teacher, the students, and the content in the environment. It complements the

individual-centered perspectives, which focus on teacher beliefs and knowledge, by taking the theoretical position that teaching is a natural phenomenon that happens in response to the conditions and constraints of the environment and that includes positions, roles, and relationships.

This theory maintains that teaching decisions are shaped by the presence of two sets of regulatory elements: norms and professional obligations. The classroom norms[2] are mutual expectations between the teacher and students that are governed implicitly by the didactic contract. Professional obligations refer to the obligations that mathematics teachers have and are theorized to fall into four categories: *disciplinary*, *individual*, *interpersonal* (to the class as a whole), and *institutional*. The *disciplinary obligation* states that the mathematics teacher must teach a valid "representation of the mathematical, practices, and applications" of mathematics (Herbst & Chazan, 2012, p. 610). The *individual obligation* states that the teacher must "attend to the well-being of the student," which includes attention to students' behavioral, cognitive, emotional, or social needs (Herbst & Chazan, 2011, p. 450). The *interpersonal obligation* is the obligation to "all of the individuals who are together in a classroom [who] need to share resources such as time, physical space, and symbolic space in socially and culturally appropriate ways" (Herbst & Chazan, 2012, p. 610). The *institutional obligation* recognizes the obligations a teacher has to "regimes of coarser grain size than instruction" (p. 610) such as their department or institution.

Herbst and Chazan's theory views these obligations as both constraints and resources that can help to justify apparent breaches of the norms of instructional situations. Thus they conclude that both usual and unusual actions of teaching can be accounted for by norms and obligations.

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[2] Norms can be defined as the most frequent or expected behavior in a recurrent social encounter (Herbst & Chazan, 2012).

This theory nicely complements the research on teachers' beliefs and knowledge. It takes a socio-cultural perspective, which recognizes and focuses on factors beyond the individual that both shape and constrain decisions. The socio-cultural and psychological perspectives together create a more robust theoretical framing to examine instructional decision making. In addition, considering these two perspectives together allows us to investigate the interaction between the individual and the environment.

Before describing the conceptual framework guiding this study, I review some theoretical underpinnings of decision making not addressed in the literature on mathematics teaching.

Decision Making

In this section I give some historical and theoretical background, then focus on two aspects of decision making which are most relevant to my understanding of instructional decisions—the logic of consequence and appropriateness, and maximizing and satisficing.

The history and theory of decision making that I review here gives us a better understanding of what a complex and multifaceted area of study it is. The earliest conception of decision making was that a reasonable person will choose the alternative that maximizes the expected value (attributed to Pascal and Fermat, 1654; Hacking, 1975). Maximizing the expected value[3] is choosing an action that if done repeatedly would result in the most desirable outcome. This conception of decision making is known as *rationality*. While rationality initially and intuitively makes sense, there are many simple paradoxes that conflict with this notion. One

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[3] Expected value is what the cost or benefit of a decision would be by removing the possibility of chance—by repeating infinitely many times. For example you enter into the following bet with a friend that involves drawing a red ball out of container that contains 1 red ball and 3 black balls. If a red ball is drawn, you get $2, if a black ball is drawn you pay $1. The expected value of this gamble is losing $0.25 [$1/4*2 + \frac{3}{4}*-1=-1/4$]. Similarly if a similar bet is that if a red ball is drawn you get $4, if a black ball is drawn you pay $1, the expected value is winning $0.25 [$1/4*4 + \frac{3}{4}*-1=+1/4$].

example is the St. Petersburg paradox[4]. The St. Petersburg paradox is a gamble with an unbounded (infinite) expected value, yet as pointed out by Hacking (1980), "few of us would pay even $25 to enter such a game" (p. 563)—hence the paradox. Thus a theory of rationality for decision making in its purest form is at odds with common sense (Gigerenzer & Selten, 2001). In spite of this realization, the underlying assumption that decision makers aim for maximization or optimization—be it expected value, utility, or some other measure relating to risk and benefit—largely dominates the thinking about decision making to this day.

Rationality became popularized in economic decision making in the 1950s when economists assumed that individuals will choose the alternative that best serves their self-interest. Studying decision making within a framework of rationality allows researchers to focus on one piece or slice of the very complex decision-making process—specifically which choice has the "best" outcome. Rationality can be used to describe and predict behavior, but does not account for *actual* behavior (Gigerenzer & Selten, 2001, March, 1994). Viewing decision making as a purely rational act ignores the psychological and sociological influences of decision making; behavioral assumptions are made that are too narrow or ignore institutions and individual actors (Nielsen, 2009). For example, investing in a friend's company may maximize the possibility of high fiscal returns, but it could also create an unwanted tension in the friendship. In a situation like this a model could not predict the likelihood of the investor's decision; it would depend on the individual.

While it has long been known that rationality has shortcomings and is generally not the perspective of decision making taken by those who theorize about or explicitly study the

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[4] The St. Petersburg paradox is a monetary gamble based on a fair coin toss. A coin is repeatedly tossed until it lands on heads at which point the game is over. If the coin lands on heads on the first toss the player receives $1. If heads appears on the second toss the player receives $2, if on the third $4, if on the fourth $8 and so on. The question is, what is a fair price to play the game? The expected value of this gamble is infinitely large
$[1/2(1)+1/4(2)+1/8(4)+1/16(8)+\ldots+1/(n^2)(n) = \infty]$.

decision-making process, it has continued to hold a major place in applied research on decision making (March, 1994). In the 1950s, H. A. Simon recognized that cognitive limitations are a key part of the decision-making process, specifically that decision makers are rational, but they are unable to find all possible alternatives and evaluate all possible consequences (Simon, 1955), which became known as *bounded rationality* (Gigerenzer & Selten, 2001). Like rationality, Simon's model had limited success and models of decision making have continued to be modified. It is still common for researchers to assume that decision making is a purely rational act and then change or modify this assumption when it do not align with observed behavior (Gigerenzer & Selten, 2001).

More recent work in behavior economics (i.e., Ariely, 2008; Kahneman & Tversky, 2000) has challenged theories of rationality and bounded rationality. This work acknowledges the effects of psychological (both cognitive and emotional) and social factors on decision making. For example, Tversky and Kahneman recognize that a decision can be framed in different ways based on individual decision-makers' norms, habits, and personal characteristics (Tversky & Kahneman, 1981) and examine the influence of risk and uncertainty on decisions (Kahneman, Slovic, & Tversky, 1982). Ariely (2008) explores the "predictable irrationality" of decision makers and acknowledges "human deficiencies" (i.e., our susceptibility to irrelevant emotions and environmental influences, procrastination and lack of self-control, and expectations) which result in irrational decisions and "falling short of our ideals" (p. 240).

Assuming decisions are made based on rationality or bounded rationality makes studying decisions a simpler task, but behavioral economics makes it clear that decision making is far more complex than individuals making decisions based their psychological capability to see what choice will produce the best outcome.

As previously discussed, decision making can be studied in terms of how decisions *ought* to happen or how they *actually* happen, both of which have their merit and contribute to our understanding of teaching. In this study I attend to what instructor say about why instructional decisions are actually made. I choose this way of looking at decision making for three reasons. First and foremost because teachers are people—they are not machines and are generally not going make decisions based only on an ideal heuristic—if one even exists. Second, teaching is not a simple task with a single well-defined goal and involves multiple and sometimes competing roles and responsibilities. Finally, a significant amount of literature focuses on what good teaching should look like. By focusing on what teaching should look like, decision making is, to some extent, taken out of the hands of individual teachers, and implies that there is an optimal heuristic for decision making or sets aside a major component of decision making by implying that one should make certain decisions. As a result, discussing what teaching decisions ought to be made focuses on student learning and the discipline, and generally does not account for the conditions and constraints or the individual. In examining what is said about why instructional decisions are actually made, I focus on two aspects of decision making that are particularly relevant to my conceptualization of instructional decision making: the logic of choice, and maximizing and satisficing.

Decisions can be seen as being made based on two different logics, one of consequence and one of appropriateness. Logic of consequence, also known as choice-based decision making, evaluates the consequences of the decision. The logic of appropriateness, also known as rule-based decision making, fulfills identities or roles by recognizing the situation and following rules that are appropriate. Both types of logic are sound, prompt thought, encourage discussion, and incorporate personal judgment and preferences. The logic of consequence focuses on individual

preferences and expectations whereas the logic of appropriateness focuses on situations, identities, and rules. Certain disciplines tend to privilege one logic over the other. For example, economics, psychology, and political science generally emphasize the logic of consequences. In these fields individual choice, preferences, and goals are central and consequential analysis dominates. In fields such as sociology and anthropology the social and institutional roles and rules are central, and thus decisions are thought to be made based on rules which includes good sense about consequences, preference, and calculations (March, 1994).

For the purposes of this study, I attend to both logics in order to account the both the psychological and socio-cultural influence on individual's decision making. I take the perspective that individuals attend to both the appropriateness and consequence of their decisions, and depending on the context—both in talking about and in the act of making and carrying out an instructional decision—one logic may be more apparent or prominent than the other.

Decision makers can seek to maximize or satisfice. Maximizing decisions occurs when one seeks to choose the optimal alternative—the one that will maximize the chosen outcome. For example, in teaching, the desired outcomes may be deep understanding of a concept, mastery of a given procedure, covering as much material as possible, or keeping students engaged. Yet, decision makers often do not search for the best possible action, but instead search for one that is good enough—they satisfice (Simon, 1956). Satisfice is a combination of the words *satisfy* and *suffice* and means to pursue the minimum satisfactory condition or outcome. Satisficing is choosing an alternative that meets (or exceeds) some criterion or target whereas maximizing is choosing the best alternative. Although many researchers assume that decision makers maximize, it can be observed that people often satisfice rather than maximize.

Maximizing assumes almost unlimited cognitive capabilities; it requires that all possible alternatives be compared and calculated so the best one can be chosen—alternatives are continually set against each other. Satisficing is cognitively a simpler task—it requires only a comparison of alternatives to the target and stops once an acceptable option is found. Decisions based on satisficing are largely influenced by which option is considered first; the process does not continue once an option that suffices is found. Satisficing assumes that people are more concerned with success or failure rather than gradations of the two. With satisficing it is also possible that no option will satisfy all the criteria, and thus a decision will not me made.

In reality, people use both maximizing and satisficing, but it is not empirically possible to distinguish which is being used—though it can be speculated when the contemplation of a decision is done out loud (March, 1994). "Observations of actual decision making in such domains as new investments, energy conservation, and curricular decisions indicate that satisficing is an aspect of most decision making but that it is rarely found in pure form" (March, 1994, p. 21). When talking about the decision-making process, people seem to generally accept the "ideology of maximization" (March, 1994, p. 20), but their description or process reflects satisficing.

There are two theoretical considerations when thinking about satisficing and maximizing in teaching—one is cognitive and the other is emotional. From a cognitive perspective, satisficing simplifies things in a complex world, which is especially relevant when one is taking on a complex task such as teaching. Yet from an emotional perspective teachers are motivated to help their students as best he or she can, not only meeting a certain goal (i.e., having every student earn a C, or ensuring that a certain percent of the students pass an exam).

While the literature demonstrates that decision making is clearly complex and attempting to distinguish between the use the logic of consequence and appropriateness or between satisficing and maximizing is futile, these notions allow us to better understand some of the nuance in decision making and help to better understand why teachers teach the way they do.

Conceptual Framework

The perspective I bring is a result of the reflexive nature of theory and practice (e.g., Cobb & Yackel, 1996), that is I approached the study with one theory in mind and through the practice of doing research I found the need to revise the theory and this revised theory will then guide later work. When initially approaching this study my perspective was largely socio-cultural; I focused on the conditions and constraints of community college mathematics instructors and how they shape or define their instructional decisions. As I delved into the data and analysis I found that the individual in the role of a mathematics teacher must not be overlooked or made less prominent than the social forces. This led to incorporating both psychological and socio-cultural perspectives into my work.

I see teachers as both professionals and individuals. I recognize that they have professional and personal obligations and beliefs as well as emotions, all of which impact the decisions teachers make, and thus cannot be ignored. In addition, I am not making judgments on the appropriateness of a decision nor attempting to discover what individuals are lacking. I take the position that community college mathematics instructors—both full- and part-time—do the best they can when teaching. Yet I recognize that in their role as instructors, they may have competing goals and obligations, which can constrain their ability to improve and excel in teaching. Furthermore I acknowledge the context in which they work, both in and outside the classroom can personally and professionally affect an individual in ways that can be indirectly

beneficial or detrimental to their teaching. In order to capture the full range and interaction of these influences on instructional decisions, I propose a conceptualization of instructional decision making that incorporates the psychological aspects of teachers as individuals in the role of a teacher and the socio-cultural influences that arise from participation in the profession and as an individual (not connected to the profession).

As indicated in the literature, both individual characteristics (psychological perspective) and the environment (socio-cultural perspective) play a role in instructional decision making. The current theories take either a psychological or socio-cultural perspective by focusing on individual characteristics (i.e., Schoenfeld) or the situation (i.e., Herbst & Chazan).   These theories acknowledge the influence of the other perspective, but do not incorporate them into the theory.   Both perspectives give incredible insight into decision making and teaching, thus including both in a theory will make it more robust. Yet simply including both perspectives into a theory is not sufficient—the interaction between the psychological and social must also be attended to, specifically, how the environment impacts the individual. What I propose is that a solid theory on why teachers teach the way they do must attend to teachers as individuals, the environment in which they teach, and the interaction between the two.

Chapter 3

Methods

This chapter is organized into three sections. I first describe the data used, including a description of the setting that provided the context for the study, data collection procedures, and the participants. I then present the details of analyses I performed, beginning with the use of Systemic Functional Linguistics for analysis and followed by a detailed description of the coding process and further analysis of the data. In the last section I address matters of trustworthiness, specifically limitations of this study, my subjectivity, and how I approached issues of validity.

Data

In this section I describe the professional development sessions in which the data for this study were collected and the data collection processes. I conclude with a description of the participants: how they were recruited and background information of each participant.

Setting

The data for this dissertation come from faculty development sessions for mathematics faculty at community college who had experience teaching trigonometry. These faculty development sessions are part of a larger research project (Mesa, 2008) studying mathematics instruction in community colleges. The faculty development was a series of five 3-hour sessions that occurred monthly on Saturday mornings during the fall 2011 semester. There were two concurrent sections—one for full-time faculty and the other for part-time faculty. I describe the

details of faculty development session as well as the rationale for the design and the use of these sessions for this study.

The faculty development sessions used to collect the data for this study were organized around discussion of key components of instruction. These sessions were an ideal setting to explore instructors' reasons for making instructional decisions because they were intended to be a safe place for instructors to talk about and explore different ideas about their teaching. This type of group setting is beneficial to this study because the participants collectively touch on many more ideas and topics than any one individual would, which creates a space where instructors can talk to each other about their practice as a means to reflect on their teaching and construct new ideas.

Trigonometry was chosen as the subject of the professional development to make sure that the discussions were about teaching specific mathematics content rather than teaching in general. Trigonometry is a topic that connects different facets of mathematics previously learned—algebra, geometry, and graphical reasoning—and is a prerequisite for calculus and other college level courses such as physics, engineering, and architecture (Weber, 2005). Trigonometry is usually the first time that these different facets of mathematics are all brought together, allowing the discussion to focus on each of them. Trigonometric functions are also mathematical notions that have multiple ways of being conceptualized and represented—all of which are important in gaining a deep understanding of the subject. Trigonometric functions can be seen as the ratio of sides on a right triangle or as functions from real numbers to real numbers (Kendal & Stacey, 1997), and can similarly be represented in triangles, on a unit circle (on a combination polar/Cartesian graph), or as a function (on the Cartesian plane). This range provides space for discussing the use and role of multiple representations in mathematics and the

meaning and correspondence with the different conceptions of the trigonometric functions. Furthermore, trigonometry occurs midway through the sequence of courses taught in community colleges (arithmetic, introductory algebra, intermediate algebra, college algebra, pre-calculus/trigonometry, calculus, linear algebra, differential equations), so discussion about trigonometry may include discussion of the other courses, because they were prerequisite or because they are meant to prepare students to further courses.

The sessions were modeled after study groups used by the Thought Experiments in Mathematics Teaching project (Herbst & Chazan, 2003; Nachlieli, 2011). The faculty development sessions served a dual purpose: to act as professional development for the participants and as a means to gather data about why community college instructors teach the way they do. To meet these goals each session had two facilitators—a moderator and a researcher. The moderator's role was to create a space in which the instructors were comfortable discussing teaching, whereas the role of the researcher was to probe and ask questions about teaching decisions and why the instructors would make those decisions. Animations were used to elicit conversations about instruction (Herbst & Miyakawa, 2008; Mesa & Herbst, 2011) through the depiction of a community college trigonometry class that either breached or complied with the norms of community college mathematics classes so that aspects of instruction that may not have otherwise been talked about were made explicit for discussion.

The sessions were designed using the instructional triangle as a guiding model for instruction (Cohen, Raudenbush, & Ball, 2003), and each session included exploration of a trigonometric topic and involved the use of either an animation depicting a community college trigonometry classroom or other video material (e.g., a Khan Academy video, a student interview) to encourage discussion about instruction, while always keeping the context and

environment in mind. For this study I only analyze the portion of these sessions where instructors responded to the animation of a community college classroom (the latter part of sessions two and four and session five). I first describe the animation and the norms and breaches, and then give an overview of each of the five sessions for the context in which this discussion occurred.

The animation.

The animation is a seven-minute segment of a trigonometry class in which the instructor is demonstrating how certain trigonometric identities can be used to find the value of the remaining four trigonometric functions given the values for sin x and cot x. The lesson follows a pattern of teaching that is common in trigonometry classes: the instructor presents the material and solves examples on the board, and students participate in the lesson by answering the instructor's questions.

In the animation, the instructor writes on the board the definitions of tan x, csc x, sec x, and cot x in terms of sin x and cos x (e.g., tan $x = $ sin x/cos x,) and the Pythagorean identities ($\sin^2 x + \cos^2 x = 1$, $1 + \cot^2 x - \csc^2 x$, and $\tan^2 x + 1 = \sec^2 x$). She gives the following problem: Find the exact values of the remaining trig functions given sin $x = $ -4/5 and cot $x = $ -3/4. She works through the problem by first finding csc x and tan x. The method she employs to find cos x and csc x is to first determine the sign of cos x using a modified unit circle to identify the quadrant in which the angle x is located and then use one of the Pythagorean identities to find cos x.

The students participate throughout the problem by asking and answering questions. Some students indicate that they understand by correctly answering the questions she poses. Other students indicate they do not follow or understand what the instructor is doing through

their facial expressions, by giving incorrect answers, by asking the instructor to repeat what she said, or by stating that they do not know what is going on. There are also students who pose alternative ways to solve the problem that do not require the use of the Pythagorean identities—one by using the triangle definitions of the trigonometric functions (i.e., sin x = *opposite* / *adjacent*) and another by using her calculator to find the value of x.

The animation was designed to exemplify some of the norms that were identified as regulatory of mathematics instruction at community colleges. One norm is that instructors should acknowledge all students questions and responses. In the animation the instructor's questions and responses to the students vary, although she generally does not respond to the students' incorrect answers or requests to repeat and often answers her own questions. Another norm is that the teacher determines how problems are solved and the students follow along answering very direct questions. In the animation, students pose alternative ways of solving the problem and the teacher redirects the class back to her method of solving the problem. For example, when the teacher asks why cos x will be positive, one student indicates that he used the ratio definitions: "because the adjacent side is positive." The instructor's response to this is, "Does anyone *else* know the answer?" When another student indicates she used her calculator to find the angle, -53 degrees, and from this determines that x is in the fourth quadrant, the instructor responds, "*Okay*, but the problem asked for exact values. How would the identities tell you that it is in the fourth quadrant?"

Three variations of the animation were designed to illustrate breaches of some of these norms. In each of the variations, the instructor's questions are more or less open-ended. For example, after stating the problem, she asks, "Could we find anything else using that information?" "How can we find the values of the other functions?" or "What are the two we

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automatically get for free?" The animations also vary in the ways the instructor allows students to interact, which alters how long it takes to work through the problem. For example, in one variation the instructor explains why the angle must be in the fourth quadrant and then says, "See how that works?" In the other variations she asks the students, "Where could the angle be given that the sine is negative?" and follows up with, "Why is that?" which results in more back-and-forth between the students and the instructor.

Throughout these animations, there are several norms that are breached (see Mesa & Herbst, 2011 for details on the design of the animation and the norms and breaches chosen). For example, one norm is that instructors engage students by asking questions about how to apply known procedures; students typically do not choose the method for solving a problem on the board. In these animations, that norm was breached by asking students to decide what procedure to apply (e.g., "How can we find the values of the other functions?"), although the instructor remained set on solving the problem with her chosen method. Another norm is that instructors should acknowledge every student's question or response. In this animation, there was one student who on several occasions asked the teacher to repeat what she said and made it clear that he did not understand, but the teacher did not acknowledge him and continued with the lesson. In another instance, one student wanted to use her calculator to solve the problem and the instructor stated that the calculator could not be used. The breach occurred when the teacher said that they could not use the calculator was because the problem asked for exact values, but she did not inform the students that using the calculator in that way could result in an incorrect answer in other problems nor why that was the case.

The professional development sessions.

As previously mentioned, the data were limited to the portion of the sessions where instructors responded to the animation. Here I describe each of the five sessions to give the context in which the discussion of the animation occurred.

The first session explored the definition of angle—a basic, yet complex mathematical notion in its origin and its measurement—and instructors were first introduced to the idea of responding to a representation of teaching through a Khan Academy video about radian and degree conversions. The goals of this session were for participants to get comfortable expressing themselves in this setting, to have conversations about mathematics, and to get them talking about teaching as well as talking about how to teach without having concrete definitions of mathematical notions.

The second session focused on noticing teaching. The mathematical topic was solving trigonometric equations (given the value of two trigonometric functions for an unknown angle, find the values of the four remaining trigonometric functions)—a common task in trigonometry. In this session the participants were also introduced to animations of mathematics instruction, first by watching and commenting on an animation of a high school algebra class followed by viewing and commenting on the animation of a community college trigonometry class.

The third session focused on a student's understanding of a trigonometry identity and teachers' awareness of students' difficulties. The mathematical topic was inverse trigonometric functions, specifically the cosine - inverse cosine identity:

$$\cos(\cos^{-1}(x)) = x \quad -1 \leq x \leq 1$$
$$\cos^{-1}(\cos(x)) = x \quad 0 \leq x \leq \pi$$

After exploring the mathematics of the identity, participants watched a video of a student who was answering a question about the identity; the discussion following the video centered on the instructor's responsibility towards students' understanding as individuals and as a class.

The fourth session was about using multiple representations and addressing multiple ways of solving a given problem, so the focus was on content but in a way that also required attention to teaching. A variation of a problem introduced in the second session—given the values for two trigonometric functions of an unknown angle, find the values of the remaining four trigonometric functions of that angle—was used throughout this session. Participants were asked to complete the task using specific methods and to mathematically connect the different methods. The trigonometry animation was then viewed and discussed.

The final session focused on instructional choices, with the students and the content being central to the discussion of those choices. In this session the instructors viewed and compared various short segments of key decision points in the three animations where the teacher took different actions. We asked instructors to give their opinion and justifications for what circumstances make those decisions viable or not. The decision points were tied to norms of the trigonometry classroom including: (1) the expectation that students check answers for correctness, even though this is rarely done in class; (2) instructor's need to be direct about what they want students to do, because open-ended questions are not appropriate; (3) every student question must be acknowledged; (4) calculators should only be used in particular situations; and (5) the only solution that should be seen in class is the correct one.

Data Collection

Each faculty development session was audio and video recorded. During each session two researchers took field notes—one kept a video log that documented the main activity,

paraphrasing what was said every five minutes, the other researcher (me) took field notes on what was being discussed and general impressions of the discourse. Prior to the first session participants filled out a questionnaire about their educational and professional background, teaching experiences and preferences, learning objectives for students, and views about mathematics in general and trigonometry in particular (Appendix A). At the end of faculty development series participants were again asked to fill out the portion of the initial questionnaire about mathematics.

This study focuses on the whole group discourse that occurred in response to viewing the animations, which occurred in the latter part of sessions two and four and all of session five. The total amount of discourse analyzed was 9 hours and 36 minutes in length (4:54 for the full-time group and 4:42 for the part-time group). I chose to analyze the discourse around the animations because the animation brought together all of the elements of instruction—the teacher, students, and mathematics in the community college setting—and the interactions between them. In contrast other portions of the sessions were more focused on one or two of those elements or were not based in the community college setting. Focusing on these data allowed me to identify instructional decisions, the given justifications, and interpersonal linguistic features of decisions that were contextualized in the community college classroom. This context created a setting in which all the elements of instruction and their interactions were open for discussion.

Participants

The participants of the faculty development program were recruited by sending a letter to the chair of the mathematics department (Appendix B) at the 18 community colleges (including their satellite campuses, for a total of 22 invitations) within 100 miles of Ann Arbor, MI. Each chair was asked to nominate four faculty members—two full-time and two part-time—that

would be able to attend all five sessions. Responses were received from 14 community colleges; only 11 chairs sent nominations for a total of 32 faculty names. To keep the groups at a size in which there were enough instructors for ample discussion, but not so many to impede even participation in the discussions, we invited 10 full-time and 10 part-time instructors representing all 11 of the colleges who had interested faculty. For transportation reasons, one part-time instructor attended the full-time instructors' session, resulting in one group of 11 instructors and one group of 9 part-time instructors. Participants were compensated with $105 for participating in each 3-hour session; transportation costs were reimbursed.

This selection generated a sample of participants with a wide range of academic backgrounds, number of years of teaching, and non-teaching experiences (see Tables 1 and 2). Among the participants, ten held a Master's degrees in mathematics, four had a Master's degree in mathematics education, and eight had either a degree in education (mathematics or otherwise) or taken the courses required to be certified as K-12 teachers. Furthermore four participants had degrees in engineering, six in physics, and one in computer science. Fourteen held degrees in multiple fields. The instructors' educational background as a group is representative of the faculty in two-year colleges in the nation (see Lutzer et al. 2007).

The years of experience teaching college mathematics in this sample ranged from 3 to 35 years with an average of 13 years. The distribution of years of experience varied between full- and part-time faculty, but both groups had both junior and senior faculty. The full-time faculty group's experience ranged from 3 to 35 years with an average of 16 years and the part-time faculty group's experience ranged from 2 to 22 years with an average of 10 years. Five instructors had also taught other subjects at the community college (including physics, astronomy, physical science, and law). Seventeen participants have taught in settings other than

the community college—twelve at a 4-year institution or university and 8 in middle or high school. All but one participant have held jobs outside academia ranging from working at retail stores and selling cosmetics to working as an engineer and practicing law.

Table 1: Participants' education background and experience, full-time group

Name	Field of Bachelor's Degree	Field of Master's Degree	Other Degrees or Certification	Years Teaching College Math
Elizabeth	Mathematics	Mathematics		10
Erin	Mathematics & Sociology	Sociology of Education	Teaching Certificate	16
John	Electrical Engineering	Electrical Engineering, Mathematics Ed; Applied Mathematics; Pastoral Care & Counseling; Practical Theology	PhD, Applied Statistics, Evaluation & Research	19
Kirk	Mathematics	Mathematics		8
Lou	Physics	Physics; Solid State Physics; Engineering Science		25
Morton	Mathematics	Mathematics Education	Teaching Certificate (math, physics, chemistry)	35
Nelson	Physics & Mathematics	Physics	PhD, Physics, general relativity	17
Olga	Mathematics	Mathematics		5
Peter	Mathematics	Teaching in the Community College	Teaching Certification (math)	23
Theresa	Mathematics; Physics	Mathematics		15
Miriam[a]	Mathematics	-		3

Note: a. Miriam was a part-time instructor.

Table 2: Participants' education background and experience, part-time group

Name	Field of Bachelor's Degree	Field of Master's Degree	Other Degree or Certification	Years Teaching College Math
Edgar	Mathematics	Mathematics	J.D., Commercial and Corporate Law	11
Kathryn	Mathematics	Mathematics	Coursework for Teaching Certification	22
Lynn	Applied Mathematics & Astrophysics; Electrical Engineering	Applied Mathematics		6
Ned	Computer Science; Mathematics	Mathematics	Teaching Certification (math)	12
Rhonda	Mathematics	Mathematics		20
Rosa	Mathematics & Physics	Mathematics	Teaching Certification (math & physics)	2
Sebastian	Engineering Physics & Mathematics	Physics		3
Thomas	Mathematics	Education	Teaching Certification (math)	5
Ursula	Business Administration (Finance) & Mathematics	Education (Mathematics)	Teaching Certification (math)	5

The participants' experience in teaching trigonometry or a course that includes trigonometry ranged from one semester to over 40 semesters with an average of 15 semesters. Fourteen instructors had taught trigonometry in the previous academic year and all had taught trigonometry in the last five years.

Analysis

The major analytical tool I used was Systemic Functional Linguistics. I start with a brief description of what SFL is, together with the rationale for this choice. I then explain the process I used to code the data including a description of the features of language I chose to analyze and how I used these features of language to inform this study. Next, I present an illustration of the coding process with an excerpt from the corpus, and then describe the analysis of turn-taking patterns. Finally I describe the analysis comparing the full- and part-time groups.

Systemic Functional Linguistics (SFL)

As meaning is created through language, I use Systemic Functional Linguistics (SFL; Eggins, 2004; Halliday & Matthiessen, 2004) to analyze the discourse. This theory of language is particularly suited for this analysis because it gives a holistic view of the discourse through analysis of different and simultaneously occurring types of meaning: the content or real-world meaning and the speakers' attitude or stance. This makes it possible to identify the instructional decisions and reasons for making these decisions, and examine the agency instructors convey in each instructional decision through language choices. I have chosen to use SFL to analyze the discourse because of its comprehensive and theoretically grounded approach to language (see Eggins, 2004; Halliday & Matthiessen, 2004). This theory of language is based on the notion that people use language to make meaning. Because SFL looks at the relationship between language and context, it allows for a holistic view of the discourse (more than many other types of discourse analysis) without losing contextual meaning and depth; it is ideal for empirically examining discourse. In this section I elaborate on the features of SFL and how they are connected to and used in this study.

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Systemic Functional Linguistics addresses how language is structured to make meaning. There are three metafunctions, each contributing to different types of meaning: *ideational*—the content or real-word meaning of what is being written or said; *interpersonal*—the relationship between the writer or speaker and the reader or listener; and *textual*—the organization of the writing or speech. Each metafunction is always simultaneously present in every instance of language use. In this study the ideational and interpersonal metafunctions are the foci of the analysis (Table 3).

Table 3: Metafunctions and features of language used in analysis

Analysis	Metafunction	Feature of Language Examined
Identification of instructional decisions	Ideational; experiential meaning	Agent and processes types
Locating reasons for instructional decisions	Ideational; logical meaning	Causal-conditional extensions and conjunctions; Purpose clauses
Categorizing reasons	Ideational; experiential meaning	Meaning in participant-process configuration
Agency conveyed through instructional decisions	Interpersonal	Degree and type of modality used; Grammatical person
Turn-taking patterns	Interpersonal and Textual	Number of and length of turns

As I describe in detail below, the identification of instructional decisions—statements about an instructional action—and the justifications for those decisions relied on analysis of ideational meaning. The ideational metafunction has two aspects—experiential and logical meaning. I drew on analysis of experiential meaning to identify instructional decisions and on logical meaning to locate the reasons.

Also presented through ideational resources is the content of the justification for making those decisions. The content of the justification for a stated instructional decision is why teachers say they make these decisions. I further examined the *participants* and *processes* in the justification to categorize these reasons

Further analysis of the instructional decisions—how instructors position themselves with respect to each instructional decision and in general—focused on interpersonal meaning. This analysis allowed me to assess the instructor's attitude or stance towards each instructional decision as well as the overall tone of the discussion. The *modality* of each instructional decision and the use of different agents enabled me to identify differences in the instructors' agency and how the full- and part-time instructors position themselves as mathematics instructors.

Also analyzed were the turn-taking patterns of the discussion. The number of turns each participant took and the length of each turn help to describe how instructors' position themselves, contribute to understanding their agency, and describe how open and collaborative the discussion is.

Coding Process

The coding process for this study was complex and had three stages (see Figure 1). I will give an overview of three stages and then describe in detail the coding method. The first stage consisted of identifying all instructional decisions in the corpus. Each instructional decision was then coded for (1) the actor (I, we, you, or teacher in the animation—she), (2) the degree of modality (no modality, high, median, or low), and (3) the type of modality (probability, usuality, requirement, or inclination) indicated. In the second stage I identified instructional decisions that included a justification. In the third stage I identified the reasons given within the justification. In the following sections I describe in detail each of these stages with the coding of each aspect.

As a result of this coding process I have two basic units for analysis—instructional decisions and justifications. Each instructional decision is assigned a single code for actor (I, we, you, or she), degree of modality (no mod, high, median, or low), and if the statement indicates a requirement. Each justification is assigned one or more codes for the reasons given.

```
Stage 1: Identify instructional decisions and determine
        (1) Actor
        (2) Degree of modality
        (3) Type of modality
Stage 2: Identify justifications
Stage 3: Identify reasons within justifications
        Student
              Intellectual
              Emotional
              Physical
        Class
        Content
        Teacher
        Institution
        Lesson
```
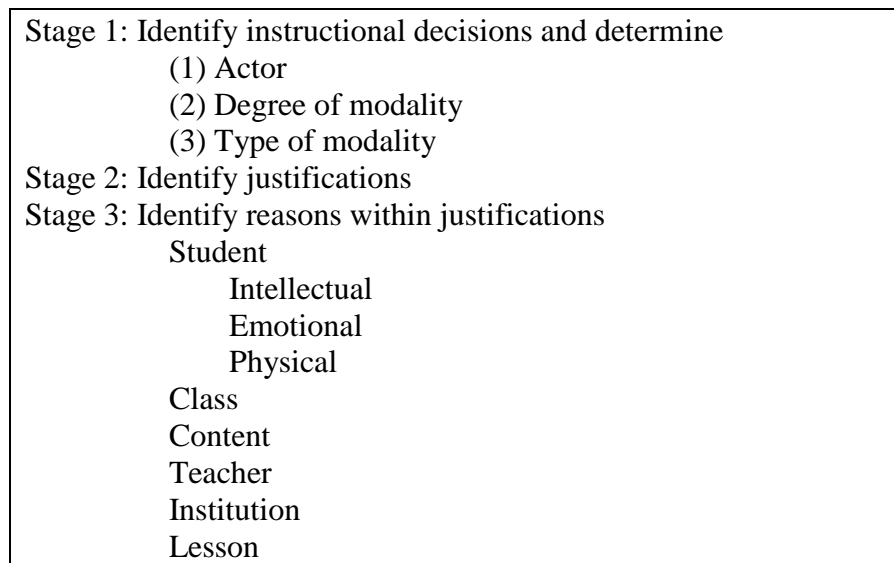
Figure 1: Stages in the coding process

Stage one: Identifying instructional decisions.

Instructional decisions are operationalized using SFL: they are statements about instruction in which a person in the role of an instructor is the actor, behaver, or sayer. To identify instructional decisions, I first located statements in which the *actor* is an individual or individuals in the role of an instructor. This included the individual instructor (I), instructors (you/we), the teacher in the animation (she), or another instructor. For each statement in which a pronoun was used, the context was examined to verify that the actor was an instructor and that the statement was referring to that person in his or her role as a teacher. I then ruled out those instances in which the *process* was mental (experiencing or sensing), or relational (being), leaving only statements with material (doing), behavioral, or verbal processes. I did not include

the statements in which the *process* was relational or mental[5] because these processes do not indicate an action (and thus decision) that could occur in instruction.

Three examples of instructional decisions are, "I would have *said* to everyone why can't we?" "She should have *written* it," and "The first day of class I will not *lecture*." Notice in the first example, the actor (sayer) is the instructor speaking and the process, saying, is verbal. In the second and third example, processes are material, writing and lecturing. Based on the context of the second example, *she* is the teacher in the animation. The following three examples were not coded as instructional decisions because the processes are mental or relational: "I *know* he [a student] has an issue," "At this point I *thought* that it's clear the angle is in the fourth quadrant," and "I *have* two good students in my calc one class this semester."

Identifying the instructional decisions drew on resources from ideational meaning; more specifically from the experiential aspect of ideational meaning that considers agency. By selecting statements in which the agent of an instructional action is a person(s) in the role of a teacher, I was able to identify all the instances in which the participants discuss an instructional decision made by themselves or others.

Example of discourse coding.

The following excerpt illustrates how instructional decisions were identified and coded for actor and modality. Following each section of the excerpt I explain in each instance how the features of language allowed me to determine which statements are or are not instructional decisions. Because I started the process of locating instructional decisions based on the actor, it is important to note that in many instances *you* refers to someone other than the teacher or the

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[5] Existential processes (existing, such as "there are…") were not included as instructional, but did not have to be ruled out because a person cannot be an actor of an existential process.

actor is ellipsed (omitted from the clause), so the context is necessary to determine the actor in a statement. There are also instances when a person in the role of a teacher is being referred to, but that person is not an agent; he or she is not initiating an action or making something happen. In the excerpt below, each *participant* holding the role of the teacher is italicized and when the action is an instructional action (action, saying, or behaving), the entire instructional decision is underlined. When the actor is ellipsed and it is recoverable, an asterisk after the action indicates that the actor is someone in the role of a teacher.

Key: *Participant* holding the role of the teacher is italicized
 * Ellipsed participant in the role of a teacher is noted with an asterisk
 Instructional decisions are underlined

1 Erin: *I*, sort of what Elizabeth said, you know, *she* at least this time talked about the different
2   strategies they utilize or at least talked about when they were doing the problem so at
3   least the student has some clue. *I* think *she* could have been even a little bit more specific
4   and said* if you did it this way try it that way but at least *she* put out a few more things
5   and other than just saying* do it again

The first instructional decision I identified begins on line 1: Erin makes a comment about what the teacher in the animation (she) did. I identified *she* as the teacher in the animation based on the context of this conversation; the participants had just finished watching a clip of the animation and Erin was responding to the moderator's question about the instructors' thoughts on that clip. In this case there are two verbal processes in the instructional decision, both *talked*. I coded this as a single instructional decision because while the action was stated twice, the second clause is exemplifying and clarifying when the action occurred. Erin continues by stating what the teacher in the animation could have done, "been even a little bit more specific and

said…" (lines 3-4). The processes in this instructional decision (been more specific, said, put

out, and saying) are all verbal processes[6].

6 Moderator: So the teacher offers the Fundamental Identities, the Pythagorean Identities and
7   even the calculator are there [pause] are there preferences about which you would [pause]
8   or priorities, I'm not sure what the word would be but.
9 Morton: Well sure as Peter said you could use the calculator and come up with an erroneous
10   answer that you weren't aware of restrictions on the inverse trig function

The moderator then asks about what the teacher in the animation did and asks about the

instructors' preferences (lines 6-8). Because I am interested in the instructional decisions stated

by the instructors, those stated by the moderator or researcher are used for context, but not

coded. Morton then comments on the use of the calculator (lines 9-10). Morton says, "you

could use the calculator and come up with an erroneous answer," but this is not an instructional

decisions because *you* is not a person in the role of a teacher. While it is initially not obvious

who *you* refers to, what he says next helps to clarify that *you* refers to students: "that you weren't

aware of restrictions on the inverse trig functions." It is assumed that someone in the role of a

teacher knows the restrictions, thus *you* refers to someone else, likely the students.

11 Kirk: Well *I* think being specific* about how to use the calculator, you take the cosine
12   squared plus your sine squared and see if you get one in the calculator and that would be
13   a good way to at least make sure you're on the right track. And, but there's different
14   ways you can use your calculator so *I* think pointing out* how to use your calculator not
15   just saying use it. And similarly, just being more specific* in general because *I* have
16   students ask me all the time, you showed us two different methods here am I gonna get
17   the same answer? Well to *us* it's obvious of course *you* are, but to students it's not so *I*
18   think point out* when you do these three different methods you should get the same
19   answer each time, so actually being specific about that it would be helpful in this case.
20 Moderator: So in an earlier session it was suggested that that there's this question that you
21   put back to the students, how would you go about checking your homework? Is that a
22   legitimate move or when is that a legitimate move?

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[6] The configuration of the first part of this instructional decision, "she could have been even a little more specific"
suggests a relational process, but in this context being more specific conveys speaking.

In lines 11-19 Kirk continues to discuss the use of the calculator. There are several instances in which the actor and process has to be closely examined to determine if it is an instructional decision. When Kirk is describing how the calculator is used, he states, "you take the cosine squared plus your sine squared and see if you get one . . . to at least make sure you're on the right track." This is not identified as an instructional decision because *you* is not specific to a person in the role of an instructor, it is a general *you*—anyone that might be using the calculator. It is also likely that he is referring to students because he says, "to make sure *you* are at least on track"; it is student who needs to check to see if they are on track, not the teacher.

In line 14, Kirk talks about what actions could be taken, "so *I* think, point out how to use your calculator not just saying use it." In this case, *I* is not the agent of a teaching action, but a mental process that is an indicator of modality for the statement that follows. The processes which indicate this is an instructional decision are verbal processes (to point out and say). The agent of these actions is ellipsed, but it is known that the person pointing out how to use the calculator would be in the role of the mathematics teacher. This instructional decision is one in which the actor is instructors in general (you), because the language used does not indicate specifically who is in the role of the teacher. In line 17, Kirk refers to instructors, "Well to *us* it's obvious of course you are," but this is not an instructional decision because the process is relational, and is not something that occurs in instruction.

23   Morton: It's a great idea. *I* would do that.
24   Elizabeth: At this point *I* would say well let's check, that would be like at this point when
25   this has been done and the students asks that question, *I*'d say that's a great idea let's
26   check this [pause] together this one and you know [pause] kind of have a plan—
27   Moderator: How would you do it?
28   John: It depends on where *you* are in the course. If this is at the end of the class session *you*
29   don't have time to do that so it depends upon where *you* are in the class session.
30   Researcher: So if you were at the end of the class session what would you have done?
31   John: Um *I* might have depending on how much time is actually left uh what she suggested
32   may be where *I* would stop. *I* probably would not have included the calculator since it

| 33 | seems like *her* goal was for them to calculate exact values and so <u>*I* probably would not</u> |
| 34 | <u>have given that as an option.</u> |

In lines 24-26, Elizabeth's statements of what she would do: "I would say" and "I'd say" are examples of when *I* is the agent of a teaching action. Line 28 illustrates another case in which *you* is someone in the role of a teacher, but is not identified as an instructional decision because "where you are in a course" is not a teaching action; it is a relational statement that indicates a point in time. In this turn, John does not indicate an instructional decision; he only discusses the circumstances that would influence his decision. After being prompted by the researcher, he states tentatively what his instructional decision might be.

Actor.

For each instructional decision, I coded for the grammatical *person* (who the actor of the instructional decision was)—the instructor speaking (*I*), instructors in general inclusive the instructor speaking (*we*), instructors in general (*you*), the teacher in the animation (*she*), or another instructor[7], as described above. I used counts of the number of instructional decisions in each category of actor for the analysis.

To determine the person indicated in each instructional decision, I used resources from the ideational metafunction. Specifically I identified who the *agent*—the "one who initiates the action" or "makes something happen" (Eggins, 2004, p. 224)—of the instructional action was. This feature of language not only enabled me to concretely identify each time an instructional decision was discussed, but also to identify who the agent is (i.e., *I*, *we*, *you*, *she*). While who the agent is does convey experiential meaning from the ideational metafunction of language, in this case it is also used to examine interpersonal meaning. This analysis, which examines

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[7] In the report of results and further analysis I did not include the few (six) instances that referred to another instructor.

grammatical agency, along with the analysis of modality focuses on interpersonal meaning to better understand these instructors' agency.[8]

Modality.

The analysis of modality gives insight into the interpersonal nature of a conversation. The usage and degree of modality gives insight on instructors' agency and can also influence the openness of the conversation and in the particular case of instructional decisions. The use of modal expressions also conveys different types of meaning: probability, usuality, requirement, or inclination.

I analyzed the use of modality to clarify instructors' stance on each decision and instructors' overall agency. Each instructional decision was identified as having or not having modality. For each instructional decision with modality, I examined the degree of modality (high, median, or low) and the type of modality (usuality, probability, inclination, or requirement).

Instructional decisions without modality were those in which the instructor states what they do or what the teacher in the animation did (i.e., "I write the problem down" or "she was asking questions but answering it herself right away"). In the excerpt above, all of the instructional decisions included modality. For example, "*I* would say well let's check" has a high degree of modality. Here, *would* indicates that Elizabeth is very likely to say "well let's check." Other phrases that indicate a high degree of modality are *have to*, *should*, *will*, and *always*. Instructional decisions that use these phrases that indicate high modality or those with no modality may include subjective modality, such as *I think*, *I probably*, or *I usually*, which

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[8] Here I must make the clear the distinction between *grammatical agency* and *instructors' agency*. Grammatical agency is the identification of who the actor is and is used to examine interpersonal meaning. Instructors' agency is the instructors' socio-cultural mediated capacity to act. The analysis of grammatical agency and modality together consider interpersonal meaning in a way that helps us to understand instructors' agency.

decreases the degree of modality of that instructional decision. For example, "I think pointing out how to use your calculator," "I think she should have pointed out…," or "I probably would have repeated it again" are instructional decisions with a median degree of modality. Phrase such as *maybe*, *might*, and *could* indicate a low degree of modality. Examples of instructional decisions with low modality are, "I might show a harder way of going about it" or "She could have said it clearer."

The degree of modality or lack of modality in an instructional decision indicates an instructor's stance on an instructional decision. When considering the different language choices to indicate modality, the interpersonal meaning conveyed by instructional decisions can vary significantly. To illustrate how the use of modality changes the interpersonal meaning, consider Morton's statement, "I write the problem down." Alternatively, he could have said, "I would write the problem down," "I sometimes write the problem down," "I think I would write the problem down" "I might write the problem down." While each choice is about writing the problem on the board, each of these choices conveys a different attitude about or degree of commitment to that decision.

The use of modal expressions also conveys the type of meaning: probability, usuality, requirement, or inclination. *Probability* and *inclination* speak to the likelihood of instructors to make certain decisions. *Usuality* indicates how often instructors choose to do certain things, and *requirement* indicates an obligation. While I initially identified the use of all four types of modality, I found that usuality, probability, and inclination were so often conveyed together and in nearly every instructional decision where *I* was the actor that the only useful type of meaning conveyed was *requirement*. The most common modal expressions indicating a requirement were *should*, *could*, *must*, *have to*, and *required to*. Two examples of instructional decisions

indicating a requirement are, "I have to ask more leading questions," and "she should have paused to reflect after each student answered and bring the rest of the class along."

To ensure I was consistent in coding for both the degree and type of modality, I created a guide which includes a full list of modal expressions and the degree and type of modality for each to reference throughout the coding process (see Appendix C).

Stage two: Identifying justifications.

For each instructional decision I determined whether or not it had a justification. To identify a justification I looked for language related to logical meaning that indicated when a justification was given for an instructional decision discussed. Temporal-spatial, comparative, and consequential relationships indicated a justification.

Causal-conditional enhancements were most commonly used to indicate a justification. Conjunctive markers, such as *because*, *cause*, *so,* and *then* were used to identify these enhancements. Purpose clauses, which reveal the purpose or intention of the instructional decision, were also frequently used. For example: "I would have done the problem two ways, with the ratios and the with the Pythagorean Theorem *to show that we got the same answers*" and "I would have got the calculator out *to show that, hey, Mr. Calculator says fourth quadrant the angle's in the second quadrant, see how it's wrong*?" Justifying language for comparing one outcome or process with another was sometimes used and was indicated by conjunctive markers such as *otherwise* and *that way.* There were also instances where the participants explicitly say *the reason is* or the moderator or research asks why they make a given instructional decision. I defined the text following these expressions as justifications and further analyzed them to identify reasons.

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Stage three: Identifying reasons.

In each justification, I evaluated the experiential meaning of the ideational metafunction through the speakers' use of grammatical participants and processes, which helped to categorize the reasons these instructors have for making instructional decisions. The participants and processes of the justifications made explicit the people or objects in the justification and what is being done. Through open coding (Corbin & Strauss, 2008) of the justifications, I identified six reason categories: student, class, content, teacher, institution, and lesson. Three sub-categories were also found within the student category—intellectual, emotional, and physical. These codes were applied to the justifications.

Student.

A justification was coded as *student* when students were a key part of a reason, that is the student is (all or part of) the reason for making an instructional decision—more than simply a participant in the reason (this is discussed in more detail in the Content section). Each justification with a student code was also coded as being intellectual, emotional, and/or physical. An additional class code was applied when the whole class or groups of students were explicitly discussed, or when student participation was talked about. I present examples of reasons coded as student within each subcategory.

Intellectual.

A justification was coded with the intellectual student code when instructors spoke about students' intellectual processes. Specifically, they referred to students' cognitive processes such as knowledge, learning, thinking, and understanding (i.e., "so the students are kind of confused," "So that they can memorize it better and remember them better and recall," "so they can see that relationship as well") or other intellectual actions or behaviors such as participating in class,

copying the answer from the back of the book, or taking responsibility (i.e., for doing their homework or asking questions).

Emotional.

A justification was coded with the student emotional code when instructors spoke about students' emotions. These reasons included student embarrassment, desires, satisfaction, interest and confidence (i.e., "you don't want them to embarrass themselves," "so you gain confidence by doing that," "because then you lose their interest"); recognition of a respect between the teacher and the student (i.e., "he knows that I'm paying attention to him I know he has an issue"); and acknowledging the usefulness/importance of mathematics to the student ("so they see that this isn't just a big random . . . use of their time but actually going forward, they may be able to take some of those skills in a different context and be able to be successful").

Physical.

A justification was coded with the student physical code when the speaker acknowledges that students in a classroom have physical needs: students need to be able to see the board, see what the teacher is doing, and hear the teacher and other students (i.e., "so it is always there where they can see," "that gives them a chance to hear it").

Content.

A justification was coded as content when a reason included the mention of specific mathematics, methods of solving problems, the correctness of solutions, mathematical connections and general statements about mathematics. This code is applied liberally—the mathematical content itself might not be the reason itself, but it is contained in the justification. This liberal coding was necessary to capture the discussion of the content because most of the

justifications that referred to the content were about student learning and understanding. For example, one reason given was "because I have students ask me all the time 'you showed us two different methods here, am I gonna get the same answer?'" This reason includes the mathematical content—getting the same result regardless of the method used, but it is focused on students' knowledge that this is the case. An example that is more focused on the content, "because now you have two x's. x as the angle and x as the coordinate in the horizontal," is less explicitly indicating students' understanding of the meaning of x in different contexts.

Class.

A justification was coded as class when a reason explicitly recognizes the class as a whole, groups of students ("types"), differences between students or groups of students, and physical classroom dynamics and class participation. Because recognizing the class as a whole is recognizing students, all the justifications coded as class are also coded as student. These reasons make explicit that the instructors make decisions with all the students in mind (i.e., "to make sure everybody's on the same page," or "because it makes it tense in the whole room"), acknowledge the differences between students (i.e., "because there are so many people in our classrooms who learn in different ways"), or recognize the dynamics of the classroom (i.e., "so that, and uh I have to do that just so that those two people, one person, doesn't dominate," "because I want them to not be quiet I want them to be noisy in my class you know").

Lesson.

A justification was coded as lesson when the pace, direction, or the shared or expected knowledge of a lesson was discussed (i.e., "then that way they don't [stall] class," "so that when you can start the question by directing them the way you want them to go," "so you're still keeping it within what they have learned"). This code was often assigned in conjunction with

other codes. The lesson code is of a different nature than the student, content, teacher, or institution code—it emerged from a group of reasons that I had coded as 'other.' A re-examination of the data allowed me to find other instances, and by including the lesson code, I was able to eliminate the 'other' category and code each reason.

Teacher.

A justification was coded as teacher when a reason given referred to the teacher as an individual—his or her personal emotions (i.e., "otherwise I'm just going to get angry," "it drives me nuts"), the way he/she is (i.e., "because that's just the way I am," "because our heads are going [so fast]"), or personal experiences (i.e., "because we were taught that way," "cause that's unrealistic I see my kids coming home [with] forty problems [due] the next day").

Institution.

A justification was coded as institution when instructors spoke about rules or guidelines set by the institution or department. They included statements about the amount of content to be covered in a given amount of time (i.e., "cause we have a departmental final at the end," "because I save a little bit of time," "in my classes you have a limited amount of time to go through material"). While these reasons about time and covering the content could possibly be traced back to other reasons they are most likely linked to institutional requirements and the institution is part of it since they set these requirements. Hypothetical examples could be because they need to get through all the material so that the students are prepared for the sequential course, or so that they keep their job.

Illustration.

The following excerpt represents the coding of an instructional decision with a justification proposed by Morton: I also include all the reasons provided.

	Reason	Student Sub-category
Um very, very typically for example I'll give an example of the product rule for exponents and then will see what happens. I'll have them tell me in words what they're seeing we'll agree what the words are. Then I'll write the words and I say the words when I'm writing them and then I stand back and I say it again, is this what you understand?	Instructional Decision Actor: I Modality: High without requirement	
And to somebody who's in a hurry to get through the <u>curriculum</u> it seems like a waste of <u>time</u>	Institution	
but <u>they don't ask question</u> about it then.	Student	Intellectual
And then when I say okay what's the product rule? Which rule can we use here? The product rule, why can we use the product rule? And and so so we are <u>making steady progress</u> rather than trying to quickly say a bunch of things and	Lesson	
students are asking questions because <u>they don't know</u> what's going on you have <u>interruptions</u>.	Student Class	Intellectual
So I think it actually lets you <u>get through the material more quickly</u> and	Lesson	
with <u>clearer understanding</u>.	Student	Intellectual

As illustrated above, this justification indicates the institution, the student (specifically the intellectual aspect), the class, and the lesson as reasons. In his justification, Morton mentioned the curriculum and time, both of which are set by the institution, and then discussed how the decision impacts students' understanding and their actions—asking questions. He also discussed how the decision affects the progression of the lesson and allows him to "get through the material more quickly." This justification was coded as institution, student (specifically the

intellectual aspect), class, and lesson. Even though the student and lesson was mentioned more than once, the justification is coded for each only once.

In addition to examining the instructional decisions and justifications through the language choices of the instructors, I examined the turn-taking patterns in the two groups. The turn-taking patterns give further insight into instructors' agency.

Turn-taking patterns.

Examining the ways in which the full- and part-time faculty interact allows for additional insight into how these individuals position themselves relative to others in the group. To examine the turn-taking patterns of each group I examined the length of turns in each group and the length and frequency of turns for each individual. Examining the turn-taking patterns of the group gives insight into the nature of the conversation—how open or collaborative the discussion is. The variation in turn-taking patterns by individuals in a conversation demonstrates how individuals position themselves with in the group—as more or less agentive. For example, the perspectives of individuals who take longer and more frequent turns are heard more, and thus have prominent voices in the discussion. The variation within the group can also create different dynamics. For example, some discussions are dominated by a few individuals and others are more equally shared among all individuals. Equally distributed turn-taking patterns create equally distributed opportunities to share, which leads to a shared, collaborative discursive space. In addition, variation in individual turn-taking patterns within the group positions some faculty members as being individually empowered, whereas more equally distributed turn-taking patterns position the speakers as trying to fit in with the rest of the group (being equals).

Each participant turn was marked with the session and the speaker. The length of each turn was estimated based on the number of characters for each turn in the transcript. This was

converted to seconds by taking the number of characters in a turn and dividing it by the total number of characters in that session, multiplying by the session time. The frequency of turns for each participant was based on number of turns per hour.

Examining potential differences between the full- and part-time groups

After completing the coding of the instructional decisions and justifications, I ran descriptive statistics for the full- and part-time groups, and then ran statistical tests to test whether the differences I noticed between the two groups were statistically significant at the 0.05 level. For each test the null hypothesis states that the full- and part-time groups have the same proportion of a given event, whereas the alternative hypothesis is that the full- and part-time groups have a different proportion of a given event. This analysis examines potential differences between the full- and part-time faculty in the reasons discussed, interpersonal tone (use and degree of modality and grammatical person), indication of requirement, and turn-taking patterns. Potential differences in reasons and modality were examined using chi-squared tests, and t-tests and F-tests were used to examine differences in turn-taking patterns. Appendix D shows the frequency tables that were used for the chi-squared tests.

In addition to the descriptive statistics and statistical testing, in the results chapter I provide quotes and examples that exemplify how these results play out in the data and effectively change the tone of a conversation.

    Reasons.

Using the coding of the justifications, I tested the independence of the reasons given by the full- and part-time faculty. I used two-tailed Pearson Chi-squared tests to examine if there was a statistically significant difference in the frequency of reasons given between the two groups. Because each justification could have multiple reasons, a series of tests had to be run—

one on each category to test if there were any statistically significantly differences in any one category between the two groups; each reason was tested to see if there was a difference. For example, to test for differences in the student category, I set up a contingency table that indicated the number of justifications with or without the student code for the full-and part-time groups. I repeated this process for each of the six reason categories (see Appendix D).

Similarly, two-tailed Pearson Chi-squared tests were also run to see if there were any statistical differences within the student category between the full- and part- time groups. The contingency tables for these tests indicated the number of student reasons with or without each sub-category. For example, to test for differences in the intellectual category, the contingency table that indicated the number of student justifications with or without the student code for the full-and part-time groups. I repeated this process for each of the three sub-categories.

Interpersonal tone: modality and person.

I also used two-tailed Pearson Chi-squared tests to examine if there were any statistically significant differences between the full- and part-time groups in their use of modality or grammatical person. I ran several tests to examine the use of modality. To test the difference in modality I set up a contingency table indicating the number of instructional decisions coded as no, high, median, or low modality for each group. In addition, I also tested the difference between statements with or without modality, and of those with modality if they were high, median, or low. To test the difference in the use of actor I set up a contingency table indicating the number of instructional decisions coded as *I*, *we*, *you*, or *she* for each group.

In addition to looking at the actor of instructional decisions, I did a text search for *I*, *we*, *you, and she* in the entire transcript (i.e., not restricted to the actor of instructional decisions) to see if the patterns held beyond the instructional decisions in the discourse as a whole. For

comparison I also ran a chi-squared test on the frequency of pronoun usage between the two groups. Counting the usage of pronouns through a text search is less accurate for determining the frequency of a person in the role of a teacher than the coding done of actor in instructional decisions. While the pronouns were the most frequent way to refer to a person in the role of a teacher, it is not the only way. For example, there are instances where "the teacher" or the "teacher in the animation" is used instead of *she*. Furthermore, *you* is often used to refer to students or other individuals in the room. Despite the shortcomings of this method, it allows for corroboration of the findings.

Because over half of the instructional decisions had *I* as the actor, a further examination of the degree of modality these instructional decision could give further insight into the agency conveyed. I ran two-tailed Pearson Chi-squared tests for this analysis restricted to those instructional decisions with *I* as actor.

Requirement.

I used a two-tailed Pearson Chi-squared test to examine if there is any statistically significant difference in the frequency in the use of requirement between the full- and part-time groups. I set up a contingency table that indicated the number of justifications with or without requirement for the full-and part-time groups. Of those instructional decisions indicating requirement I ran a two-tailed Pearson Chi-squared test to see if there was a difference in the degree of modality used. This contingency table included the number of high, median, or low instructional decisions. Because requirement is conveyed through modality, there are none without modality.

Turn-Taking patterns

To examine possible differences in the mean and variance of turn length and frequency of turns I ran three sets of F- and t-tests: average length of turn between groups, average length of turn for each participant between groups, and average number of turns per hour for each participant between groups. In addition I examined box plots of the length and number of turns for each participant. I illustrate the differences using box plots to show the difference between the two groups because the small number of participants (11 and 9) made statistical differences unlikely.

Trustworthiness

Trustworthiness is an important element of qualitative research. Here I refer to trustworthiness as a trust or confidence in the way this study is carried out. I discuss three aspects that can compromise the study's trustworthiness, specifically, limitations of this study, the subjectivity I bring as a researcher, and how I handled issues of validity. I also include steps I took to ensure reliability in the coding, in order to address some of the trustworthiness issues that emerged.

Limitations

There are three major limitations of this study, sample size, the small percentage of instructional decisions with justification, and the use of data from professional development sessions.

This study involved only 20 community college instructors who teach trigonometry. Their participation was based on the recommendation of their department chair and their willingness and ability to participate. Thus the sample is by no means representative of

community college instructors; it is at best a select sample of "outstanding" community college instructors in the Midwest. By restricting the sample to instructors who teach trigonometry, a large number of instructors, particularly those who teach only developmental mathematics courses, were excluded from the sample. Thus the results cannot be generalized to the entire population of community college mathematics instructors. However, the insights gained through the study are very informative because the participants are acting in their role of trigonometry instructors which are played out in the environment in which they work. Having data from both full- and part-time faculty allows for an exploration of the difference in agency conveyed between the two groups.

In total, 1,358 instructional decisions were identified which gives more than ample evidence for the analysis of actor, modality, and requirement. However, only 13% (176) of those decisions included a justification, so the reasons for the remaining decisions are unknown. For this reason, the ability to assess the relative importance of each obligation is limited, but the justifications can be used to confirm the existence of each professional obligation. There are many possible explanations for why there are so few justifications. In conversations where speakers are not defending a position, it is not typical to justify every statement made. It is also possible that justifications were not stated in this context because it was assumed the reason was common knowledge or understood by everyone. For example, given that all of the instructors have a strong background in mathematics, pointing out the mathematical reasons for making a decision may have been seen as obvious and unnecessary. More active moderation could increase the frequency in which justifications are stated.

Using discourse from professional development sessions as data has both benefits and drawbacks. The data cannot account for actions that actually occur in the classroom, only the

instructors' reactions to the situations in the animation and what they report doing in the classroom. But because the goal of this study is not to determine how these teachers act in the classroom, but rather their reasons for teaching the way they do, this is not inherently an issue. Other methods such as the discussion of a video recording of a lesson could give insight into why teachers teach the way they do, but instructors may feel the need to defend their choices and may give reasons that sound correct rather than talking freely about why they made certain decisions. The use of the animation is intended remove the need to defend one's teaching.

Researcher Subjectivity

As Peshkin (1988) reminds us, researcher subjectivity is inevitable. While this subjectivity is not necessarily problematic, it needs to be acknowledged so others can better understand the approach to the research. Researcher subjectivity is present from the moment a question is raised and a study is conceived, and thus it is important to understand where the individuals who are instrumental in the process are coming from. From the conception of this study, the researchers involved were aware of the negative literature about part-time faculty at colleges and universities, but in our prior work in college classrooms we had not observed any distinctive differences in what went on in the classrooms of full- and part-time faculty.

My experience as part-time faculty positioned me to expect that there would be no differences in these professional development sessions between the full- and part-time faculty groups. As a result, I started the study without an interest in the similarities and differences between the two groups. I was really interested in their reasons for teaching the way they do because I knew that most college mathematics courses are taught in a traditional lecture format and that community college faculty are focused on student learning. I was interested in the tensions between the different obligations that might mimic what I felt as an instructor—

wanting to help students learn and understand, but limited by the material and the restrictions imposed by the department. I also expected that instructors would acknowledge that they lacked knowledge and resources to attempt different methods of teaching and improve student success.

Two Types of Validity: Descriptive and Interpretive

Maxwell's (1992, 2005) work regarding validity in qualitative research serves as a guide. Maxwell identifies five categories of validity: descriptive validity, interpretive validity, theoretical validity, generalizability, and evaluative validity. These categories are useful for qualitative studies in which understanding the phenomenon is more important than searching for "the truth." In taking this stance it is understood that there may be different, yet equally valid accounts of a phenomenon. Descriptive and interpretive validity pertain to the factual accuracy of the data—the physical objects, events, and behavior which are being observed—and the meaning of these to the people engaged. Theoretical validity relates to an explanation or theory given for the phenomenon being studied and generalizability is the extent that the findings of a particular study can be extended to other people or different settings. Evaluative validity pertains to statements that make judgments on what has been observed.

The limitations previously discussed addressed some issues associated with generalizability and theoretical validity. The small sample size and participant selection limits the generalizability of these results. The explanations I offer for the findings (theoretical validity) are grounded in the literature, but like most explanations for observed phenomena they are based on my interpretation of the results and the subjectivity I bring. In the discussion chapter I make clear to what extent I am generalizing and how I came to explanations I give. Given the perspective I bring and the goals of this study I do not make evaluative claims, and thus evaluative validity does not apply to this study. In this section I discuss in detail the

descriptive validity and interpretive validity that apply. I then discuss the reliability of the coding—a notion that is often associated with quantitative research and discourse analysis—not addressed in Maxwell's framework.

According to Maxwell, descriptive validity is the factual accuracy of an account whereas interpretive validity is concerned with the meaning of an account, that is, interpretive validity seeks to understand a phenomenon based on the participants' perspective, not the researcher's. The data collection and accuracy of the transcriptions speaks to the descriptive validity of the data I used. The faculty discussions were transcribed by a professional transcriber. I then verified the accuracy of the transcripts by watching the videos and reading the transcripts. I corrected errors (i.e., incorrect mathematics terms, missing words) and used the video data to note any gestures or facial expressions needed to better interpret the discourse. The transcripts did not include intonation, but did indicate emphasis when it helped clarify meaning. While a written transcript does not and cannot replicate the actual discourse, it is sufficient for the methods used in this study because the features of language I am analyzing focus on the language choices, which are conveyed through the transcription. In reporting the results, I frequently remove stutters, repeated words, and expressions such as "you know" and "like" that do not alter the meaning to make the transcripts more readable. Whenever there is content removed from quotations for clarity I indicate it with an ellipsis in accordance with APA style.

Once I could trust the transcripts as valid representations of the discourse in the group discussions, I made choices about what aspects of the text I would attend to and how I would attend to them. I chose to use resources of SFL as the means to analyze the language of the participants to ensure that the voices of the participants came through with minimal interpretation and because SFL is a holistic and well documented theory of language. SFL

focuses simultaneously on three different functions of language (ideational, interpersonal, and textual) and the features of language that contribute to these functions have been described in detailed in the literature. I chose to use resources from the ideational and interpersonal metafunction for understanding the agency of the participants and those from ideational meaning for the reasons. These two metafunctions align with the type of meaning I wanted to gather from the data. The choice of linguistic features was based on my understanding of the discourse and of SFL. How I chose to code different phrases for modality was based on other researchers' use SFL, but because much of this work uses British English—where different terms are used and others carry different meaning—my own understanding of American English helped to determine the type of modality conveyed by terms such as *should*, *would*, and *could*.

The further interpretation of what the use of certain language choice means is well documented in SFL. For example, Martin and White (2005) discuss how the lack of modality or use of high modality makes a conversation monoglossic and less open to discussion, and Eggins and Slade (1997) discuss how the use of modality can show evidence of status. Thus the conclusions I draw from my analysis is grounded in the research.

Inter-Rater Reliability

In this study I approach reliability as the ability for others to replicate the coding methods—with this or another data set. Addressing the reliability ensures that the coding is rooted in the discourse, not merely in my interpretation. To achieve this type of reliability, I carefully documented how I coded different linguistic features. The most difficult part of the coding was the initial identification of instructional decisions, but once this was done the determination of actor was straightforward and I explicitly laid out how modality was coded (see Appendix C).

In order to make sure that other researchers could replicate the analysis and to better understand the coding system, I asked another graduate student in the program, with expertise in SFL to provide feedback on the process of coding instructional decisions[9]. We each coded two 15-minute segments, one from each group, that were representative of the discourse and contained a sufficient number of instructional decisions. After coding the first 15-minute segment we met to compare the results of the process. This allowed me to clarify the definition of an instructional decision. Specifically, I restricted the action of an instructional decision to be a material, verbal, or behavioral process. This revision was used to code the second 15-minute segment. In this coding, we both identified the same 29 instructional decisions and each coded ten instructional decisions that the other did not. This discrepancy was largely due to a lack of clarity about what defined a single instructional decision and from omissions. For example, I coded the following excerpt as one instructional decision whereas the other coder identified it as four instructional decisions: "If **I ask** a question and I hear a lot of responses **I'll ignore** some and **pick out** maybe a wrong one that **I want to point out**." While our unit for an instructional decision was different—his was based on the use of a process (verb) whereas mine was based on the action of the decision as a whole—it was clear that our conceptualization of an instructional decision was similar. In this case, the previous excerpt was identified as a single instructional decision because even though there are four different processes, they are all part of a single decision about how to respond to the students. In this process I also realized how easy it was to miss instructional decisions on a first pass, so I did a second pass of each transcript to address this issue.

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[9] Appendix E includes the coding directions I wrote to facilitate the process.

Another less obvious point of discrepancy was the distinction between behavioral and mental processes. Instructional decisions were defined as an action of a teacher, not simply a thought. Behavioral processes are at the intersection of material and mental processes. A mental process conveys emotion, perception, cognition or desideration, but does not have an associated material process that goes along with it like a behavioral process would. While this seems like a clear distinction, it can sometimes be difficult to come to an agreement. Discrepancies in coding processes types have been documented in the SFL community (O'Donnell, Zappavigna, & Whitelaw, 2008).

Language can be complex; one statement can indicate both a mental and a material process. For example, "I wish I could cover all the material." The theme of the clause, "I wish," is a mental process, but this desire is an indicator of modality for the instructional decision, "covering all the material"—a material process. If the mental process was not followed by an instructional decision, such as, "I wish students would try harder," it was not coded as an instructional decision. Once instructional decisions were identified, the identification of actor was unproblematic and the use of coding guides for modality ensured consistency (see Appendix C).

Chapter 4 Results

In this chapter I discuss the results of the analysis that seek to answer the research questions of the study:

1. What reasons do community college mathematics faculty give for the instructional decisions discussed?

2. How is faculty status associated with these reasons?

3. How is faculty status associated with agency in the instructional decisions discussed?

The analysis I performed suggests that there are no statistically significant differences in the reasons given by the full- and part-time groups and the part-time faculty indicate less agency than the full-time faculty, but their discussions are more open and collaborative.

In this chapter I first present the reasons instructors gave for the instructional decisions they talked about during the professional development sessions and show the similarity in the reasons given by the full-time and part-time groups. In the second section I discuss the way instructors talked about instructional decisions to examine their agency in instructional decision making and the turn-taking patterns between the two groups.

Reasons Instructors Give for Instructional Decisions

Examining the reasons given in the justifications for instructional decisions gives insight into why teachers teach the way they do. I identified 176 justifications for instructional decisions in the text. Of these 176 justifications, nearly half contained more than one reason, resulting in

264 reasons. This speaks to the complexity of instructional decisions; the justification for an instructional decision often includes multiple reasons.

To elaborate on these results, I describe each category in detail and illustrate how each category was present in the data using discourse excerpts. The examples I present for each category often indicate more than one reason category. The subsequent section illustrates this complexity in the justifications. I then discuss how these reasons corroborate the professional obligations proposed by Herbst and Chazan (2003, 2011, 2012) and conclude with a comparison of the reasons given by the full- and part-time groups.

Reason Categories

The student was the most frequent reason given for making an instructional decision (included in 80% of the justifications, see Figure 2). The mathematical content was mentioned in 34% of the justifications, 24% mentioned the class as a whole, and close to 18% mentioned the lesson. Teacher and institutional reasons were the least frequently mentioned (12% and 7% respectively). These results illustrate how central students were in the discussion of reasons.
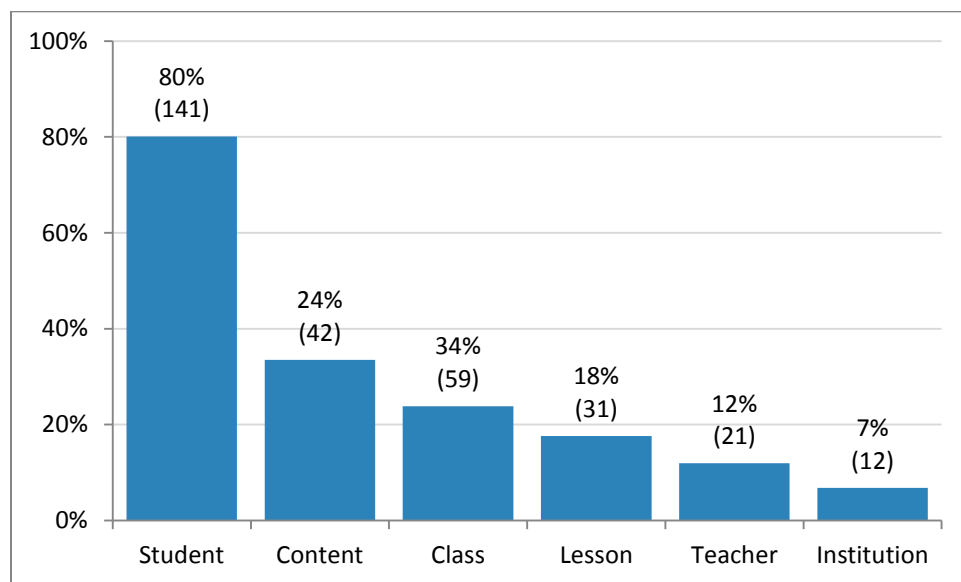
Figure 2: Percent and frequency of justifications mentioning each type of reason—in 176 justifications with 264 reasons

Student

The student is given as a reason in 80% (141) of the justifications, with 40% (71) of the justifications having only the student code (in other words the student is the only reason given for making the decision). For each justification that included the student as a reason, I looked at what aspect of students was being attended to—the intellectual, emotional, or physical.

The students' intellectual processes were mentioned most often (84% of the justifications that include the student, 119) followed by students' emotional, and physical needs (see Figure 3). Of the 141 justifications that include the student as a reason, 15 (11%) justifications include more than one student subcategory, with the intellectual reason standing alone in most of the justifications (74%, 105).
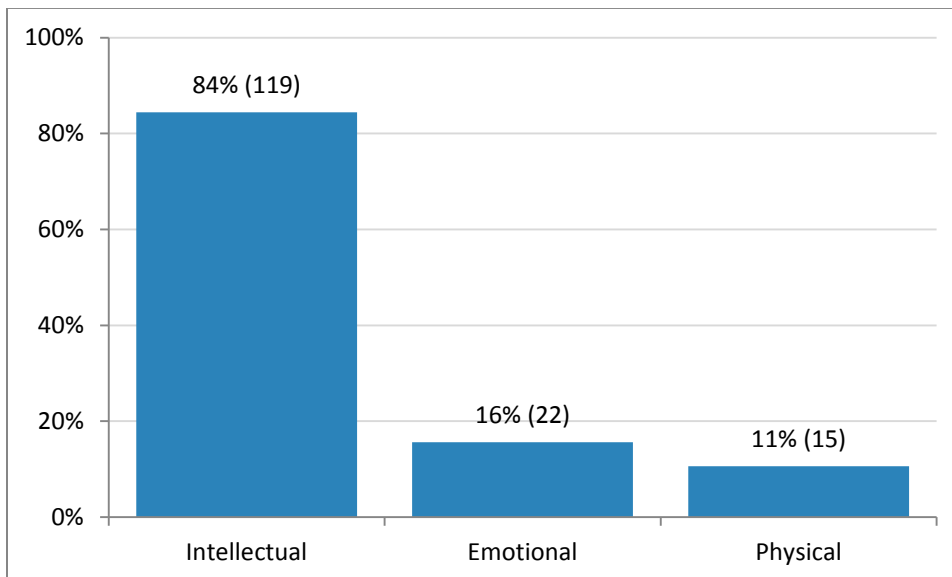
Figure 3: Frequency and percentage of types of student reasons (student sub-categories)—in 141 justifications with student as a reason with 156 reasons

Intellectual.

Intellectual reasons for instructional decisions were those that attended to students' cognitive processes such as knowledge, learning, thinking, and understanding and other intellectual activities or actions such as participating in class, copying the answer from the back

of the book, or taking responsibility. Many of these reasons attended to the students' knowledge or level of understanding. Lou (FT) makes sure that when students come to the board to do a problem that the student writes in all the steps because otherwise "the [other] students are kind of confused." Attention to student difficulties—both with the mathematics and learning in general—is common and instructors would gear the way they teach to help with these difficulties. Erin (FT) states that she never talks and writes on the board at the same time "because they're trying to hear it and they're trying to write it and it's hard, it's really hard to do both of those things." These instructors also give reasons for the way they teach based on how students think. Nelson (FT) tells his students that "Mr. Calculator's really only as good as you are" because "students have a tendency to think that all math is contained in their calculator and if they just knew how to press the buttons right it would work." Instructors also discuss decisions relating to how they organize their teaching so that it will help students learn. Kathryn (PT) explains how she organizes the trigonometry identities on the board "so that they can memorize it better."

Student intellectual reasons were indicated in the majority (68%) of all the justifications given for instructional decisions. As I elaborate in the discussion section, this attention to the intellectual dimension strongly suggests that student learning is the main focus of these community college instructors. Even though student learning is so prominent there is also recognition of students' emotional and physical needs.

Emotional.

Emotional reasons for instructional decisions included student embarrassment, desires, satisfaction, interest and confidence; recognition of a respect between the teacher and the student; and acknowledgment of the usefulness or importance of mathematics to the student.

The most common emotion mentioned by these instructors was embarrassment. Some teachers did not bring students up to the board or only brought up those who volunteered because "it's not very nice to invite someone to show the work and then expose them in front of everybody" (Lou, FT) and "you don't want them to embarrass themselves" (Kathryn, PT). Teachers also paid attention to and responded to some of the desires of students. Theresa (FT) modified the way she taught the Pythagorean identities because "they don't want to use the trig sine squared plus cosine squared . . . they remember x related to cosine and y related to sine." The teachers sometimes chose to have students come after class that need a more in depth explanation because they did not want to lose the interest of the rest of the class (Theresa, FT)[10]. Many teachers indicated their way of assigning problems was so that student would "gain confidence" (Lou, FT).

While all of the reasons about student emotions indicate a level of respect between the teacher and student, there were some occasions when this was very explicit. For example, Theresa (FT) had a learning disabled student and knew that he could not participate like the rest of the students, but she would regularly ask him how he was doing so that "he knows that I'm paying attention to him, [that] I know he has an issue." Several teachers were very explicit about how the mathematics they were learning was purposeful. Erin (FT) stated:

> I'm very intentional about what did we do and what did it mean and how can it link us to the next thing that we're gonna do so they see that this isn't just a big random use of their time, but actually going forward, they may be able to take some of those skills in a different context and be able to be successful. Cause a

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[10] These are an examples of a justifications in which more than one reason applies. "They don't want to . . . they remember . . ."attends to both the emotional (desire—wanting) and intellectual (remembering) aspects of the student. Similarly keeping the interest of the whole class attends to both the students' emotions (interest) and the class.

lot of this stuff I mean really when are they ever gonna use it? So [laugh] you know when you were saying double angle and half angle . . . you know that day drives them nuts.

All of these examples illustrate the instructors' attention to the emotional needs of the students. Even though it is not always explicit, notice that most of these decisions and reasons also have to do with student learning. For example, if students are concerned about being embarrassed, they may not be as involved in the class or ask questions when they have them. Furthermore when learning is pertinent, not just "a big random use of their time" students tend to be more active and involved in the learning process. So for these teachers, recognizing and responding to students' emotions can improve their learning of mathematics.

Physical.

This category of reasons included student needs in the physical space of the classroom—students need to be able to see the board, see what the teacher is doing, and hear the teacher and other students. Like the student emotional reasons, the physical reasons sometimes are explicit about student learning, but at other times student learning is implicit—the student must be able to hear the teacher and see the board in order to learn in the classroom. Rhonda (PT) states that the teacher in the animation should make marks on the board where she is pointing "because some student might be busy writing and they might not be looking up right at the moment she's pointing so if she's left a mark when they do look up they'll still see something that she had pointed to." Rosa (PT) prefers classrooms that have an overhead projector where she can leave up all the formulas from the class "so it is always there where they can see [it]." Many instructors state the importance of saying what they write on the board "so students that are

blocked from seeing what I'm writing can hear it" (Lou, FT) or so that it "gives them a chance to hear it" (Morton, FT).

Content

Content reasons were those reasons pertaining to the discipline of mathematics and the specific mathematics being taught. These reasons mentioned specific mathematics, methods of solving problems, the correctness of solutions, mathematical connections or general statements about mathematics. As mentioned in the methods section, unlike the other codes, this code was applied liberally—whenever mathematics was mentioned in a justification. This made it possible to capture the role the content played. The mathematical content was mentioned in 34% (59) of the justifications and was largely mentioned as secondary to student intellectual needs; 71% (42) of those mentioning content also indicated students' intellectual needs.

Ned (PT) noted that the teacher in the animation was regularly using x to represent the angle. He stated that the teacher in the animation should be using theta (θ) rather than x "because now you have two xs: x as the angle and x as the coordinate in the horizontal." This was one of the few justifications where the mathematics was the only reason given for an instructional decision. While the student is not explicitly mentioned in this justification, this instructor recognizes that students may not understand what the x is referring to in different contexts. Instructors also make explicit the mathematical knowledge they are trying to convey.

Kirk (FT) states how important it is to be specific. For example, when he shows students different methods he has to be explicit that different methods will produce the same answer "because I have students ask me all the time you showed us two different methods here I'm I gonna get the same answer?" Instructors are also aware of common conceptions of mathematics. Ned (PT) purposefully asks questions that are more open ended, like an opinion or "what

direction do you think we should go?" because "math has a tendency to be either right or wrong."

Many instructors talked about the need to be very explicit with the students about the mathematical capabilities of the calculator. Students must be told that when using the inverse trigonometric functions on the calculator you may not get the correct answer "so the student doesn't think when they get on their homework, they're just gonna type away and get a whole bunch of answers and half of them are right half will be wrong [laughs]" (Kirk, FT). Lou (FT) spends time at the beginning of each course talking about and showing examples of how calculators cannot always give an exact answer "so they finally realize if I want to get the exact answer I need to put my calculator away because my calculator, chances are, would not give me an exact answer for some locations."

Class

Reasons coded as class made explicit that the attention of these instructors is on all students in the class, not just a select few. Each justification coded with class also indicated a student reason (intellectual, emotional, or physical).[11] Thirty percent of the justifications that included the student explicitly recognized the class as a whole, groups of students ("types"), differences between students or groups of students, or physical classroom dynamics. The class as a whole is included in nearly one-quarter (24%) of all the justifications, demonstrating that instructors' are aware of and recognize all students in their classroom.

Instructors talked about strategies they used during lecture "to make sure everybody's on the same page" (Lou, FT). During group work, Rhonda (PT) would ask groups that were

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[11] Class reasons could be thought of as a subset of the student reasons. This is a result of the way the student and class code emerged and was subsequently defined. I chose to separate the class category from the student category because recognition of the class as a whole is a central task of the teacher (in contrast to the task of a mathematics tutor).

struggling leading questions rather than the whole class "because it's pointless to ask a whole class leading questions [when] only two or three students are going to pay attention and answer and everybody else is lost anyway." Many instructors indicated their attempts to have whole class participation by asking a question and then saying, "okay what do you guys think about this anybody BUT so and so . . . just so that those two people, one person, doesn't dominate" (Thomas, PT). Some instructors stated they used different teaching methods throughout the class because they recognized that students "learn in different ways" (Erin, FT). They also indicated an awareness of the general classroom atmosphere. When discussing the animation where the teacher was ignoring a student that was repeatedly asking the teacher to repeat the question and stating that he was confused, several teachers indicated that they would have talked to that student outside of class rather than just ignore him and allow him to continue "because it makes it tense in the whole room" (Erin, FT).

All of the reasons that acknowledge the class as whole made it clear that these instructors are aware of, and when possible, address the needs of the whole class as best they can. Some instructors that acknowledged that keeping the attention of the whole class and making sure that everyone follows and understands is not always possible, but that they try to keep as many students on track as they can.

Lesson

Reasons pertaining to the lesson had to do with its pace, direction, or the shared or expected knowledge. The lesson was given as a reason in 18% (31) of the justifications. Of these 65% (20) were about the pace or direction of the lesson and 19% (6) were about shared or expected knowledge. Most (83%, 25) of the justifications that included a reason pertaining to the lesson also included the student, content or institution; only five justifications (17%) did not

indicate another reason (see Figure 4). In these cases the justification was vague, so it could not be traced back to one of the other categories. For example, Olga (FT) says that when students offer input on a problem she often writes what they say on the board rather than having the student come to the board so that she is "controlling what's being written." In this case, Olga does not discuss why she wants to have control of what is being written.
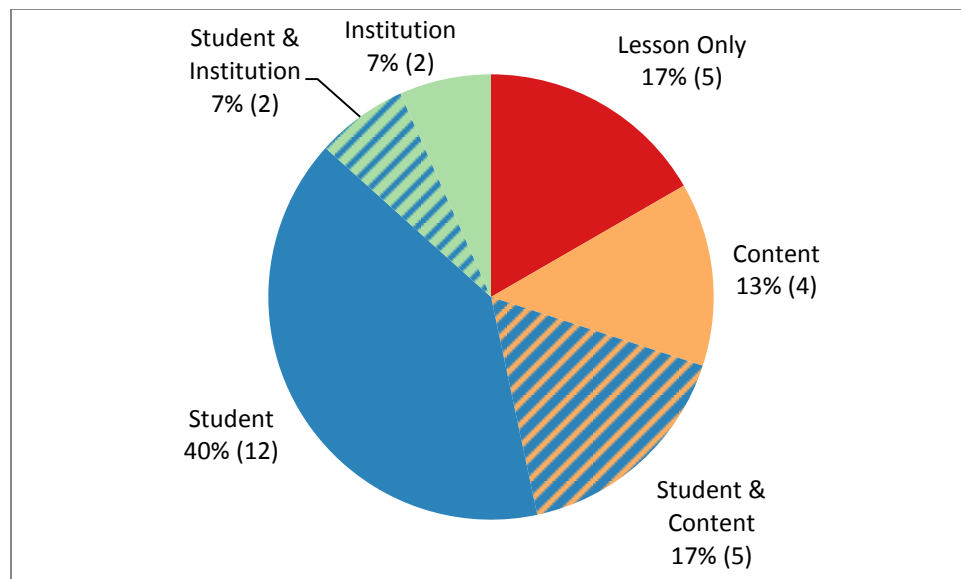
Figure 4: Percent and frequency of lesson overlap with student, content, and institution

An example of a reason discussing the direction of the lesson is given by Theresa (FT). She plans her questions ahead of time so that she is "directing them the way [she] want them to go . . . otherwise you have them all coming with different ideas." This indicates that Theresa has a plan for where she wants the lesson to go and takes specific actions to keep the class on track with her plans. Morton (FT) advocates the use of the calculator so that "we are making steady progress rather than trying to quickly say a bunch of things." This reason, which also alludes to the limited amount of time in class, also speaks to the necessary pacing of the class.

The shared or expected knowledge for a lesson may be mathematical or non-mathematical in nature. For example, Theresa (FT) is explicit about the tools that the students can use to solve a problem about trigonometric inverses even though she knows that some

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students have seen other methods in previous math classes. She will tell the students that they cannot use the calculator's inverse trigonometric functions "because we don't know . . . at this point what [it] does, will learn about it soon." Here she is acknowledging that there is knowledge out there that is not yet known or understood by the class and therefore it cannot be used yet. Elizabeth (FT) tells her students that they "have no business touching those buttons yet" because "I've already told them . . . weeks ago, quit pushing those." In this case the instructor is relying on the shared knowledge that punching numbers into the calculator will not do any good, which she had previously made clear to her students.

Teacher

The justifications sometimes indicate an individual instructor's personal reasons. The individual teacher is given as a reason in 12% (21) of the justifications. Most of these justifications (57%, 12) are about personal experience or beliefs that are connected to student learning. For example, John (FT) states that he always assigns problems that do not have solutions given in the back of the book because:

> when I was a student my solutions manual was open and I felt I understood problems and I'd get to the test and I didn't understand concepts . . . so part of the decision making for me in terms of assigning was partly personal from my own experiences as a student and then seeing other students doing the same thing I did.

In this instance, the instructor brings in his own experience of how he learned as a student—what helped him really understand the concepts. He gives his own experience as a reason for how he teaches.

Lou (FT) uses his experience with his own children as a reason for choosing how much homework to assign. He does not require students to do a lot of rote work because he sees his

children "sitting for three hours" doing "drill" work, which he sees as "ridiculous" and "a bunch of nonsense"—it's like "beating a dead horse." It is interesting that he acknowledges that it is "his own personal opinion," but is very adamant that "there's no such thing as drill."

Other justifications that indicate the individual teacher as a reason do not indicate the student (43%, 9) and are based only on personal preferences, emotions, or statements of how they are. Rhonda (PT) encourages students to speak up in class because she "hates a quiet class". She even tells students: "it drives me nuts to have a quiet class." She also encourages students to speak out rather than raising their hand "because that's just the way I am." While she may have other reasons for encouraging this type of student interaction she does speak of them— the only reason she gives is that it is a personal preference. Nelson (FT) states that there are certain students that he "need[s] to ignore otherwise I'm just going to get angry." Here the instructor reason is emotional. It is implied that there is really no good reason to ignore students, but in order to keep his sanity, he has to. The low frequency of these reasons may be a result of the professional setting in which the data was collected or how focused these instructors are on student learning, but the fact that they are mentioned indicates that there is an individual component to instructional decision making that is beyond the professional obligations of an individual in the role of a teacher. This individual component in the reasons given for an instructional decision will be explored in the discussion section.

Institution

The institution (or department) is mentioned in very few justifications (7%, 12) and when it is mentioned it is mostly about content and time (83% of those coded as institution, 10). Instructors mentioned that there is "a lot of material to get through in class" and "a limited amount of time to go through material" (Edgar, PT). Erin (FT) who advocates for a lot of

student interaction acknowledges that "time's always an issue." Several instructor talk about how they present the material and structure their class in order to avoid rushing through the material, "save a little bit of time" (Lou, FT), and "get through the material more quickly with clearer understanding" (Edgar, PT). In two justifications the instructors link their instructional decisions explicitly to their department's requirement. Rhonda (PT) provides students with a formula sheet on exams even though she does not think it is useful for the students. She says, "But it's not my choice it was decided [by our department]." Olga (FT) talks about how she has to cover all the material because there is a departmental final exam and students need to pass it. She goes on to say that if she didn't finish the curriculum, "my department would kill me."

The infrequent discussion of institutional reasons is an interesting feature of the analysis; it demonstrates the need to attend to all reasons even if they are only occasionally discussed. The rules and requirements of the institution or department exist for all instructors and likely have an impact on nearly every instructional decision made. There are many possible reasons for the infrequent discussion of institutional requirements. For example, it could be because many of these requirements are often not negotiable and always present. As a result they are likely unconsciously or unintentionally interwoven into every decision. Furthermore, many of these requirements are the same for all faculty members, so it is shared knowledge and there is no need for discussion—it is just how things are.

Complexity of Justifications

As previously indicated over half of the justifications given for an instructional decision included multiple reasons. The analysis shows that faculty do not rely on a single reason to justify the decisions they talk about—they consider multiple factors that contribute to instructional decisions. We could also speculate that all of the thoughts that go into an

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instructional decision are even more complex—have more categories of reasons and nuances within those categories—than what these instructors thought of or expressed and which were captured by my categorization of reasons.

Each justification identified indicated one, two, or three different reason categories: 56% (99) of the justifications have one code, 38% (66) of the justifications have two codes, and 6% (11) have three codes. To give the reader an idea of how complex a justification might be and how intertwined the reasons that teacher talked about are, I attempt to illustrate the overlap in codes visually and with some examples. Figure 5 illustrates the overlap of reasons within justifications between the student, content and teacher. I chose three reason categories to chart—student, content, and teacher—because they give the largest number of justifications represented when any three categories were chosen. The chart includes 95% (167) of the justifications. Figure 5 illustrates that it is common for a justification to have more than one reason, and also that the student is often the single reason given for an instructional decision.
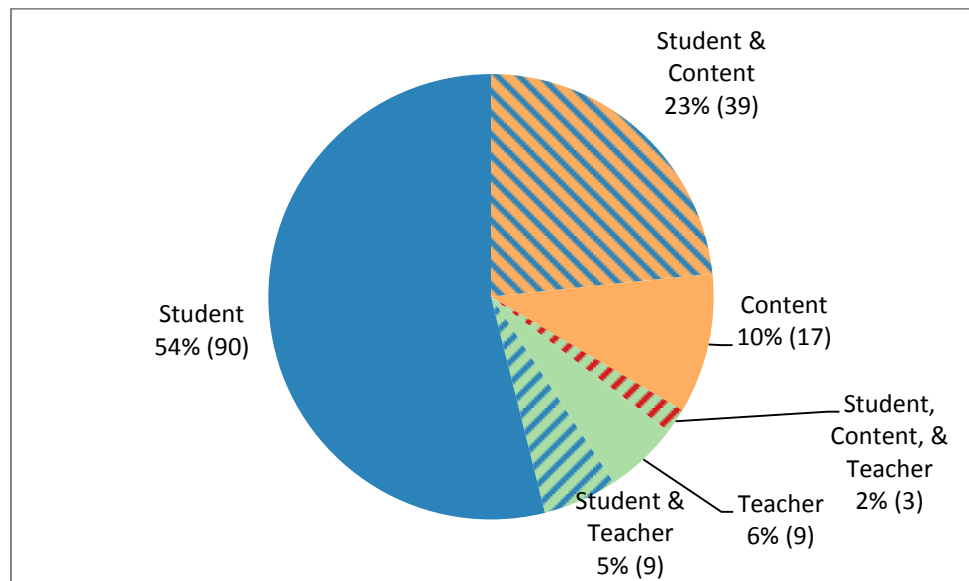
Figure 5: Frequency and percentage of overlap within justifications for the student, content, and teacher reasons in 167 justifications with lesson with 221 reasons

Edgar (PT) says that he prefers to show students how to do the math rather than allowing them to explore and figure things out. His justification for this instructional decision involves a combination of several reasons, making the reasoning complex. It includes the institutional obligation to cover the curriculum and to clearly present the lesson: "So you have to get through the material and clearly present it . . . you've got a lot of material to get through in class." He then goes on to talk about how different types of students learn, which acknowledges that certain types of classroom interaction are more or less beneficial to different types of students: "Brighter students can benefit by the back and forth and interaction and struggling through it. The students who are struggling . . . I don't think they get as much of a benefit from that." Thus, Edgar's reason for his instructional methods is shaped by the requirements of the institution to cover certain material in the set amount of class time, his desire for the lesson to be clearly presented, and his belief that this way of teaching is most beneficial to the learning of all students, rather than a select few. For Edgar, there is little tension between the different reasons, except perhaps that certain student could be learning more. Yet if he were to be asked to implement reform oriented practices where students work together on intellectually challenging problems and discover the mathematics, each of these reasons would need to be addressed. We can anticipate genuine worries that emerge from his reasons: How would he be able to cover all the course material? How can his lessons be successful when not clearly laid out and presented to the students? How will he structure his lessons so that all students can benefit? Clearly these are important concerns that in the absence of resources and support will put a stop in any reform effort.

A second example that illustrates the complex set of reasons comes from Ned (PT) when discussing the need for instructors to "be careful [and] very precise in what [they] say." In his

justification he talks about student learning, mathematics, and the nuances of its teaching. He talks about being very precise with the mathematics, particularly in cases where certain symbols have different meaning in different contexts such as using *x* for the angle and the horizontal coordinate. He speaks about student thinking and learning and how that is different than the knowledge of the instructor. "They'll misconstrue things. . . . [you have] to make sure that it's always clear. . . . We know because we've been doing this for . . . years. But for a student that walks in for the first time and [is] just now seeing trigonometry." He also recognizes their emotional state when they get something wrong and a level of respect between the student and teacher. It's "a huge issue, when you have overlapping things and imprecise terms when you're trying to understand something precisely. Because if they do it wrong on a test then we knock them down, 'you obviously don't understand.'" The complexity illustrated here also highlights that instructors need to be aware of the differences in what the students know and what the instructor knows, implying that the instructor's mathematical knowledge and understanding may interfere with the teaching process. Ned mentions the need for instructors to be cognizant of students' emotions—that the precise and nuanced nature of mathematics can cause students difficulty and the negative emotions that can result when done incorrectly. This justification illustrates that Ned recognizes his multiple obligations and potential tensions between them. This type of reflection on teaching is important for instructors, particularly when attempting to implement a new curriculum or encourage certain teaching methods that focus primarily on only one obligation.

A third example comes from Erin (FT), who is very attentive to student learning, understanding, and emotions, but who also recognizes that time is insufficient for the amount and type of interaction she would like to see. She tries "as much as [she] can" to redirect a student

question back to the students, "because we tell them a lot of things that they don't hear and the more we give them the opportunity to say it, it becomes a little more natural to them," but the acknowledges that "time's always an issue."

Thus we see across the board that the students are the primary reason instructors provide. The student reasons alone provide important insight into the many considerations taken into account by these instructors. There is a complexity that emerges from the number of reasons that instructors state in each justification. It shows the many potential influences on instructional decisions ranging from those that arise within the classroom—from the students and the mathematics—to the conditions and constraints of the institution as well as individual experience or beliefs. I turn now to the comparison between full-time and part-time faculty, a key comparison because of the extensive literature on the negative impacts of part-time faculty.

Practical Rationality and Professional Obligations

In this section I will talk about how my findings relate to the professional obligations as described in Herbst and Chazan's theory of practical rationality of mathematics teaching. As previously described, Herbst and Chazan (2003, 2011, 2012) pose that there are (at least) four professional obligations: *individual*, *interpersonal*, *disciplinary*, and *institutional*. My analysis corroborates the existence of these four obligations.

Herbst and Chazan (2011) describe the individual obligation as the teacher's obligation to "attend to the well-being of the student," which includes attention to students' behavioral, cognitive, emotional, or social needs (p. 450). This description of the individual obligation aligns with the reasons in this study in which the student was central. Specifically, the reasons in which the intellectual processes of the student were discussed included both the student's cognitive and behavioral processes. The reasons in which the instructors discussed the student's

emotions attended to emotions related to social setting (i.e., embarrassing themselves in front of the class) and independent on the social setting (i.e., gaining confidence). There were also reasons I identified as student intellectual or emotional which could be seen as tangential or contributing to the "well-being" of the student. These included recognition of students' actions (i.e., participating in class or copying answers), acknowledging students' desires and interest, and a level of respect between the teacher and students. I also found that the instructors' attended to the students' physical needs. The physical needs attended to both the classroom setting (i.e., ensuring that the whole class can see the board) and individual students with physical disabilities (i.e., visual impairments or hearing loss).

Herbst and Chazan's *disciplinary obligation* states that the mathematics teacher must teach a valid "representation of the mathematical, practices, and applications" of mathematics (2012, p. 610). This obligation is reflected in those reasons in which the content was addressed, specifically when discussing methods of solving problems, the correctness of solutions, mathematical connections or general statements about mathematics.

Herbst and Chazan define the *interpersonal obligation* as the obligation to "all of the individuals who are together in a classroom [who] need to share resources such as time, physical space, and symbolic space in socially and culturally appropriate ways" (2012, p. 610). This obligation can be seen in both the class and lesson categories. The reasons categorized as class recognized the intellectual and emotional of the class as a whole (all students) or sub-groups of students. These reasons also recognized the physical space of the classroom (i.e., students' ability to see the board) and the dynamics of the classroom (i.e., student participation or keeping the attention of the entire class). The reasons pertaining to the lesson—the pace, direction and

shared or expected knowledge—also relate to the interpersonal obligation. These reasons relate to the shared resources of time and symbolic space.

Herbst and Chazan's *institutional obligation* recognizes the obligations a teacher has to "regimes of coarser grain size than instruction" (2012, p. 610) such as their department or institution. The reasons that discussed the institution referred rules or guidelines set by the institution or department and were mostly about to the amount of material that needs to be covered in a limited amount of time.

The reasons referring to the teacher as an individual do not pertain to the professional obligations proposed in Herbst and Chazan´s theory of practical rationality. This is not surprising given that these reasons are more closely related to the individual that is in the role of the teacher—his or her past experiences, characteristics, and emotions—and less connected to the social setting or the role of the teacher. As one would expect, individual experiences and characteristics play a role in instructional decision making and they also likely contribute to their conception of what the role of the teacher is. The reasons that refer to an individual's emotions (i.e., "it drives me nuts to have a quiet class" or "I'm just going to get angry") indicate that instructors have an obligation to themselves—their own well-being. This obligation would not be considered a professional obligation because it is not tied to the role of the teacher; it indicates that instructors have obligations as individuals that may play a role in instructional decision making.

Full-time and Part-time Comparison

Figure 6 illustrates that the reasons given by each group are fairly similar with no statistical difference at the .05 level (see Appendix D). The most frequent reason given, the student, is very close in proportion between the full- and part-time groups and mentioned in

about 80% of the justifications for both groups. There is a moderate amount of variation between the two groups in the frequency of mentioning the class as a whole.
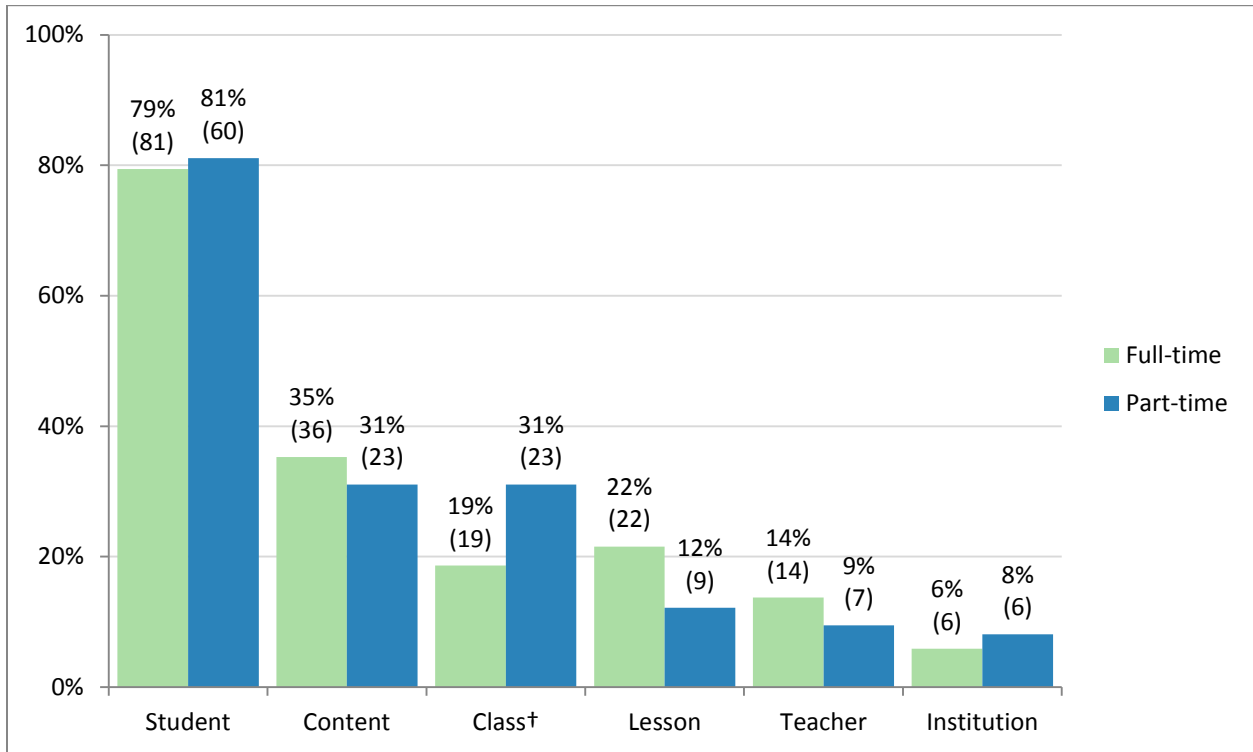
Figure 6: Percent of justifications with each reason in the full- and part-time groups
Justifications: 176 (total), 102 (FT), 74 (PT); Reasons Coded: 264 (total), 159 (FT), 105 (PT)
Note: There are no statistically significant differences at the .05 level between the full- and part-time groups. †: Marginally significant with a p-value of .06

Figure 7 shows the percentage of student justifications with each type of student subcategory in both the full- and part-time groups with no statistically significant difference. These results indicate that the types of reasons instructors give for making instructional decisions are similar for the full-and part-time groups.
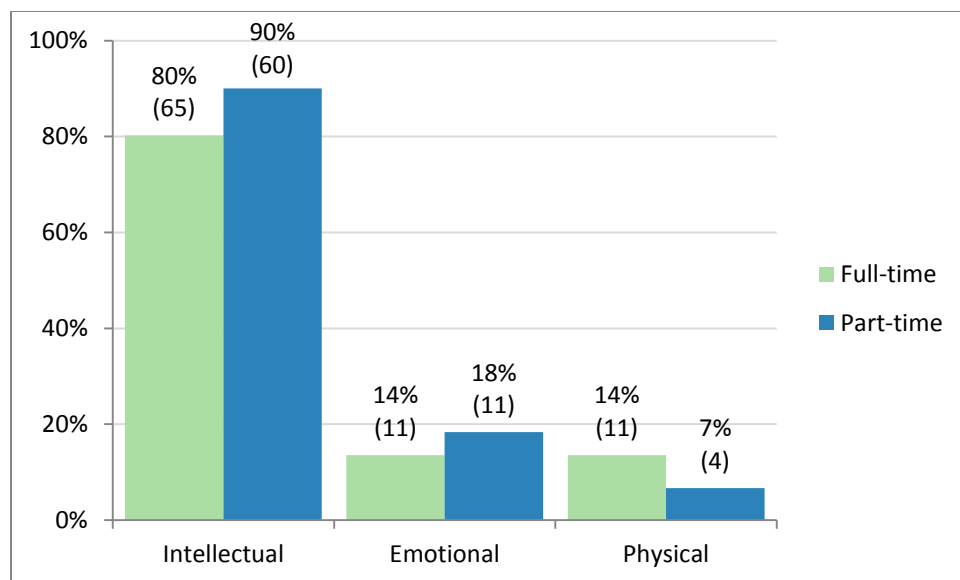
Figure 7: Percent of student justifications mentioning each student subcategory by full- and part-time groups

Justifications: 141 (total), 81 (FT), 60(PT); Reasons Coded: 156 (total), 87 (FT), 69 (PT).

Note: There are no statistically significant differences at the .05 level between the full- and part-time groups.

Summary

The analysis of the reasons proposed by the faculty suggests a heavy emphasis on student learning in both the full- and part-time groups. These reasons also illustrate the professional obligations of mathematics teachers proposed by Herbst and Chazan and indicate other reasons, such as instructors' emotions, that may influence their decision making. The justifications given for instructional decisions are complex and include more than one type of reason. There is no statistical difference between the frequencies with which full- and part-time faculty cite reasons for instructional decisions. This lack of difference between the two groups indicates that both groups embrace their role as professional mathematics teachers and demonstrates the need to further examine the instructional decisions made by faculty and other potential influences such as the environment in which they teach.

The Way Instructors Talk

Looking at the way instructors talk allows us to gain insight about their agency and helps to describe the nature of their interactions. Examining the linguistic features pertaining to the interpersonal meaning of instructional decisions gives us insight into faculty agency and how they position themselves as instructors. Examining the turn-taking patterns of each group and of individuals within each group helps to describe the nature of the group's discourse. The results of this analysis show that the part-time faculty indicate less agency than the full-time faculty, but that the discussion of the part-time faculty is more open and collaborative.

Instructional Decisions

A total of 1,358 instructional decisions were identified, and, as described in the previous chapter, each instructional decision was assigned a single code for modality (no modality, high, median, or low), actor (*I*, *we*, *you*, and *she*), and if the modality indicated a requirement. I first discuss the use and degree of modality, followed by the use of actor, and then take a closer examination of the modality of instructional decisions with *I* as the actor (*I*-instructional decisions). I conclude with an examination of the use of requirement in instructional decisions.

Modality.

The majority (53%, 724) of instructional decisions have no modality and of those decisions with modality, over half of them (52%, 329) are of a high degree (see Figure 8). The instructional decisions without modality are statement of how one teaches or comments on what the teacher in the animation did. The instructional decisions without modality and with *I* as the actor give insight into what occurs in an individual teacher's classroom. For example, "I assign the homework from the remaining even problems" (Lou, FT), "I do sine cosine tangent in the

second column and I put reciprocals next to them" (Kirk, FT) and "I tell them if we just spend the whole semester on one chapter everybody's going to understand and everybody's going to get an A" (Lou, FT). In each of these examples the instructors are sharing with the group a particular aspect of how they teach. The instructional decisions without modality and with *she* as the actor are statements of what the teacher in the animation did, usually to make a comment on that decision. For example, "she said, 'what does that mean about cosine'" (Mariam, PT) and "she ignores everything the students are saying" (Morton, FT).
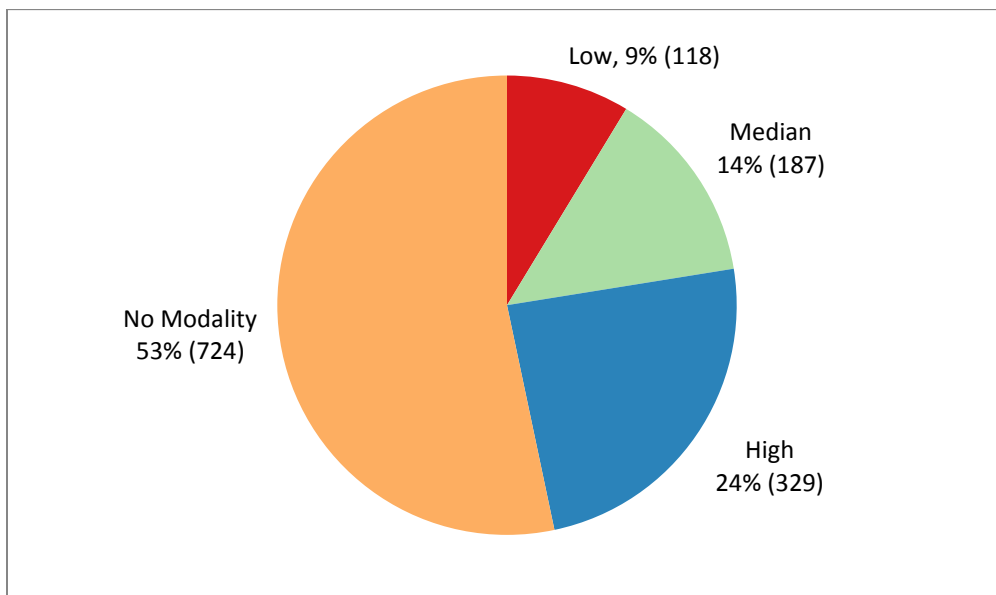
Figure 8: Distribution of modality use for instructional decisions

The modalized instructional decisions are often hypothetical—what an instructional decision would (high) or might (low) be in a given certain circumstance. For example, Nelson (FT) said that if he felt that students were just pushing buttons on their calculators and not knowing what they were doing he, "would have said, 'okay everybody put your calculators away I want to see how much we can do by hand'." When there was a discussion of departments requiring the use of formula sheets on exams, Thomas (PT) said that if his department required instructors to allow students to have a cheat sheet "I might say no sheet and wait until someone

says something to me." These modalized statements also included alternatives or additions to the decisions the teacher in the animation made. For example, Lou (FT) noticed that when the teacher in the animation wrote down the problem on the board, she did not include that she wanted the students to use the Pythagorean identities and he said, "she should have written that down." Similarly Ursula noted that when the teacher in the animation responded negatively to a student who got the answer from her calculator, Ursula (PT) said, "She could have explained, 'yeah, that works and you can find a value, but you're not finding the exact value'."

When we look at the use of modality by the full- and part-time groups differences emerge. Not only does the full-time group state many more instructional decisions than the part-time group, there is also a difference in whether or not modality is used (Figure 9). The part-time group has proportionally fewer decisions without modality. A two-tailed chi-squared test confirms that there is a statistically significant difference in the use of modality between the two groups ($\chi^2(1, N = 1358) = 5.5$, $p = .02$).
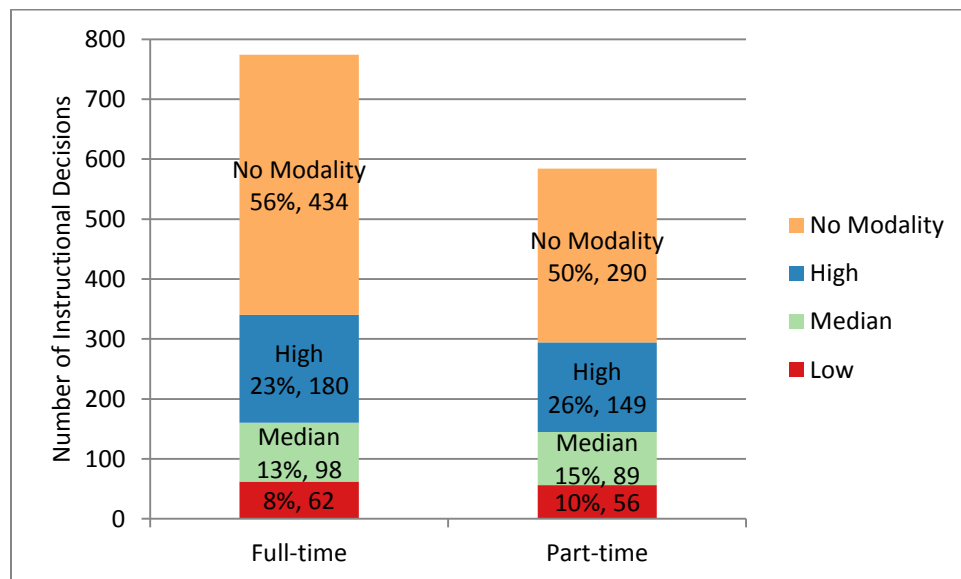
Figure 9: Use of modality by the full- and part-time groups

As the figures show, and the statistical tests confirm, there is a significant difference in the use of modality between the two groups; the full-time group states more instructional

decisions without modality than the part-time group. In other words, the full-time group talks much more frequently about what they actually do or what the teacher in the animation did. Simply looking at the difference in the existence of modality demonstrates a difference in the way the instructors in these two groups communicate. A conversation with modalized statements, (i.e., I would do this, I might say that, and then explain) presents these actions as possibilities, and leaves the option for others to talk about what they would do as well. Statements with modality can also be more or less inviting of further conversation. Statements with a high degree of modality (i.e., I would say this, and I always do that) are less inviting than those with low modality (i.e., I might do this or could say that; Martin & White, 2005). It is the amount of possibility left that invites others to mention other possibilities. Thus, using no modality creates a more monoglossic space, which is less open to interpretation and closes down the conversation. The use of modality creates a space where there is more room to comment and have more discussion on a topic. Difference in the use of modality indicates that overall, the conversation of the part-time group was more open for discussion.

In the next two sections I further examine the instructional decisions by looking at the use of different actors and look at the modality of instructional decisions with *I* as the actor where the difference between statements with no modality and high modality carry a different type of interpersonal meaning.

Actor.

The actor in each instructional decision is the one in the role of the instructor. There were four different actors used: *I*, *we*, *you*, and *she*. The use of these different actors can tell us about how individuals position themselves. The choice to use *I*, *we*, or *you* implies a different sense of agency. Consider the following structures for an instructional decision: "I could," "we

could," or "you could." *I* is very personal; it is particular to an individual and a statement about one's self. *You* is much less personal; it implies the general population of instructors and conveys less agency. *We* on the other hand is personal but it also indicates the speaker is part of the group or collective of instructors. The use of *she* is more about the content of discussion, but it does allow us to see how the conversation is prompted by the animation but then moves to the real world.

About half (51%, 683) of instructional decisions have *I* as the actor and about one-third (34%, 458) have *she* as the actor (see Figure 10). Thus most of the conversation focuses on an individual—either the speaker or the teacher in the animation.
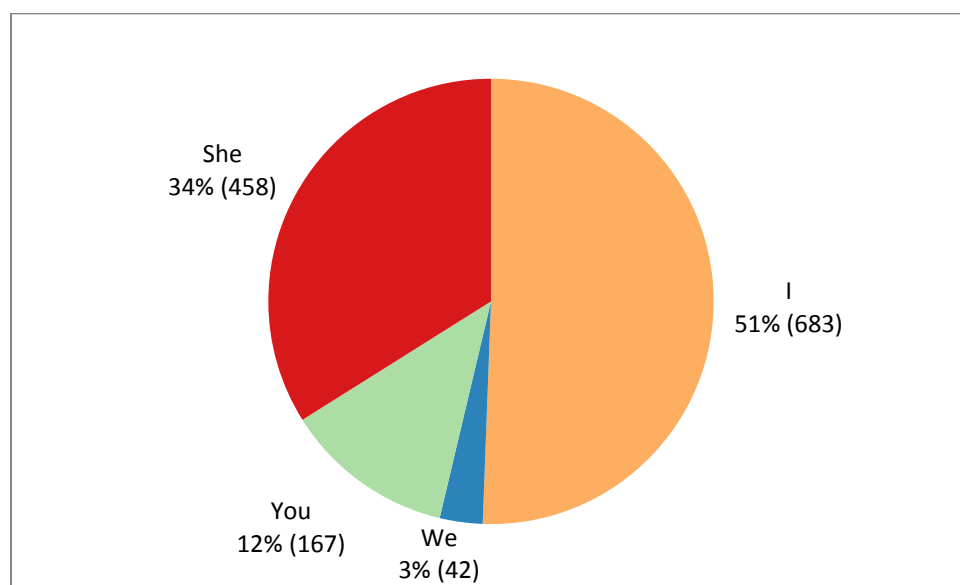
Figure 10: Use of Actor

There is a significant difference in instructional decisions in the use of the actor between the full- and part-time groups, $\chi^2(3, N = 1350) = 46.33, p < .001$.[12] The difference in the use of actor is much more striking than the difference in modality usage. The full-time group uses *I* and

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[12] There is a slight discrepancy in the number of instructional decisions coded for actor and modality (1,350 and 1,358 respectively; 755 and 774 for the full-time group; 595 and 584 for the part-time group). This discrepancy likely comes from either accidental double coding or the way that the qualitative program queries the data. Given that these discrepancies are small (less than 2.5% error) and would not affect the results, and the time it would take to manually review over 1,300 instructional decisions, I have decided to let them stand.

we more frequently whereas the part-time group uses and *you* and *she* more frequently (see Figure 11).
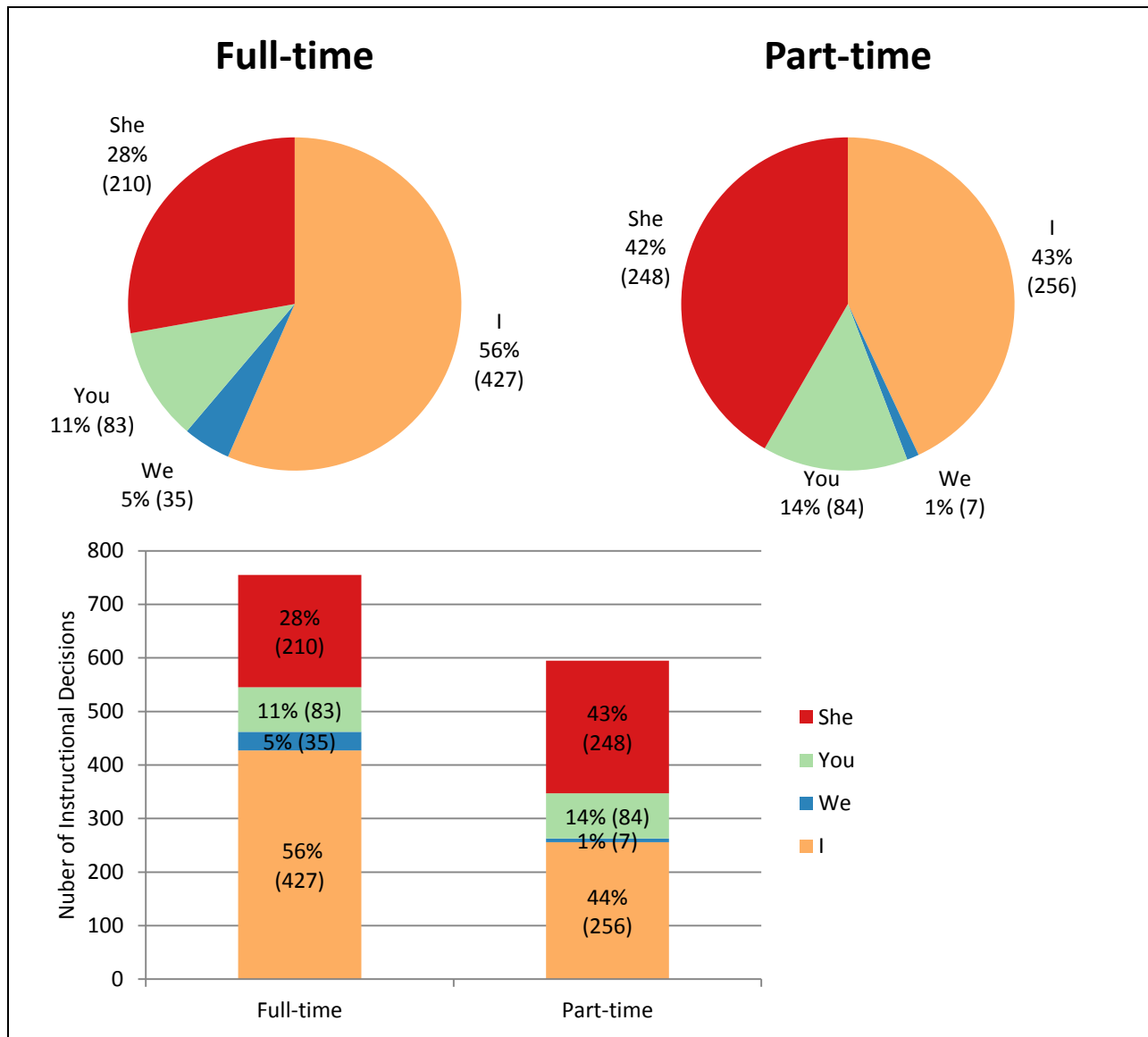
Figure 11: Use of actor for full- and part-time groups[13]

The full-time group used *I* as the actor in 56% (427) of instructional decisions whereas the part-time group used *I* as the actor in only 43% (256) of instructional decisions. Given that the full-time group also made more instructional decisions than the part-time group, the number

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[13] I use both pie charts and bar graphs to illustrate the differences between the full- and part-time groups. The pie charts better illustrate difference in proportion of instructional decisions in each category whereas the bar graphs better illustrate of difference in frequency—both of which are important to understand the results.

of *I*-instructional decisions made by the full-time group is nearly double that of the part-time group. The full-time group was more focused on themselves and their individual decisions rather than on those of instructors as a whole or of the teacher in the animation. Because of this large proportion of all decisions with *I* as the actor, and because of the significant difference between the two groups and the implications for agency, in the next section I explore the modality of *I*-instructional decisions.

The part-time instructors stated instructional decisions in terms of the teacher in the animation just as frequently as they stated their own instructional decisions. With 42% (248) of the part-time instructional decisions indicating the teacher in the animation as the actor, the part-time group made more statements about the teacher in the animation's action than the full-time group even though they had a smaller number of total decisions. This indicates that the conversation of the part-time group focused more on the instructional decisions of the teacher in the animation rather than on their own decisions.

The use of *we* in instructional decisions was infrequent in both groups, but more infrequent in the part-time group, with *we* as the actor in only 1% (7) instructional decisions. In the full-time group, *we* was the actor of 5% (35) of the instructional decisions. The small number of occurrences and the difference between the two groups may reflect the documented isolation of community college faculty that is more pronounced for part-time faculty (Grubb & Associates, 1999).

Because the use of *we* was relatively infrequent in the instructional decisions, I did a text search of the entire transcripts looking for *I*, *we*, *you, and she* to see if the difference in the use of *we* held in the discourse as a whole. This analysis confirmed that the part-time faculty use *we* less frequently than the full-time faculty (see Figure 12; $\chi^2(3, N = 5495) = 185.03, p < .001$).

The instructors in the full-time group used *we* more than twice as frequently (2.35 times) than the instructors in the part-time group. The patterns for use of *I*, *you*, and *she* also held in this analysis. The part-time group used *she* over 50% more than the full-time group and the full-time group used *I* nearly 50% more than the part-time group.
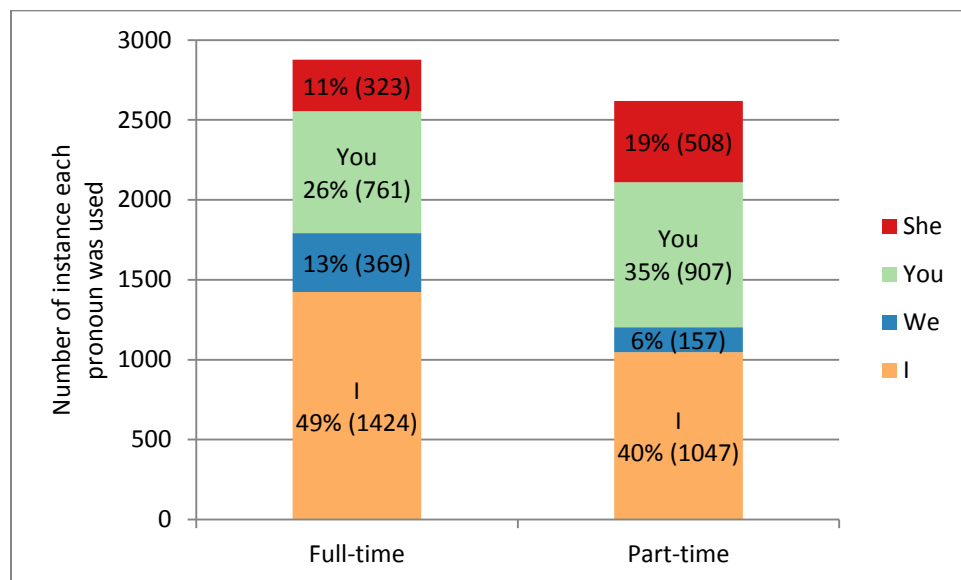
Figure 12: Frequency of pronoun use for the full- and part-time group in entire text

The more frequent use of *I* and *we* by the full-time group conveys a greater sense of agency—in telling others about their own choices more frequently—than the part-time instructors. The relevance of this difference will be explored in the discussion chapter.

Modality of *I*-instructional decisions.

In this section I explore the use of modality in instructional decisions with *I* as the actor (*I*-instructional decisions). A close analysis of the degree of modality used in these instructional decisions gives further insight into the agency conveyed by individuals in their role as mathematics instructors. While looking at the modality of all instructional decisions gave us a sense of the overall openness of the two groups, looking at the modality of *I*-instructional differences can help us to better understand the agency conveyed by the two groups.

Similar to the analysis of the modality of all instructional decisions, the full-time group makes significantly more unmodalized instructional decisions with *I* as the actor than the part-time group ($\chi^2(1, N = 687) = 11.59, p < .001$, see Figure 13). The difference between the full- and part-time groups in the use of modality in *I*-instructional decisions is more marked than in all instructional decisions. Furthermore, there is a significant difference in the degree of modality used by the two groups ($\chi^2(2, N = 372) = 6.03, p = .05$). The full-time group uses a high degree of modality more often than the part-time group (see Figure 14)
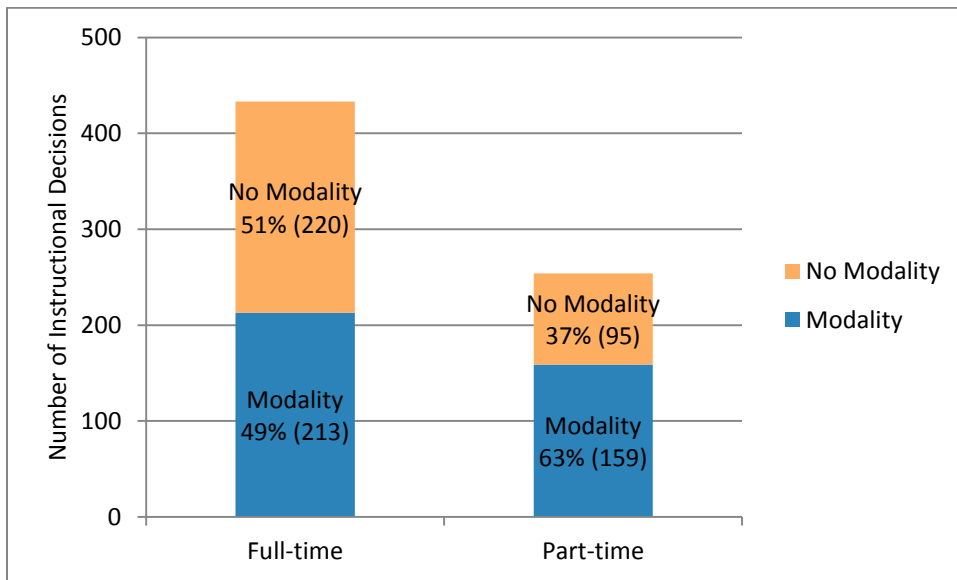
Figure 13: Modality of *I*-instructional decisions by full- and part-time group

The more frequent use of unmodalized *I*-instructional decisions and *I*-instructional decisions with a high degree of modality by the full-time faculty further substantiates that their sense of agency as mathematics instructors is greater than that of the part-time faculty. This increased agency indicated by the full-time faculty may be connected with the previous finding that they have a greater sense of belonging to the collective of mathematics instructors and are more confident in the way they teach.
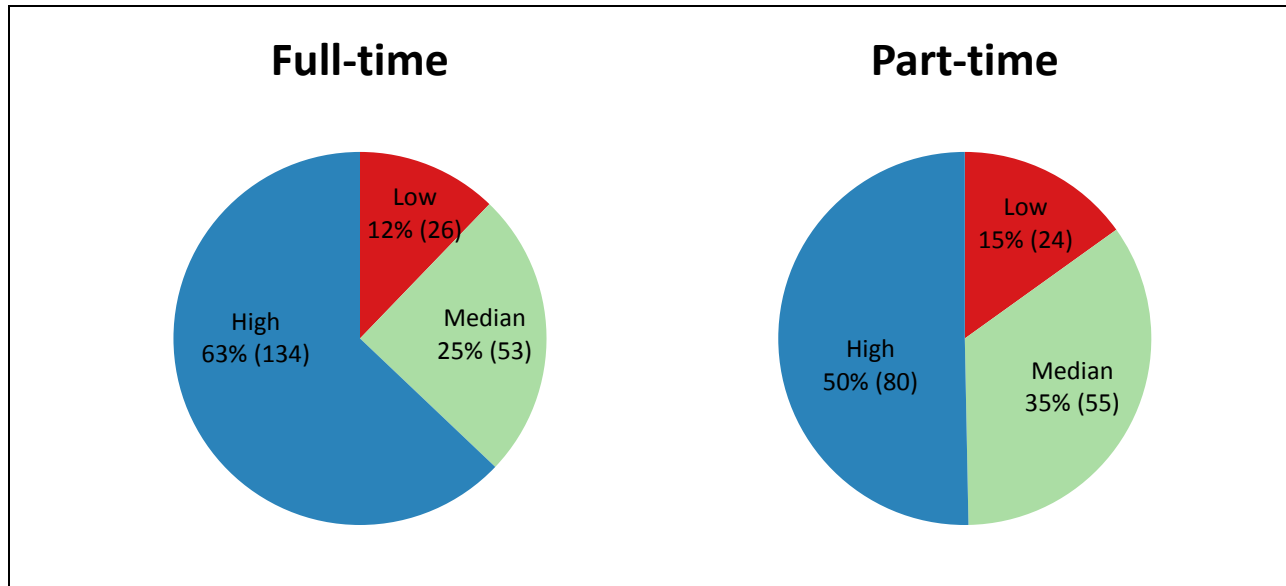
Figure 14: Usage of modality in *I*-instructional decisions by the full- and part-time groups

In addition, the more frequent use of unmodalized *I*-instructional statements by the full-time group means that they are more focused on telling others about what they do in their classroom rather than talking about possible or hypothetical actions. Speaking more about what one does creates a more monoglossic discussion, which closes down conversation. We can imagine how different a conversation would be with so many unmodalized statements. If another teacher is telling you how she teaches using unmodalized statements (e.g., I do this, I say that, I explain) the likelihood for having a back and forth discussion of such approaches is small. It will sound like a show and tell: here is what I have to offer to you. In the case of this professional development the moderator and researcher created an atmosphere that was thought to encourage discussing why an instructor did those things by regularly asking for reasons when the speaker did not offer them. The discussion of reasons helped to open up the conversation because others resonated with those reasons. These findings corroborate a difference in the atmosphere of the two groups meeting noticed by myself and the other researchers who were present in the sessions.

Use of requirement.

As mentioned in the methods chapter, there are different types of modality—inclination, probability, usuality, or requirement. Nearly every instructional decision with *I* as an actor indicates an inclination, probability, or usuality of that instructional decision happening, but not all indicate a requirement. Compare for example, "I would do that" versus "I should do that" or "I have to do that." All three have a high degree of modality indicating a high likelihood of taking that action, but "should" and "have to" also indicates that there is a requirement to do so. On the other hand, statements with modality of instructional decisions with the teacher in the animation as the actor mostly indicate requirement because it would be odd to impose inclination onto another person. In the decisions that indicate requirement, the degree is of interest to examine. For example, "She should do that" is a fairly strong statement, whereas, "She could do that" is a relatively weak statement.

The difference in the use of requirement between the full- and part-time groups is statistically significant ($\chi^2(1, N = 634) = 13.89, p < .001$ for instructional decisions with modality, and $\chi^2(1, N = 1358) = 19.40, p < .001$ for all instructional decisions). The part-time faculty group included requirement in 114 instructional decisions (39% of instructional decisions with modality or 20% of all the instructional decisions). In contrast, the full-time faculty group included requirement in only 85 of the instructional decisions (25% of instructional decisions with modality or 11% of all instructional decision).

Furthermore the level of modality of these decisions is much higher for the part-time group ($\chi^2(2, N = 199) = 11.32, p < .01$, see Figure 15). The majority (77%) of the part-time group's instructional decisions indicating requirement have high or median modality whereas only a little more than half (58%) of the full-time group's have high or median modality. These

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instructional decisions with high modality use "should," "have to," or "need," and those with

median modality also use "have to" or "should" but include other modality such as "probably" or

"maybe" or include subjective modality such as "I think." This is in stark contrast to those with

low modality that use "could," which indicates a weak requirement.
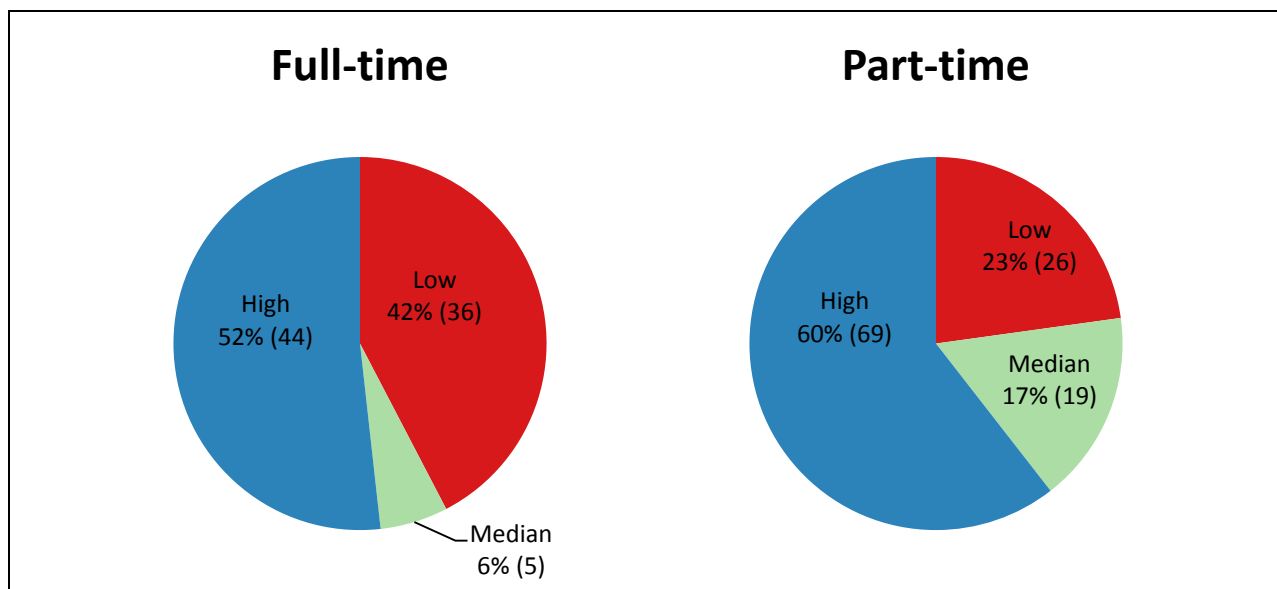
Figure 15: Modality of instructional decisions indicating requirement by the full- and part-time groups

Notice the sense of necessity that is conveyed with high requirement instructional

decisions: "I have to ask more leading questions" (Kathryn, PT), "the teacher should pick one

and show and draw it" (Rosa, PT), or "you should give a clear explanation first, then see if there

are questions regarding the explanation" (Edgar, PT). In those indicating a low requirement, that

sense of necessity is muted: "she could have just said yeah that's right . . . rather than . . . have

them come to the board" (Ursula, PT), or I think you could make some connections . . . and she

could connect more of the ideas that were coming in" (John, FT).

The significantly greater use of requirement and the higher degree of requirement by the

part-time faculty indicates that the decisions they report are things that must or ought to be done.

The use of requirement may stem from the notion that there is an ideal way to teach that all

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teachers should aim for. This could explain the use of requirement by both groups, but does not fully explain why the part-time group indicates requirement so much more frequently. The feeling of having more requirements could stem from external pressures from the institution or more internal attempts to fit in with what they see as the collective way mathematics instructors teach—a collective which they may not feel a part of, but attempt to fit in.

In order to better understand why instructors indicate a sense of requirement, I turn to those instructional decisions with requirement in which a justification was given (36 total; 12 from the full-time group and 24 from the part-time group). The majority of these instructional decisions indicate a high degree of requirement ("should" or "have to"). Most notable in the justifications for these instructional decisions is that the students are given as a reason in almost every one. Only three of these justifications do not explicitly attend to the students. These three justifications indicate what the teacher in the animation should have done with regards to the mathematics, and thus are implicitly attending to student learning. There were very few (three) justifications that mentioned requirements set by the institution. Each of these three justifications mentioned time, but always secondary to students. For example Ned (PT) promotes spending extra time on the signs of the different trigonometric functions in different quadrants. This way "she doesn't have to go through that again . . . because now she really knows they understand that . . . [and] it was worth the time because now we can cut down to the original method if we do a similar problem."

The use of actor in the instructional decisions was also different for the full- and part-time groups. The full-time group used *we* more often whereas the part-time group more frequently used *she* and *you*. Half of the full-time instructional decisions (six) have *we* as the actor conveying that the requirements are for all mathematics instructors. For example, Erin

(FT) stated, "we need to give [the students] more opportunity to talk about it so that they can hear themselves in the process and we can hear what they know and don't know," indicating that all instructors should give students more opportunities to be active participants in the classroom. In contrast, there was only one instructional decision with *we* as the actor in the part-time group; the majority had *you* as the actor (seven out of nine). Although these ways of talking indicate that there are requirements for all mathematics instructors, part-time faculty distance themselves from the group by using *you* rather than *we*: "you have to be careful, be very precise in what you say because they, they'll misconstrue things" (Ned, PT). In this case, Ned chose to use *you*, but could have said, "we have to be careful.".

For the part-time instructors, half of instructional decisions indicating requirement (12) have *she* as the actor. Stating that there are things that *she* should have done indicate that there was something that the teacher in the animation did that was not acceptable. For example, Edgar (PT) said, "she should have drawn a triangle that fits in there, so when he said adjacent the other students that might get confused [would see], oh that's the adjacent side." Only two instructional decisions with *she* as the actor were given by full-time faculty: "she could have kind of structured the question to avoid bringing up the calculator at this point" (Erin, PT) and "she should have drawn a triangle that fits in there" (Nelson, FT). These examples further illustrate the difference in agency that these two groups display. Based on the earlier analysis of the actor in instructional decisions and the frequent use of *I* as the actor by the full-time faculty, it is possible that the full-time faculty more frequently used themselves as exemplars rather than stating what the teacher in the animation should or could have done—making the actor the individual speaking rather than the teacher in the animation. In this case for example, Nelson

stated that "she should have drawn a triangle," but could have alternatively stated "I would have drawn a triangle."

Turn-Taking Patterns

To explore the interaction of and possible differences between the full- and part-time groups, I explored three aspects of the discourse: the length of turns in each group, the average length of individuals' turns, and the frequency of individuals' turn taking. Each of these features of the discourse contributes to understanding how individuals position themselves and how open and collaborative the discussion is. The length and frequency of turns by individual instructors along with the average length of turns in each group illustrates how the discourse is distributed among the speakers and gives insight into how instructors position themselves in the conversation and how open and collaborative the discussion is.

The average length of turn in the full-time group was 2.6 seconds longer than that of the part-time group, with an average turn length of 14.4 seconds (SD = 19.4) for the full-time group and 12.8 seconds (SD = 13.8) for the part-time group. Both the mean and variance were significantly different at the .01 level between the two groups ($t(1615) = 3.28, p = .001$; $F(895, 978) = 1.92, p < .001$; see Table 4). Shorter turns allow for more opportunities for participants to speak. Examining the turn-taking patterns by individuals within each group gives more insight into the nature of the discussion and how individuals position themselves in the conversation.

Table 4: Descriptive statistics for length of turn, and average length and frequency of turns by individuals

	Full-time		Part-time			
	n	Mean (SD)	*n*	Mean (SD)	*t*	*F*
Length of turn (sec)	896	14.4 (19.4)	979	11.8 (13.8)	3.28**	1.92***
Average length of turn by individuals (sec)	11	14.8 (5.4)	9	11.9 (2.1)	1.51	6.79**
Frequency of turns by individual (number of turns per hour)	11	18.9 (11.4)	9	24.2 (9.5)	-1.08	1.45

Note: **$p < .01$, ***$p < .001$

When examining the average length of turn by individuals within each group, the mean was not significantly different (likely a result of the small number of participants), but the variance is statistically different at the .01 level ($F(10, 8) = 6.79$, $p < .01$). Figure 16a illustrates this difference with a box plot. In the full-time group, the average length of turn for each instructor ranged from 7 to 22 seconds, whereas the range for the part-time group was between 9 and 16 seconds. The greater variation in the full-time group indicates that certain individuals held the floor at greater length each time they spoke, whereas the smaller variation in the part-time group indicates that all the individuals in the discussion interacted more as equals.

When examining the frequency of turns by individuals within each group, the variance in the frequency of turns by individuals is not statistically different at the .05 level[14]. Despite this lack of statistical differences, I include this result because the difference in the pattern of turn taking between the two groups was noticeable in the discourse and can be seen when illustrated in a box plot (see Figure 16b).

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[14] It is not relevant to compare the difference in means between the full- and part-time groups because the number of participants in each group was different. It is expected that the frequency of turns per hour in the full-time group with 11 participants will be less than in the part-time group with only nine participants.
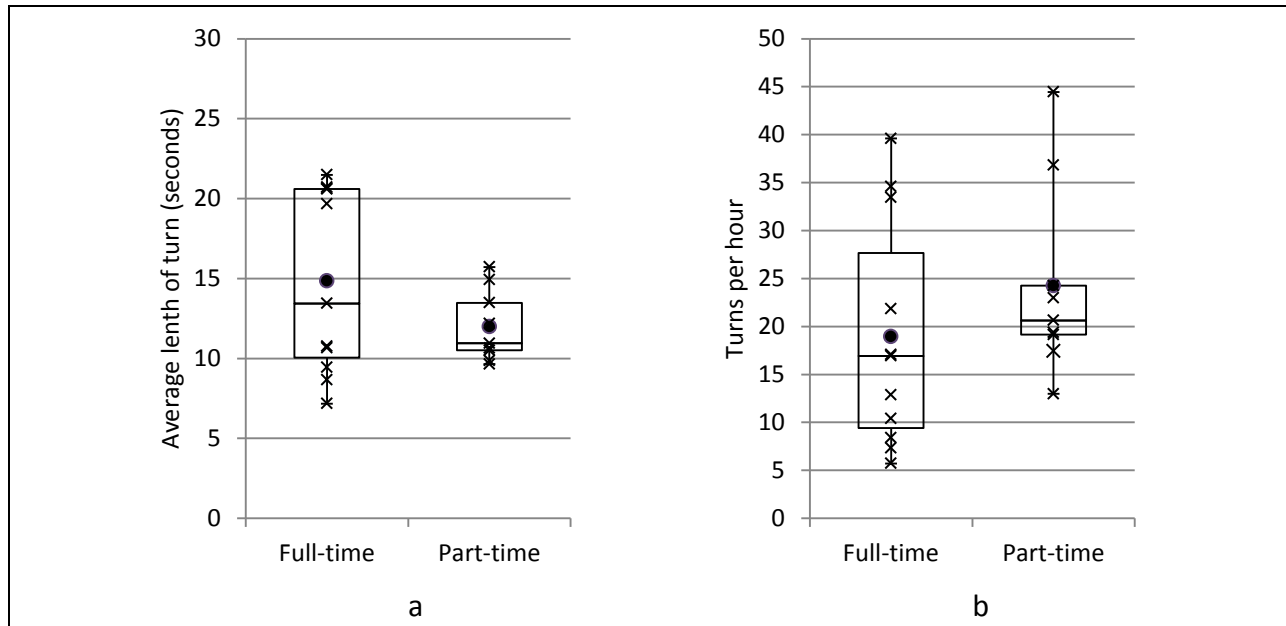
Figure 16: Box plot of (a) average length of turn by individuals and (b) frequency of turns by individuals in the full- and part-time groups

Note: ● indicates the median; × indicates the (a) average length of turn and (b) average turn per hour for each instructor.

In the full-time group, the frequency of turns for each instructor ranged from 6 to 40 turns per hour, and the range for the part-time group was between 13 and 45 turns per hour. While the overall range for the two groups is comparable, the pattern of distribution varies. Notice in Figure 16b how the distribution for the part-time group is skewed; all but two individuals take between 13 and 24 turns per hour. In the full-time group, there are three individuals who clearly take more frequent turns, but the distribution of turns is much more varied. This analysis further demonstrates the difference in how the two groups interact. The distribution in frequency of turns by individuals indicates how certain individuals asserted themselves and projected their perspectives more often than others. While this analysis indicates that certain individuals in both groups stand out as more dominant, the majority of the part-time group positioned themselves as equals.

The different lengths and frequencies of turns by individuals in each group demonstrates the different dynamics of the two discussions. In the full-time group, there are a group of

individuals that dominate the discussion by taking more frequent or longer turns, and others who speak less frequently and for a shorter amount of time. In contrast, the length of turns by individuals in the part-time group is more evenly distributed. Two individuals take more frequent turns than the rest of the group, but the length of their turns are close to the average for the group.

The results of these three analyses indicate that there is more back-and-forth among instructors in the part-time group and that the discussion is more evenly distributed than the discussion of the full-time group. A discussion with evenly distributed turn-taking patterns creates a space where everyone has equal opportunities to share and positions the speakers as being equals and trying to fit in with the rest of the group. The unequal division of the discursive space within the group positions some speakers as being individually empowered. The results of these analyses suggest that the discussion of the part-time groups is more open and collaborative and that the speakers position themselves more as equals and further support the difference in agency in the two groups discussed earlier.

The difference might be due to faculty status—that the part-time faculty are more tentative and more collaborative because they are in a position where they don't have the agentive power of full-time faculty; they have to fit into the group and institution and with what other instructors are doing and saying as opposed to feeling authoritative and empowered to make decisions more independently.

Summary

The way these instructors talk about instructional decisions indicates that part-time faculty position themselves as less agentive in instructional decision making as revealed by their use of modality, choice of actor, and indication of requirement. This difference in agency

between the two groups suggests that the working environment in which faculty teach may impact individuals and their instructional decision making. As a result of the more frequent use of modality, the less frequent use of *I* as the actor, the shorter length of turns, and the smaller variation in turn taking, the part-time group's conversation is more conducive and likely to encourage discussion and collaboration of faculty. The turn-taking patterns observed also suggest that the part-time faculty position themselves as equals among themselves whereas the full-time faculty do not. In the next chapter I will explore possible explanations for these findings and how they substantiate the need for a theory of decision making that attends to teachers as individuals, the environment in which they teach, and the interaction between the two.

Chapter 5

Discussion

I start this chapter by stating the research questions that guide this study together with the findings that answer the questions. I then discuss the connection between roles (both professional and non-professional), reasons, and obligations, and introduce the notion of the fulfillment of professional obligations, which explores the relationship between the individual, the social context, and instructional decisions. With this framing, I then explore possible explanations for the differences found between the full- and part-time faculty discussions. I then make some concluding remarks and discuss how these findings support the need for a theory of instructional decision making that attends to teachers as individuals, the environment in which they teach, and the interaction between the two. I conclude with a discussion of future research and implications for practice and research.

Research Questions and Summary of Findings

1. What reasons do community college mathematics faculty give for the instructional decisions discussed?

2. How is faculty status associated with these reasons?

The most frequent reason instructors gave for making an instructional decision was the student (given in 80% of the justifications), followed by the content (34%), class (24%), lesson (18%), teacher (12%), and institution (7%). Most of the attention to students was intellectual (84%), followed by emotional (16%) and physical (11%). These reasons support the existence of

the professional obligations proposed by Herbst and Chazan in the theory of practical rationality of mathematics teaching (2003, 2011, 2012) and illustrate that in addition to professional reasons for making instructional decisions, instructors also have personal reasons, such as their experiences, beliefs, and emotions for making instructional decisions. The justifications given for instructional decisions were complex with nearly half of the justifications containing more than one reason. No statistically significant differences were found in the reasons given by the full- or part-time faculty.

3. How is faculty status associated with agency in the instructional decisions discussed?

The part-time faculty indicated significantly less agency and more frequently indicated requirement in their instructional decisions than the full-time faculty. The full-time faculty spoke more about how they teach rather than the possible ways of teaching. While the overall modality of instructional decisions by the part-time faculty was less than that of the full-time faculty—making the conversation more monoglossic, the instructional decisions indicating requirement made by the part-time faculty had a higher degree of modality than those of the full-time faculty; the instructional decisions of the part-time faculty indicates a stronger sense of requirement. Increased use of requirement further indicates a difference in agency between the two groups. The full-time group's turn-taking patterns were different than those of the part-time group. The full-time group's turns were longer and the discursive space was less equally distributed among members of this group than in the part-time group; thus the part-time group's discussion was more open and collaborative and the speakers positioned themselves more as equals.

Roles, Reasons, and Obligations

In order to be able to discuss the reasons instructors give for their teaching decisions, a discussion of roles is necessary. "Roles embody some of our highest aspirations and provide social mechanisms for shaping action in their light. They are parts people play in society and do not describe individuals" (Buchmann, 1993, p. 147). Most people hold multiple roles in their lives, and these roles often overlap. Roles vary widely; they can range from what many see as careers or professions such as mechanic, chef, doctor, or professor to non-professional (personal) roles such as friend, spouse, parent, wage-earner, or caregiver. Different roles have different responsibilities and goals. The goals of professional roles are defined by the profession—to fix a car, prepare a meal, or help a patient get healthy. Non-professional roles are not so clearly defined, but one could also speculate about what defines them. In the context of why teachers teach the way they do, it is important to recognize that individuals in a faculty position are in a professional role, but as individuals, they also have other roles that are unique.

Furthermore, an individual in a given role is likely fulfilling necessary parts of other roles that have different goals. For example, it is expected that an individual who takes a position as a teacher takes on the role of a teacher and likely holds the position in order to earn wages to fulfill their role as a self-sufficient individual or family member. But this may not always be the case. It is possible that an individual takes a position as a teacher only because he or she needs to make money, but does not fully embrace the role of a teacher or gain any personal satisfaction in that role. Alternatively, an individual may be independently wealthy and choose to teach for personal enjoyment or satisfaction. While neither of these extremes is typical, it sets forth the idea that individuals usually have to attend to both their professional and personal roles and which role is more prominent varies by individual and their professional and personal circumstances.

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We also need to recognize that roles themselves are often complex. Any given role can have multiple parts or sub-roles, and thus, somewhat separate, possibly competing goals. When examined closely, the role of faculty is quite complex. This role varies in by type institutions but may include roles such as instructor, researcher, committee member, advisor, or administrator. While it is not my goal to untangle or attempt to separate all the roles of faculty, thinking about these different professional sub-roles—with sometimes complementary and sometimes competing goals and obligations—allows for a more comprehensive view of the role of faculty. This study focuses on the faculty's role as an instructor, yet acknowledging the variety of professional roles held by faculty and other personal roles held by individuals who take on the role of faculty is necessary to better understand instructional decision making.

Roles have obligations. For teachers, obligations are "those behaviors and dispositions that students and the public have a right to expect" (Buchmann, 1993, p. 147). These teacher (or faculty-oriented) obligations do not depend on any particular individuals (teachers or students); apply regardless of personal opinions, likes, or dislikes; and relate to what is taught and learned (Buchmann, 1993). By examining the reasons given for decisions or actions, we can theorize about the obligations of instructors.

I bring up this discussion of roles and obligations for two reasons. First, this study showed that these instructors do have reasons beyond their professional obligations for the instructional decisions that they talk about, that is they have faculty-oriented and individual-oriented reasons, which influence their decisions. Second, the different ways in which the full- and part-time faculty talk about these decisions indicates that their faculty status might influence how professional obligations are fulfilled. Incorporating the notion of multiple and complex

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roles helps us understand the full range of reasons given by these instructors and explain similarities and differences between the full- and part-time faculty.

The reasons that instructors give for instructional decisions can be characterized as faculty-oriented (professional) and individual-oriented (non-professional or personal). Faculty-oriented reasons are based on the professional obligations of faculty. They focus on the students, the content, and the institution. Individual-oriented reasons include reasons that may stem from obligations from other roles held by the individual (i.e., wage-earner) or those of a personal nature. Personal or subjective reasons are those reasons that indicate the self; they center on an individual's "habits, interests, and opinions" (Buchmann, 1993, p. 146) and include personal preferences, inclinations, and emotions (i.e., "[Y]ou realize there's a couple guys that, I need to ignore them, otherwise *I'm just going to get angry*" and "I encourage [students to speak out] in my class. I don't like my students to raise their hand at all, just shout things out then we stop and talk, because *that's just the way I am*").

While it is not possible to know the extent that faculty- or individual-oriented reasons play in any given decision or action, this distinction is useful in thinking about why certain reasons are or are not discussed and how they are discussed. It also allows further examination of the goals and obligations of those in faculty roles.

Even though professional and individual reasons can be conceptually separated, they are inherently intertwined and thus cannot be empirically distinguished. Take for example the differing views seen in this study on the best methods to teach students. Erin (FT) advocates for student interaction and for giving students the opportunity to talk about and discover the mathematics. On the other hand, Edgar (PT) prefers to clearly present the material—to show students how to do the math rather than allowing them to explore and figure things out. Both of

these instructors indicate that they use these methods to help students learn the mathematics and that the amount of time available in class is problematic, and therefore both instructors are attending to their professional obligations to the students and the institution. The distinctive ways in which each chooses to teach indicates that how instructors fulfill their professional obligation varies, and thus other influences must be examined. We could speculate that the choice of such different teaching methods are influenced by the environment in which they teach, such as responding to pressures from the department, or individual reasons such as their beliefs about how students learn best or the way they are most comfortable teaching.

Although it is the case that any individual in a position of a faculty member elects to take on the professional role of faculty, how that individual views this role may vary. The role of a faculty member is complex and individuals may choose to embrace certain aspects of the role and minimize or ignore others. Within the multiple roles of faculty—such as instructor, researcher, committee member, advisor, or administrator—other sub-roles may exist (see Figure 17). For example, the role of instructor includes, but is not limited to, the role of a teacher (specifically helping students learn as seen in student intellectual reasons), conductor (coordinating/orchestrating the classroom as seen in class and lesson reasons), and evaluator (correcting student work and giving grades). In addition there are other sub-roles that are less easily defined that instructors at community colleges fulfill; one example is being a counselor—a person who can attend to and empathize with student emotions.

Faculty

Advisor | Committee Member | Instructor | Researcher | Administrator

Teacher | Classroom Conductor | Evaluator
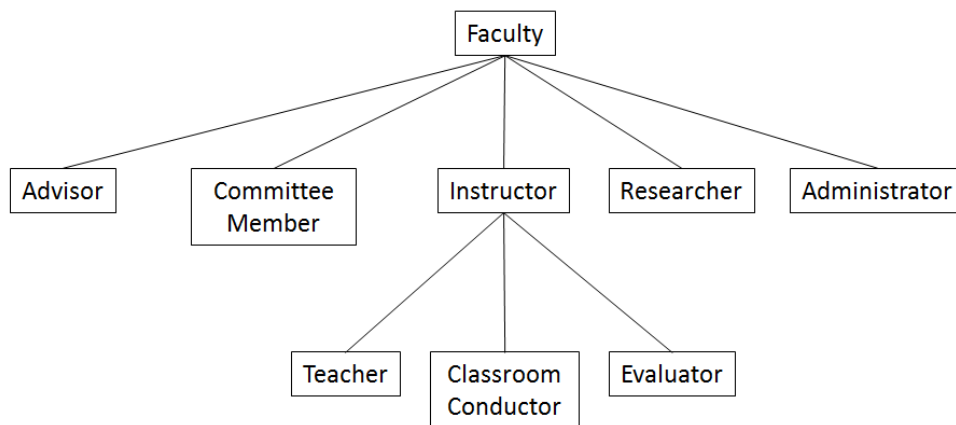
Figure 17: Multiple roles of faculty

Each of these roles and sub-roles has its own goals and obligations and the roles may vary by institution, assignment (i.e., teaching load, administrative duties), and individual. The obligations of these roles may align or conflict. Because the focus of this study is on classroom instruction, I will zoom in on the role of instructor more closely, but the other roles of faculty are important to keep in mind when thinking theoretically about why teachers teach the way they do.

Acknowledging the multiple roles that individuals and faculty members can have is important; teasing out the difference between the obligations themselves and the fulfillment of those obligations helps us to understand better why community college faculty teach the way they do.

Fulfillment of Professional Obligations

In this section, I bring together the finding from my research questions about reasons and agency and role they play in instructional decisions. The analysis of reasons indicated that these faculty do attend their professional obligations and that personal reasons also play a role in instructional decision making and the analysis of agency demonstrated that the part-time faculty group convey significantly less agency than the full-time faculty. In addition to these finding,

the analysis indicated that how each individual instructor carries out those obligations varies (i.e., to fulfill the student obligation the instructor may present facts and procedures or encourage student interaction and discovery learning) and there are occasions when faculty choose to disregard an obligation (i.e., choose not to attend to the institutional obligation to cover all course material). In other words, what a teacher does—his or her decision or action—to fulfill (or ignore) an obligation can vary depending on other obligations, the institutional environment[15], on an individual's resources, beliefs and goals, the agreeability, willingness, and knowledge of the students, and personal circumstances.

The literature has shown that individual characteristics such as beliefs, knowledge, experiences (i.e., Aguirre & Speer, 2000; Hill et al., 2008; Schoenfeld, 2011) and the social context (i.e. Herbst & Chazan, 2012) can influence instructional decisions. The notion of fulfillment of professional obligations in an instructional situation, gives insight into the relationship between instructional decisions, and the individual (i.e., beliefs, knowledge, emotions), the context (i.e. role, professional obligations, norms, and the working environment), and their interaction (i.e., agency), and gives more explanatory power to the processes in which instructional decisions are made. Figure 18 illustrates how the fulfillment of professional obligations mediates this relationship.

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[15] The institutional environment includes the norms, expectations, and constraints of the college and department and how the faculty are positioned and treated by the college and department
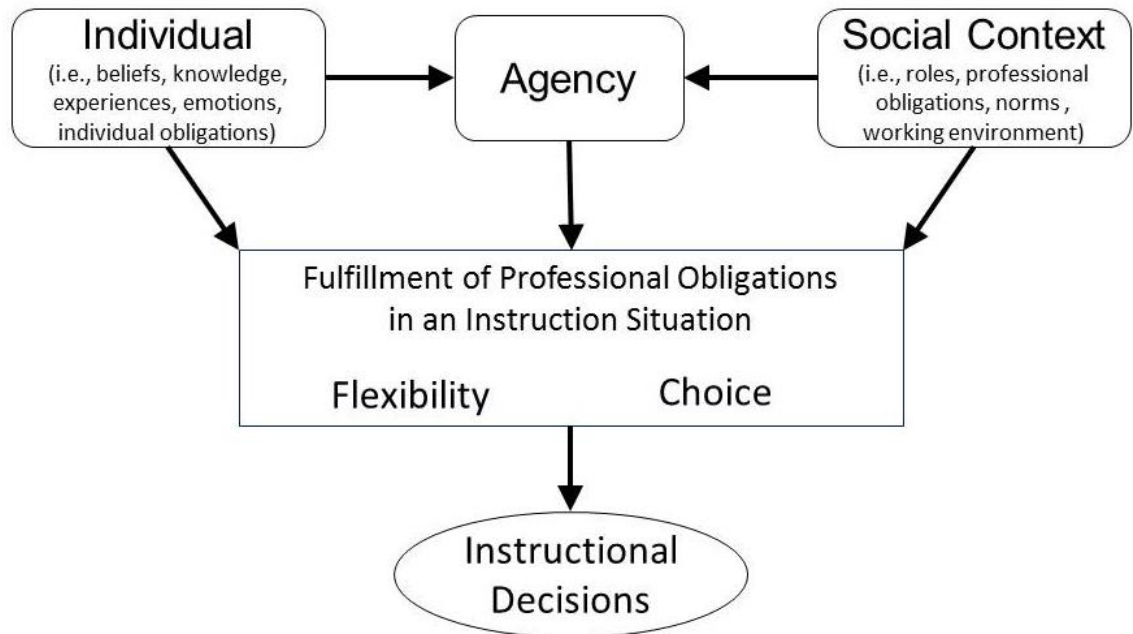
Figure 18: The relationship between the individual, the social context, and instructional decisions

In order to understand the role of agency in instructional decisions there are two dimension of how professional obligations are fulfilled in an instructional situation—flexibility and choice—that are useful to discuss.

Flexibility is the range of possible decisions that can fulfill a professional obligation. For example, in the case of this study, the obligation to help students learn mathematics was fulfilled through a variety of teaching methods, such as lecture, group work, presentation of facts and procedures, or discovery learning. Choice is the decision to attend to or disregard a professional obligation. For example, the teachers in this study spoke of an obligation to the department to cover a defined set of content for each course they teach, yet not all the faculty fully complied. Several of the full-time faculty stated that they choose not to cover some "unnecessary" content to allow them more time to focus on the "important" topics and one of the part-time faculty, Thomas, stated that if his department required instructors to allow students to have a cheat sheet for tests, he might not allow it and wait until someone said something. These two examples

illustrate how instructors may, at times, choose to disregard their obligation to the institution in favor of doing a better job in fulfilling their obligation to the students or the mathematics.

These two notions—perceived flexibility in how professional obligations can be fulfilled and a decision to attend to or disregard an obligation—are important when trying to understand the instructional decisions of teachers and how a wide variety of instructional decisions fulfill (or disregard) professional obligations. These notions provide language to jointly discuss the social and individual factors that play a role in instructional decision making. Such language allows for an examination of the interplay between the environment and the individual, specifically how the working environment might influence individuals and their instructional decisions.

I argue that the perceived flexibility in how professional obligations can be fulfilled and choice to attend to or disregard a professional obligation depend on many factors that stem from the individual, the social context, and individual agency.

As previously discussed, the literature in mathematics education has identified individual characteristics such as knowledge, beliefs, and experiences as having an impact on instructional decisions and thus have an impact on the way professional obligations are fulfilled. I postulate that that other personal obligations (i.e., to one's own well-being or other individual roles) also play a role in how professional obligations are fulfilled. For example, the examination of reasons in this study indicated individual emotions (i.e., "it drives me nuts to have a quiet class" or "I'm just going to get angry") are involved in how professional obligations are fulfilled and these emotions could be seen as a personal obligation to one's own well-being. We could also speculate how other roles such as parent or wage-earner (e.g., having multiple jobs) could limit the ways in which professional obligations are fulfilled to those choices that take up minimal time outside the classroom. For example, an instructor might choose to follow the same lesson

plans each semester to avoid spending extra time creating new plans or use on-line homework and multiple choice exams rather than homework or exams that include open ended questions or essay type responses to reduce the amount of time grading takes.

The social context[16] regulates the norms and professional obligations that shape instructional decisions and to some extent limits the range of socially acceptable ways in which the professional obligations can be fulfilled. For example, it seems that a certain amount of freedom is granted to instructors when they teach in an environment like the community college. Yet, it seems obvious that this freedom has some boundaries or limits. Instructors are often given the freedom to choose how much time he or she spends covering each topic, but if an instructor did not cover a good a portion of the required class material, the administration would likely reprimand or choose to no longer employ that instructor. This demonstrates how the social context can constrain instructors' decisions, but can still leave a wide range of possible ways to fulfill professional obligations. Within the broader social and institutional context, the working environment may further constrain the range of possible ways to fulfill professional obligations for different individuals or groups of instructors (i.e., full- and part-time faculty, tenured and untenured faculty).

The difference in agency found between the full- and part-time faculty in this study demonstrates the need to look at the interaction between the individual and the social context. Recall that the definition I use for agency—the socio-cultural mediated capacity of an individual to act—acknowledges both the individual and the social context. Thus it is important to recognize that individuals are "neither free agents nor completely socially determined products" (Ahearn, 2001, p. 120) and "while we [individuals] have some choice in the ways we choose to

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[16] Appendix F: The Social Context, illustrates my conceptualization of the social context, which includes wider society, the institutional environment, working environment, and working conditions.

create ourselves, our every action takes place within a social context, and thus can never be understood apart from it" (Hall, 2012, p. 35).

There are many ways in which agency might influence how professional obligations are fulfilled. For example, instructors who position themselves as more agentive may fulfill their obligations in ways that they see most appropriate, even if their departments or colleagues have different views, and possibly even choose to disregard their obligations at times, as was seen when the full-time faculty stated that they do not always cover the required material. On the other hand, part-time or untenured faculty (as was seen in the case of Olga) may be less agentive and choose to follow the norms set by their departments and colleagues and ensure that all of their professional obligations, particularly the institutional obligation, are met to the best of their ability.

This framework (Figure 18), which introduces the idea of fulfillment of professional obligations and the relationship between instructional decisions, and the individual, the context, and their interaction, allows for a more comprehensive discussion of the difference in agency between the full- and part-time faculty and the role of agency in instructional decisions.

Full- and Part-Time Faculty

The findings of this study support the literature on part-time faculty, which suggests that part-time faculty are largely alienated by their institutions and departments (i.e., Gappa & Leslie, 1993; Grubb & Associates, 1999; Townsend & Twombly, 2007). The obligations that are reflected in the reasons given by these instructors do not vary between the full-time and part-time groups, yet there is a significant difference between the ways the two groups position themselves. In discussing why there are similarities and differences between the two groups in my study I postulate that the similarities between full- and part-time faculty come from what

both groups see as their role as professional mathematics teachers, and, based on the literature on part-time faculty, the differences are a result of the different working environments and assigned roles that accompany their title. The difference in the way the two groups talk supports the view that part-time faculty are largely alienated by their department and institutions; they are seen and treated largely as laborers rather than professionals by the institutions (Kezar &Sam, 2011). Understanding the conditions that likely contribute to these differences can help us to appreciate (beyond personal characteristics) why instructional decisions and actions may be different for full- and part-time faculty and lead to suggestions for ways of improving teaching.

In this study, both the full- and part-time faculty embrace their role as professional mathematics teachers; they wholeheartedly accept the role of a teacher. Considering that the working environment of the two groups are very different and there is a difference in the agency conveyed by the two groups, it is somewhat surprising that there is not a difference in weighting of the reasons between the two groups (e.g., the part-time group putting more emphasis on the institutional obligation). There are several possible explanations for this. One possibility is that both groups are more similar than different because of how they were selected for the study: all the faculty in this study were recommended by their department chairs because they were "outstanding faculty." A possible consequence from this selection process is that the part-time faculty in the study see themselves more as professionals than laborers. This may also be the case for any part-time faculty member that is called to participate in a professional development setting that focuses on teaching mathematics. It is also conceivable that the institutions that employ the part-time faculty in this study put a strong emphasis on student learning and student satisfaction—which is not uncommon for community colleges—and use learning outcomes and student evaluations of teaching to make decisions about who to employ. If this is the case, then

when discussing reasons for instructional decisions in a professional context, part-time faculty are likely to simply give a reason pertaining to student learning or satisfaction; it would be less professional to say that they make decisions to improve student learning or satisfaction because it is the focus of their institution.

The difference in the way full- and part-time faculty talk about instructional decisions and in their interaction suggests that status might be influencing their instructional decisions. The part-time faculty's language choices reveal less agency and confidence in conveying their views relative to the full-time faculty, and thus, these choices position the part-time instructors as marginalized. The more frequent use of requirement and the more equally distributed discursive space in the part-time group positions them as trying to fit in. Trying to fit in often indicates that individuals are positioned as outsiders. When an individual sees him or herself as an outsider it is because the individual has a sense of what it means to be part of a group; the individual recognizes the group without being or feeling fully integrated. This makes the individual less certain about appropriate actions and with ideas of what he or she has to do or should be doing, which can result to more tentative language and language that conveys a stronger sense of requirement. I will now explore how these differences might be a result of the different working environment and how the differences might impact instructional decisions.

Full-time faculty—especially those that are tenured—have been formally acknowledged and accepted as belonging to the institution in their role as mathematics instructors. In contrast, the working environment—how faculty are positioned and treated by the college and department (see Appendix F)—in which part-time faculty teach often does not formally acknowledge them as professionals (Kezar &Sam, 2011). Part-time faculty are often left out of department meetings, governance, and course decision making (i.e., content or textbook), and lack of support

to attend professional conferences. This explicitly excludes them from being fully integrated into the department and profession. The working environment also includes the conditions of their employment—low pay, lack of office space, being paid only for teaching hours—which further separate them. It may also be the case that because of their title and these conditions, their full-time counterparts do not respect them or treat them as equals (Cross & Goldenberg, 2009). This alienation by the department, institution and possibly their peers is likely to impinge on their ability to fully integrate into the profession and positions part-time faculty as outsiders. The differences found between the full- and part-time faculty in this study indicates that the working environment does impact the way individuals use language to position themselves and suggests that working environment may also impact how individuals position themselves as professionals.

While this study does not address if there is a difference between the two groups in what actually happens in the classrooms, I argue that the difference in how the full- and part-time faculty position themselves is likely to impact instructional decisions. In the analysis I identified times when instructors in both groups stated that they disregarded or would disregard certain institutional obligations. However such statements were more common in the full-time group and more hypothetical in the part-time group (i.e., "if that was the case, then I would"). In both groups it was more common for instructors to disregard obligations when they had been teaching in community colleges longer. This variation due to status and experience suggests a possible influence on instructors' decision making (in this example, their decision to disregard certain institutional requirements). Instructors will at times resist changes, but they may be more likely to resist if they are in a position where resistance will not have severe professional or personal repercussions.

To better understand how a faculty member's position might impact their instructional decisions, we need to also consider two aspects of decision making previously discussed, that are particularly relevant to my conceptualization of instructional decision making: the logic of choice, and maximizing and satisficing. There are two ways of viewing the logic of choice in decision making, the logic of consequence and the logic of appropriateness. The logic of consequence, or choice-based decision making, assumes that decisions are made by evaluating the consequences of the choice whereas the logic of appropriateness, or rule-based decision making, assumes that decisions are made based on identities or roles by recognizing situation and following rules that are appropriate (March, 1994).

Based on the findings of this study and the working environment of part-time faculty, I conjecture that part-time faculty rely heavily on both logics, following what the institution, department, and colleagues deem appropriate and attending to the potential personal consequences from the institution or department for making decisions. The full-time tenured faculty seem less concerned about consequences from the institution or department or what their institution, department or colleagues deem appropriate; they seem to be guided by what is most appropriate in terms of the students and the content.

The guiding principles and norms of the institution and department can have a significant influence on what is considered appropriate. What the institution and department deems most appropriate would likely be reflected more in the instructional decisions of those instructors whose decisions attend to possible consequences from the institution (i.e., part-time and untenured faculty). Those who feel that they face fewer consequences from the institution are more likely to make decisions based on what the profession views as appropriate and what they

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as individuals—grounded in their own experience, knowledge and beliefs—see as most appropriate.

Content coverage is an example of when the logic of appropriateness is more prominent for full-time, tenured faculty and the logic of consequence is more prominent for the part-time and untenured faculty. In this study several of the full-time faculty stated that they choose to not cover some "unnecessary" content to allow them more time to focus on the "important" topics. This decision fulfills their primary role as teachers by focusing on what they see as the most important content for the students to learn and setting aside the curricular requirements of the department. In contrast the part-time faculty only talked about the need to cover all the content, never mentioning the possibility of excluding any content. The logic of consequence is very clear when Olga, who is full-time, but not yet tenured states that her "department would kill" her if she didn't cover all the material—indicating that there would be negative consequences for her actions.

The logic of consequence may also influence both full- and part-time faculty when considering personal roles and obligations. Some instructional decisions may be very time consuming necessitating time over and beyond the required hours to help students, grade papers, and create materials and assessments. For example, Lou's (FT) choice of assigning certain problems for homework was based on not "wasting" his time when checking. Not only does the amount of time spent outside of class depend on individual preferences and an individual's other roles and responsibilities, but for part-time faculty who are usually not paid beyond class-contact hours, instructional choices that take more time outside classroom hours may be out of the question even when instructors have students' best interest in mind.

Related to the logics of choice is the notion of maximizing and satisficing, both of which are also likely to influence instructional decisions, particularly when deciding whether or not to try new innovative teaching methods. Maximizing aims to find the optimal alternative, whereas satisficing looks for an alternative that meets a set target. In teaching, there are times when satisficing may be a safer choice than maximizing. For example, when teaching students facts and procedures, it is expected that students will be able to remember and replicate those procedures and this is what they are evaluated on. From prior experience, the instructor knows what the likely outcome on tests will be. When allowing students to work in groups to encourage critical thinking and discover the mathematics, the outcome is less clearly defined or measured, and how the knowledge and skills gained will transfer to other situations, such as testing, is unknown. In the case of open-ended group work and other innovative teaching strategies where the outcome is unknown, there is the possibility that the results are significantly better than the memorization of facts and procedures—that the students come away with a deep understanding of the mathematics. But there is also the possibility that students come away confused with the impression that not much knowledge was gained. By trying to use those innovative teaching strategies, the instructor is attempting to maximize student learning, rather than meeting a set criterion that students are able to use given procedures to solve problems.

Faculty make the decision to either teach facts and procedures or use more innovative teaching methods to target conceptual understanding, yet the individual's choice of method—one which attempts to satisfy a narrow learning objective that focuses on memorizing facts and procedures and the other to maximize student understanding—may be different based on the logic of choice employed. Part-time and untenured faculty may be more inclined to take the safer choice, teaching facts and procedures, for fear of negative repercussions from the

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institution if the outcome is not good, that is if their students cannot even demonstrate that they have learned the minimal requirements in the course, proficiency with basic facts and procedures. On the other hand, full-time tenured faculty, who have been formally accepted as mathematics instructors and are openly granted academic freedom, are likely less concerned with institutional consequences and may find it more appropriate to try to maximize student understanding of concepts, even though doing this risks not meeting a set criterion that revolves around demonstrating proficiency with basic facts and skills.

The tentativeness in the language of the part-time faculty in this study suggests that they perceive boundaries that they need to respect, and thus when there are choices (e.g., between memorizing facts or pursuing more complex conceptual understanding), they are going to be less likely to choose the risky, though potentially better, one. When a professional is worried that the "department would kill" her if she does not comply with content coverage[17], there is little room to attempt innovative teaching methods that might result in better student learning at the expense of covering all the material.

The logic of choice along with the notions of satisficing and maximizing are important to consider when the profession or institutions are trying to implement reform. In the case of community colleges, the push to move away from lecture and to include more discussion, group work, and other innovative teaching methods comes largely from professional groups such as the American Mathematics Association of Two-Year Colleges (AMATYC), and may or may not be supported or encouraged by the institution or department (either implicitly or explicitly). This state of affairs can lead to two different sets of standards for instructors, in which individual

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[17] In this case the faculty member, Olga, is full-time, but not yet tenured. Her stance was not typical among the full-time faculty, but illustrates how the working conditions, specifically job insecurity, can have an impact on individuals and their instructional decisions

instructors have to choose which set they deem most appropriate. Part-time faculty are generally less connected with their colleagues and the profession, and are more likely to consider the consequences of making decisions that do not align with the expectations of the institution or department; full-time faculty might be more likely to take the risks inherent in pursuing a novel teaching approach.

The positioning of part-time faculty as outsiders could either inhibit or encourage the use of reform methods. The way part-time faculty position themselves suggests that they are trying to fit in and are more constrained by their department than their full-time counterparts. If their department fully embraces the reform and requires or strongly encourages faculty to use in innovative teaching methods and gives support to do so, I think that the part-time faculty will be more likely to comply. But if the department does not encourage nor support innovative teaching methods, part-time faculty will be less likely to use those methods in their teaching. The department's position will likely have some influence on full-time faculty instructional decisions, but the influence will be more moderate. This largely leaves the choice of using innovative teaching methods in the hands of individual instructors.

Conclusion

This study shows a difference between the full- and part-time faculty in their agency as mathematics instructors, and gives a unique perspective on community college instructors' reasoning about their teaching. The difference in how the two groups talk empirically supports the research that part-time faculty are not only treated as second-class faculty (Grubb & Associates, 1999; Townsend & Twombly, 2007; Washington, 2011), but are also impacted (either consciously or not) by this treatment; through their talk they position themselves as less agentive and as outsiders. Furthermore, the current research on part-time community college

faculty has not examined how the working environment impacts what goes on in the classroom. This study is a first step in making this connection by understanding—from the instructors' perspective—the reasons why certain instructional decisions may be chosen and examining instructor agency with respect to these decisions. The differing working environments of the two groups has the potential to impact how and why these teachers make the decisions they do (both positively and negatively), but because these conditions are largely out of the control of individual instructors, emphasis should not be put on the possible shortcomings of part-time faculty. Instead the focus should be on what institutions can do to remedy these issues for part-time faculty and how professional development (for both full- and part-time faculty) can be geared to result in improved teaching.

The findings of this study also support the need for a theory of instructional decision making that attends to both the psychological and socio-cultural influence and the interaction between them. The difference in interaction and agency conveyed between the full- and part-time groups could be examined and explained from a strictly psychological perspective; that the individuals who fill the roles of full- and part-time faculty are different not because of the position they hold, but because of individual characteristics. Thus attempting to understand why differences exist between teachers or groups of teachers without taking into account the working environment and other socio-cultural influences is problematic. As illustrated in much of the current literature on mathematics teaching and part-time faculty, the over reliance on individual characteristics (i.e., knowledge, beliefs, resources) or actions (i.e., participation in professional development, teaching methods, amount of time spent outside of class with students) in research often results in the conclusion that individual teachers or certain groups of teachers are to blame for less than satisfactory teaching or student outcomes. Incorporating a socio-cultural

perspective takes the focus off the individual and allows for an examination of the environmental and cultural influences. Attending to both the individual and the environment then creates the space that allows us to examine how the environment might affect individuals. This study demonstrates the importance of attending to this interaction. The difference in agency conveyed by the full- and part-time groups suggests that holding a position of a part-time faculty member depresses a teacher's agency in being who they might otherwise be if they weren't in that context. Thus, the different social contexts in which these two groups teach impact the individual in ways that might affect the instructional decisions they make.

Future Research

The findings of this study lead to more questions about agency and instructional decision making. Here I propose several paths of research that would give more insight into the matter. Exploring the ideational meaning (content) of the instructional decisions discussed would give more insight into the teaching methods and strategies these instructors say they use. This would also allow for an analysis of similarities and differences between the full- and part-time groups in the decisions talked about. The connection between agency and instructional decisions also needs further examination. While this study showed the association between faculty status and agency conveyed in instructional decisions, further studies need to examine how differences in agency and positioning impact instructional decisions and what actually occurs in the classroom.

Further exploration of agency by different groups of faculty would also provide insight into the impact of individual circumstances and the social context on agency. Full- and part-time faculty are not a homogenous groups. Gappa and Leslie (1993) identified four categories of part-time faculty: *aspiring academics*, those seeking a full-time faculty appointment; *career enders,* retirees; *freeway flyers*, those working multiple positions, either academic or non-academic, to

make ends meet; and *professionals, experts, and specialists*. I suspect that *aspiring academics* and *freeway flyers* would convey less agency in their instructional decision making and position themselves as outsiders more so than *career enders* and *professionals, experts, and specialists*. Further examining the agency conveyed by different categories of full-time faculty (untenured or non-tenure track faculty) could also provide insight to how faculty position themselves. Based on the statements of Olga, untenured faculty are likely to position themselves as less agentive than that of tenured faculty. The use of full-time, non-tenure track faculty (not represented in this sample) are growing in numbers in community colleges around the nation and such a position could also impact agency. An additional attribute to be explored is years of experience (of all types of faculty), which is also likely to impact agency.

Another path of research I would like to explore is the tensions between professional obligations and how faculty manage these tensions. Given the findings of this study, I am particularly interested in how possible tensions between the institution obligation and individual student and disciplinary obligations are managed by faculty and how faculty status might influence how the obligations are or are not fulfilled. Other potential tensions could provide more insight into instructional decision making such as the tensions between the emotional student obligation and the intellectual student, class, and disciplinary obligations or between the individual student obligation and the disciplinary obligation.

Implications

Community Colleges and Instruction

Many community college researchers give a wide range of suggestions for how to improve teaching and better integrate part-time faculty. These recommendations typically include professional development, extending the roles and responsibilities of part-time faculty to

align with those of the full-time faculty, and improving the working conditions (i.e., pay, job security, and benefits) of part-time faculty (e.g., Gappa & Leslie, 1993; Grubb & Associates, 1999; Townsend & Twombly, 2007), yet such recommendations have not been widely adopted. I argue that if community colleges want to have an impact on teaching and learning—which is directly associated with their mission—they need to attend to how the working environment impacts individuals and their instructional decision making and thus likely the instruction that occurs in the classroom. This study demonstrates the association between faculty status (and thus differing working environments) and agency. I claim agency, in addition to the individual and social context, will have an impact on how professional obligations are fulfilled and therefore on instructional decisions and actions. I suspect that this connection between the working environment and what occurs in the classroom is not apparent to most community college leaders. While I am focusing here on the institution and the environment they create, I do not view either as the only factor inhibiting the improvement of teaching. Instead I see institutional and departmental decisions as either encouraging or deterring faculty from improving their teaching or using either traditional or reform-oriented instruction.

Even if institutions cannot or choose not to improve the working environment of their faculty, particularly part-time faculty, the findings of this study can help institutions to increase their impact on instruction by focusing on the professional development of part-time (and untenured) faculty. Because the part-time faculty conveyed less agency and positioned themselves as trying to fit in, I speculate that part-time faculty would be more likely to follow the recommendations of the department than tenured, full-time faculty. In addition, the more open and collaborative discursive space observed in the part-time faculty group is more conducive to discussion of new and innovative teaching practices and could create a space in which faculty

could discuss their difficulties and successes in implementing these teaching practices. This discussion would not only help the faculty to continue to improve their teaching, but also provide feedback to the institution and department about what might be constraining the faculty's use of their recommended practices.

Methods

The methods used in this study gave a unique way to see the effects of departments and institutions alienating part-time faculty. The research on contingent faculty generally uses interviews and asks about their faculty position and working conditions, and their view or feelings about them. While this type of data is illuminating, it does not examine how these conditions might impact teaching. This study shows that the working environment of part-time faculty do have an effect on instructional decision making and this is apparent even when faculty status and working conditions are the topic of discussion.

The methods I used in this study, specifically the use of SFL, offer two major advantages when analyzing teacher or classroom discourse; the focus is on what the speaker is conveying, not the researcher's interpretation of it and there is a plethora of detailed literature which describes the features of language that can be used to examine any or all of the metafunctions of language (e.g., Eggins, 2004; Halliday & Matthiessen, 2004; Martin & White, 2005). SFL provided the tools that allowed me to empirically differentiate the agency and differences in the discursive spaces of the full- and part-time group. Prior to analyzing the interpersonal meaning conveyed by the two groups, the research group had noticed a marked difference in the discussion of the two groups, but were unable to clearly describe or explain the differences. Furthermore, the extensive nature of SFL provided insight into the research itself. For example, when reading about types of processes to better specify how to identify instructional decisions, I

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read about the different types of sensing (cognitive, desiderative, emotive, and perceptive), which gave me resources and examples that helped me to more concretely identify the intellectual (cognitive), emotional (desiderative and emotional), and physical (perceptive) aspects, which I initially was coding as intellectual and other. The use of SFL in this study demonstrates how crucial the choice of methods is in research; without the tools to identify differences in agency and positioning conveyed I would have had significant difficulty exploring and discussing the interaction between the individual and the social context.

Theory

A major contribution of this study is that it established the need for a theory of instructional decision making that attends to both the psychological traits of individuals and socio-cultural influences of the environment on instructional decision making and the interaction between them. While current research addresses the psychological and socio-cultural influences on teaching, it is important that they be considered together. For example, the theory of practical rationality of teaching mathematics (Herbst & Chazan, 2003, 2011, 2012) addresses the professional role of teachers focusing on the contextual (socio-cultural) influences. Schoenfeld takes a psychological approach focusing on the individual teacher's goal, beliefs and resources. Others focus on how individuals feel in their teaching positions (i.e., feeling isolated, lack of appreciation, job satisfaction; Grubb & Associates, 1999; Gappa & Leslie, 1993; Townsend & Twombly, 2007), but do not examine how this might impact practice. A theory that attends to the interaction between social and psychological influences on teachers, specifically how the environment can impact individuals, will create a space in which instructional decision making can be more holistically examined and lead to a better understand why teachers teach the way they do.

Appendices

Appendix A: Faculty Survey

Thank you for your interest in this faculty development program. Your participation makes a contribution towards improving teaching and learning in college mathematics. This questionnaire asks about your teaching experiences and preferences, your learning objectives for students, and your views about mathematics in general and trigonometry in particular. Your participation is voluntary. You may skip questions you do not wish to answer, or choose not to participate. For publications, we will aggregate responses from other participants in the faculty development program and your answers will not be reported in any way that may identify you individually. By completing this questionnaire, in part or in whole, you agree that we may use the data to understand and improve faculty development for mathematics instruction at community colleges. Thank you for your candid responses! We appreciate your assistance. Please contact us with any questions. After you have completed this questionnaire, please e-mail it to tmcc-mi@umich.edu, fax it to 734-936-1606, or bring it with you to our first meeting.

Name:
Please list your academic degrees, including teaching certifications, and the area of study for each:
How many years have you been teaching college mathematics?
What is your current teaching position?
___ Full-time faculty, tenured
___ Full-time faculty, untenured
___ Full-time faculty, non-tenure position
___ Adjunct or part-time faculty
___ Other (please specify):

Do you hold an administrative position?   Yes   No
        If yes, please describe:

In what types of institutions have you taught (indicate years and subjects taught for all types of institutions that apply):

Type of institute	Years	Subjects
K-12 setting		
Two-year college		
Four-year college or university		

Other (please specify):		

Are you currently teaching at more than one institution?   Yes   No

    If yes, please describe:

What attracted you to teaching?

What types of non-teaching work experience have you had?

What types of faculty development experiences have you had and how have you benefitted from them?

What courses, and how many sections of each, do you expect to teach in the Fall 2011 semester? What are the expected class sizes for these courses?

When did you last teach trigonometry (either as a stand-alone course or as part of another course)? (term, year)

Approximately how many semesters have you taught trigonometry?

Describe the profile of students that you have taught in trigonometry courses (attitudes towards school, attitudes towards mathematics, mathematical proficiency, ages, majors, goals, etc.).

Below are some goals for student learning held by college mathematics instructors. Assess the importance of each goal to what you deliberately aim to have your trigonometry students accomplish. Indicate the importance of each goal, using the criteria below, by placing an "X" in the corresponding column.

Essential   a goal you always/nearly always try to achieve
Very important ....a goal you often try to achieve
Important a goal you sometimes try to achieve
Unimportant ....a goal you rarely try to achieve
Not applicable .... a goal you never try to achieve

	Essential	Very Important	Important	Unimportant	Not Applicable
Develop analytic skills					
Develop problem-solving skills					
Develop ability to think critically					
Develop ability to think creatively					
Develop capacity to think for oneself					
Develop ability to draw reasonable inferences from given information					
Develop ability to think holistically: to see the whole as well as the parts					

	Essential	Very Important	Important	Unimportant	Not Applicable
Develop ability to solve problems independently					
Develop ability to apply principles already learned to new problems					
Prepare for transfer or graduate study					
Improve self-esteem/self-confidence					
Gain confidence in doing mathematics					
Improve mathematical reading skills					
Improve mathematical listening skills					
Develop ability to communicate mathematics through speaking					
Develop ability to communicate mathematics through writing					
Learn to understand the role of proof in mathematics					
Learn to appreciate the beauty or significance of mathematical ideas					
Learn terms and facts of trigonometry					
Learn concepts and theories in trigonometry					
Develop skill in using methods and/or technology central to trigonometry					
Learn techniques and methods used to gain new knowledge in trigonometry					
Learn to evaluate methods and content in trigonometry					
Learn to appreciate important contributions to trigonometry					
Learn to use multiple representations of trigonometric concepts					
Develop skill in using multiple representations in a single problem					
Learn to connect trigonometric concepts to "real world" applications					

Community college instructors fill many roles for their students. Rank the six roles below 1 to 6
   (with 1 being the most important role and 6 being the least important role).
___ Teaching students facts and principles of the subject matter
___ Providing a role model for students
___ Helping students develop higher-order thinking skills
___ Preparing students for jobs/careers
___ Fostering students development and personal growth

___ Helping students develop basic learning skills.

What is trigonometry to you?

What do you think is the best way to teach trigonometry?

What do you think is the best way to learn trigonometry?

How is teaching trigonometry different for you from teaching other mathematics courses?

Thanks again for your responses. Please contact us with any questions. We look forward to
   seeing you in later in the month.

Appendix B: Recruitment Letter

Vilma Mesa
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July 13, 2011

Professor
Name
Address
City, State Zip Code

Dear Name,

I am writing to invite you and mathematics faculty in your department to join in an exciting opportunity to test faculty development materials centered on the teaching and learning of trigonometry and related content. In the last four years, and with funding from the National Science Foundation, my research group and I have been studying how mathematics is taught in non-developmental courses that prepare students to take college courses that would lead them to a science, technology, engineering, or mathematics major. Specifically we have been working with mathematics faculty who teach college algebra, trigonometry, and pre-calculus. We have conducted student surveys and interviews, interviewed faculty and administrators, analyzed college algebra textbooks, and observed many classes.

One product of this work is a series of activities that use some of the resources we have collected (math problems, transcripts of students' interviews, animations and transcripts of classroom instruction) that constitute a first attempt to create a faculty development program that is focused specifically on community college mathematics faculty dealing with mathematical notions that are difficult to learn and to teach. This program constitutes a part of the larger investigation into how mathematics is taught at community colleges.

We will be holding two sessions of this program from August to December 2011, one for full-time faculty and one for part-time faculty. Each session requires participants to attend five 3-hour long meetings—once per month on a Saturday morning—at the School of Education, University of Michigan, Ann Arbor campus. We will provide breakfast, lunch, and a modest honorarium of $105 per meeting to each participant, which will be added to a Visa Debit card, after each meeting. Transportation costs (mileage and parking) will be reimbursed as well.

Who should participate?

We want our sessions to include outstanding mathematics faculty at your community college who have taught college algebra, trigonometry, pre-calculus, or calculus, and who are either full-time or part-time faculty. We would like you to nominate up to four faculty, two full-time and two part-time. Please nominate yourself if you have taught any of these courses. To nominate your faculty, share the information in this letter with them to check interest and availability. Please send us the names and contact information of your nominations to the following e-mail address: tmcc-mi@umich.edu by August 5th, 2011.

What will be the content of the faculty development session?

We have included topics on functions, composition of functions, inverse functions, trigonometric functions, finding values of trigonometric functions, and trigonometric identities.

We may also touch on the derivative of inverse functions. The meetings include a combination of mathematics activities, discussion of solutions, observation of students solving problems, analysis of textbooks, and observations of animations of trigonometry classrooms.

What will instructors gain by participating in this program?

We anticipate that the instructors will gain substantive depth in their understanding of the complexity of teaching these notions to community college students and that this knowledge will inform the teaching of other mathematics courses. In the meetings there will be ample opportunities to discuss and share mathematics teaching experiences with other outstanding community college mathematics faculty. We anticipate that these discussions may create a community that can be sustained after the conclusion of the program. In addition, we anticipate that participants will learn the pros and cons of using certain mathematics activities with their students, some principles of theories of learning and teaching with college students, and some ideas for analyzing content textbooks. More importantly, instructors will learn strategies for investigating their own practice and advance in their understanding of community college students' learning of mathematics.

Who else will be invited?

Because of the novel nature of this program, we are initially restricting the invitation to faculty of mathematics departments at community colleges in Michigan and Ohio, within approximately 100 miles driving distance from Ann Arbor, including: **Grand Rapids Community College** MI, **Henry Ford Community College** MI, **Jackson Community College** MI, **Rhodes State College** OH, **Kalamazoo Valley Community College** MI, **Kellogg Community College** MI, **Lansing Community College** MI, **Macomb Community College** MI, **Monroe Community College** MI, **Montcalm Community College** MI, **Mott Community College** MI, **Northwest State Community College** OH, **Oakland Community College** MI, **Owens Community College** OH, **Schoolcraft Community College** MI, **Terra Community College** OH, **Freemont Community College** OH, **Wayne County Community College District** MI, and **Washtenaw Community College** MI.

What will be the participants' responsibilities?

Participants are expected to attend all five meetings in Ann Arbor (from August to December, 2011). Because this is part of a larger research effort, we will seek consent to gather data during the meetings that will be used to inform our research and improve the faculty development program. Participation in the research is anonymous and voluntary and it will not affect the faculty development experience

What happens after faculty are nominated?

We would like to have your nominations by **August 5**[th] in order to be able to create the groups of faculty and notify them. We will contact all nominees in order to determine level of interest and eligibility. We will create two groups, one composed of 10 full-time faculty and another composed of 10 part-time faculty. We will give priority to faculty who have taught trigonometry and reply by August 12th. If there is more demand than availability we may offer a second session from January to May 2012.

What is the tentative schedule of the session?

We propose meeting the following five Saturdays with each group of faculty:

Full Time Faculty	**Part Time Faculty**
August 20	August 27
September 17	September24
October 22	October 29
November 12	November 19
December 10	December 17

This is an exciting and unique opportunity for you and your faculty to contribute to the generation of knowledge that may transform how non-developmental community college mathematics courses are taught. I look forward to hearing from you by August 5th. If you have questions or would like more information, please contact me directly at 734-647-0628 or vmesa@umich.edu.

Sincerely,

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Appendix C: Guide for Coding Modality in Instructional Decisions

Phrase	Type of Modality	Degree	Other/Note
I **think**	Probability	Med	Subjective; this may be tacked on to an instructional decision that has no modality or another type of modality, generally making it of median degree, though it is also possible to be low
I **don't know**	Probability	Low	Subjective; this may be tacked on to a statement that has no modality or another type of modality, making it of low degree
I (**don't**) **want to**	Inclination Probability Usuality	Med	
I **mean**			Does not affect modality—it acts more as a conjunction than modality
I **try** to	Inclination Probability	Med	Subjective
I **like** to	Inclination Probability Usuality	Med	Subjective
I/teachers **need** to	Inclination Probability Requirement	High	
I **always**, **never**	Inclination Probability Usuality	High	Probability and Usuality may be dropped if the always is past tense (i.e., I have always)
I **usually**	Inclination Probability Usuality	Med	
I **sometimes**	Inclination Probability Usuality	Low	
I **probably**	Inclination Probability Usuality	Med	There could be variation in this depending on what goes along with it. (i.e., *we probably should* will include requirement)
I **would**	Inclination Probability Usuality	High	Degree may vary in some occasions (i.e*., I would probably, I think I would, perhaps I would*—med; *Maybe I would*—low)

I/teachers **may**	Inclination Probability Usuality	Med	
I/teachers **might/maybe**	Inclination Probability Usuality	Low	
I/teachers **should**	<u>Inclination</u> <u>Probability</u> Requirement	High	Depending on the context *we should* may only be requirement. Degree may also vary in some occasions (i.e., *I don't think you should*—med)
I **can/could** We **can/could**	Inclination Probability Requirement	Low	Note: I include requirement to parallel should
I/we **have** to	Requirement	High	Graduation modifying have to may change the degree (i.e., *I sometimes have to*—low)
The teacher **should** (have) /**needs** (to)	Requirement	High	Note: Because it is past-tense and 3rd person inclination and probability don't make sense.
The teacher **could** (have)	Requirement	Low	Note: This is parallel to the teacher should code as requirement.
The teacher **might** (have)	Inclination Probability Usuality	Low	Note: This is parallel to I might, even though it is third person it is giving possibilities that the teacher speaking might do
The teacher **needs** to	Requirement	High	
A (reasonable)/ the teacher **would**	Inclination Probability Usuality	High	She would is sometimes used in the past-tense, in which case I am coding it as no modality since the statement parallels 'she did.'
The teacher **never**, **always**	Usuality	High	
I **will**	Inclination Probability Usuality	High	
I **guess**	Inclination Probability Usuality	Med	

Appendix D: Contingency Tables for Statistical Analysis

The contingency tables below were in the statistical analysis of the data (see Chapter 3). For each table a two-tailed Pearson Chi-squared test was run to examine differences between the full- and part-time in the reasons given and modality used. Below are the contingency tables and just below each are the results of the chi-squared test.

In order to test for statistically significant differences in the reasons the full- and part-time faculty gave, a series of chi-squared tests were run because the categories were not mutually exclusive. Table 5 shows the set up for the reason contingency tables (student, class, content, lesson, teacher, and institution). Table 6 through Table 11 are the contingency tables for each reason and the results of the chi-squared test.

Table 5: Contingency table set up for testing difference in reasons

Justifications	With [given code]	Without [given code]	Total
FT	x	102-x	102
PT	y	74-y	74
Total	x+y	(102-x)+(74-y)	176

Table 6: Contingency table and chi-squared test for student

Justifications	With student	Without student	Total
FT	81	21	102
PT	60	14	74
Total	141	35	176

Degrees of Freedom	Chi-Squared Statistic	P-value
1	0.075	0.784

Table 7: Contingency table and chi-squared test for class

Justifications	With class	Without class	Total
FT	19	83	102
PT	23	51	74
Total	42	134	176

Degrees of Freedom	Chi-Squared Statistic	P-value
1	3.66	0.056

Table 8: Contingency table and chi-squared test for content

Justifications	With content	Without content	Total
FT	36	66	102
PT	23	51	74
Total	59	117	176

Degrees of Freedom	Chi-Squared Statistic	P-value
1	0.34	0.559

Table 9: Contingency table and chi-squared test for lesson

Justifications	With lesson	Without lesson	Total
FT	22	80	102
PT	9	65	74
Total	31	145	176

Degrees of Freedom	Chi-Squared Statistic	P-value
1	2.61	0.106

Table 10: Contingency table and chi-squared test for teacher

Justifications	With teacher	Without teacher	Total
FT	14	88	102
PT	7	67	74
Total	12	164	176

Degrees of Freedom	Chi-Squared Statistic	P-value
1	0.74	0.389

Table 11: Contingency table and chi-squared test for institution

Justifications	With institution	Without institution	Total
FT	6	96	102
PT	6	68	74
Total	12	164	176

Degrees of Freedom	Chi-Squared Statistic	P-value
1	0.33	0.563

In order to test for statistically significant differences in the student sub-categories between the full- and part- time faculty gave, a series of chi-squared tests were run because the categories were not mutually exclusive. Table 12 shows the set up for the student sub-categories contingency tables (intellectual, emotional, and physical). Table 13 through Table 15 are the contingency tables for each student sub-category and the results of the chi-squared test.

Table 12: Contingency table set up for testing difference in student sub-categories

Justification with Student	With [given code]	Without [given code]	Total
FT	x	81-x	81
PT	y	60-y	60
Total	x+y	(81-x)+(60-y)	141

Table 13: Contingency table and chi-squared test for intellectual

Justification with Student	With intellectual	Without intellectual	Total
FT	65	16	81
PT	54	6	60
Total	119	22	141

Degrees of Freedom	Chi-Squared Statistic	P-value
1	2.49	0.115

Table 14: Contingency table and chi-squared test for emotional

Justification with Student	With emotional	Without emotional	Total
FT	11	70	81
PT	11	49	60
Total	22	119	141

Degrees of Freedom	Chi-Squared Statistic	P-value	
1	0.59	0.442	

Table 15: Contingency table and chi-squared test for physical

Justification with Student	With physical	Without physical	Total
FT	11	70	81
PT	4	56	60
Total	15	126	141

Degrees of Freedom	Chi-Squared Statistic	P-value	
1	1.73	0.188	

In order to test for statistically significant differences in the use of modality in instructional between the full- and part- time faculty gave, a series of three chi-squared tests. The initial test included no modality, high, median, and low (Table 16). Two additional chi-square tests were to see if there was a difference in the use of modality and the degree of modality used (Table 16 and Table 17)

Table 16: Contingency table and chi-squared test for use of and degree of modality in instructional decisions

ID	No modality	High	Median	Low	Total
FT	434	180	98	62	774
PT	290	149	89	56	584
Total	118	187	329	724	1358

Degrees of Freedom	Chi-Squared Statistic	P-value	
3	5.83	.120	

Table 17: Contingency table and chi-squared test for use of modality in instructional decisions

ID	No modality	With modality	Total
FT	434	340	774
PT	290	294	584
Total	634	724	1358

Degrees of Freedom	Chi-Squared Statistic	P-value
1	5.50	.019

Table 18: Contingency table and chi-squared test for degree of modality used in instructional decisions with modality

ID	High	Median	Low	Total
FT	180	98	62	340
PT	149	89	56	294
Total	329	187	329	634

Degrees of Freedom	Chi-Squared Statistic	P-value
2	0.32	.851

A chi-squared test was used test for a statistically significant difference in the use of actor in instructional decisions between the full- and part- time faculty (Table 19). In addition, to corroborate these findings I ran a chi-squared test on the counts of pronoun usage in the whole text (Table 20).

Table 19: Contingency table and chi-squared test for use of actor in instructional decisions

ID	I	We	You	She	Total
FT	427	35	83	210	755
PT	256	7	84	248	595
Total	861	42	167	458	1350

Degrees of Freedom	Chi-Squared Statistic	P-value
3	46.33	4.84×10^{-10}

Table 20: Contingency table and chi-squared test for use of different pronouns

Pronoun count	I	We	You	She	Total
FT	1424	369	761	323	2877
PT	1047	157	907	508	2619
Total	2471	526	1668	831	5496

Degrees of Freedom	Chi-Squared Statistic	P-value
3	185.23	6.56×10^{-40}

To test for statistically significant differences in the use of modality in instructional with *I* as the actor between the full- and part- time faculty gave, I ran a series of three chi-squared tests. The initial test included no modality, high, median, and low (Table 21). Two additional chi-square tests were to see if there was a difference in the use of modality and the degree of modality used (Table 22 and Table 23).

Table 21: Contingency table and chi-squared test for use of and degree of modality of *I* instructional decisions

*I*_ID	No modality	High	Median	Low	Total
FT	220	134	53	26	433
24	95	80	55	24	254
Total	315	214	108	50	687

Degrees of Freedom	Chi-Squared Statistic	P-value
3	17.92	4.57×10^{-4}

Table 22: Contingency table and chi-squared test for use of modality in *I* instructional decisions

*I*_ID	No modality	With modality	Total
FT	220	213	433
PT	95	159	254
Total	372	315	687

Degrees of Freedom	Chi-Squared Statistic	P-value
1	11.59	6.63×10^{-4}

Table 23: Contingency table and chi-squared test for degree of modality used in *I* instructional decisions with modality

*I*_ID	High	Median	Low	Total
FT	134	53	26	213
PT	80	55	24	159
Total	214	108	50	372

Degrees of Freedom	Chi-Squared Statistic	P-value
2	6.03	0.049

To test for statistically significant differences in the use of requirement in instructional decisions between the full- and part- time faculty, I ran two chi-squared tests. Because requirement can only be indicated through the use of modality, the first test included only instructional decisions with modality (Table 24) and the second included all instructional decisions (Table 25).

Table 24: Contingency table and chi-squared test for use of requirement in instructional decisions with modality

ID with modality	With requirement	Without requirement	Total
FT	85	255	340
PT	114	180	294
Total	199	435	634

Degrees of Freedom	Chi-Squared Statistic	P-value
1	13.89	1.94×10^{-4}

Table 25: Contingency table and chi-squared test for use of requirement in all instructional decisions

ID	With requirement	Without requirement	Total
FT	85	689	774
PT	114	470	584
Total	199	1159	1358

Degrees of Freedom	Chi-Squared Statistic	P-value
1	19.40	1.06×10^{-5}

I ran a chi-squared test to test for statistically significant differences in the degree of modality used in instructional decisions indicating requirement between the full- and part- time faculty (Table 26).

Table 26: Contingency table and chi-squared test for degree of modality used in instructional decisions indicating requirement

ID with requirement	High	Median	Low	Total
FT	44	5	36	85
PT	69	19	26	114
Total	113	24	62	199

Degrees of Freedom	Chi-Squared Statistic	P-value
2	11.32	.003

Appendix E: Instructions for Testing Reliability of Coding for Instructional Decisions

I asked another graduate student, with expertise in SFL to provide feedback on the process for coding instructional decisions. He received the following set of instructions:

Instructional decisions are statements by the participants (not the moderator or researcher) of an instructional action by those in the role of a mathematics teacher. For a statement to be considered an instructional decision, it must meet two conditions:

1. The actor is a person in the role of an instructor
2. The action is a process that pertains to instruction (teaching action)

The person in the role of an instructor can be an: (commonly used pronouns for each)

- individual instructor (I),
- instructors (you/we), or
- the teacher in the animation (she),
- There are some instances where the actor is ellipsed (when the actors are omitted from the clause, but are required to make meaning).

Notes: When thoughts/beliefs are the process, it not considered instructional action (i.e., I believe that students learn best when). It is okay if an instructional decision begins with I think/believe (i.e., I think that we should write the key points on the board).

This analysis is not based on clauses or anything that detailed, so the location of instructional decisions can be standalone statements/clauses or embedded in more complex statements. For example there is sometimes an instructional decision within an if-then type of statement.

I only need you to identify what is an instructional decision, so you do not need to actually identify the actor or action, just simply highlight or underline (or whatever you want) the text that you have identified as an instructional decision.

On the next page I give an example of coded instructional decisions and explain why they are (or are not coded).

Key: Instructional decisions underlined
Actor in the role of an instructor in Italics
* Ellipsed agent in the role of a teacher is noted with an asterisk
Instructional action in bold

Transcript	Commentary for Coders
Moderator: Okay, so what are your thoughts? Erin: I, sort of what Elizabeth said, *she* at least this time **talked** about the different strategies that they utilized or at least **talked*** about while they were doing the problem, so at least the student has some clue, *she* could **have been even a little more specific** and **said**, if you did it this way, then try it that way, but at least *she* **put out** a few more things other than just do it again. Moderator: So the teacher offers the fundamental identities, the Pythagorean identities and even the calculator. Are there preferences about, that you would, or priorities, I'm not sure what the word would be but…	Erin makes a comment about what the teacher in the animation (she) did. The actor is ellipsed, but can be recovered. The context and the previous clause indicate that the agent is again the teacher in the animation. Erin continues with two more references to the teacher in the animation.
Morton: I'm sure, as Nelson said, you could use the calculator and come up with an erroneous answer if you weren't aware of restrictions on the inverse.	Even though Morton says, "I'm sure," being sure is not a teaching action; it is an indicator of modality for what he says next: "you could use the calculator." So "I'm sure" is not coded as an instructional decision. In what Morton says next, "if you weren't aware of restrictions on the inverse," it is initially not obvious who *you* refers to. Because it is assumed that someone in the role of a teacher knows the restrictions, *you* likely refers to someone in the role of a student, and therefore *you* is not identified as an actor in the role of a teacher.

|	
Kirk: I think it depends on how you use the calculator, take the cos squared plus sine squared and see if you get one, in the calculator and that would be a good way to make sure you are at least on track. And there are different ways you could use your calculator so I think **point out*** how to use your calculator, not just **saying** use it. And similarly, **be more specific*** in general. I get students, you show me two different methods, am I going to get the same answer? Well to us it is obvious, of course you are, but to students it's not, so I think **point out*** when you do these three different methods you should get the same answer each time, so actually **being specific*** about that would be helpful. Moderator: So in an earlier session it was suggested that this question be pushed back to the students, how would you go back checking your work? Is that a legitimate move, or when is that a legitimate move maybe?	"it depends on how you use the calculator" is not identified as an instructional decision because the *you* again refers to students because Kirk says, "to make sure *you* are at least on track"; It is student who needs to check to see if they are on track, not the teacher. "so I think, point out* how to use your calculator." *I* is not the agent of a teaching action, but an indicator of modality for the statement that follows. The teaching action Kirk talks about is to "point out." The agent of this action is ellipsed, but can be recovered because the person pointing out how to use the calculator would be in the role of the mathematics teacher.
Elizabeth: At this point *I* would **say**, well, let's check, that would be at this point, when this has been done and the student asks that question, *I'*d **say**, that's a great idea, let's check this, together, this one, and *you* know kind of **have*** **a plan in place**.	"I would say…," "I'd say," and "kind of have* a plan in place" are examples of when *I* is the agent of a teaching action, which appears frequently throughout the remainder of this excerpt.
John: It depends on when you are in the course. If this is at end of the class session, and you don't have time to do, so it depends upon where you are in the class session [whispering and laughing] Researcher: So if you were in the end of the class session, what would you do? John: Umm, *I* might **have [done]**, depending on how much time is actually left, what she suggested maybe where I could stop. *I* would probably not **have included** the calculator since it seems like the role was to calculate exact values, and so *I* probably would not have **given** that as an option.	"when you are in a course" is not identified as an instructional decision even though *you* is referring to someone in the role of a teacher because there is no teaching action; it is a statement that indicates a point in time. "you don't have time" is also not identified as an instructional decision because having time is not a teaching action
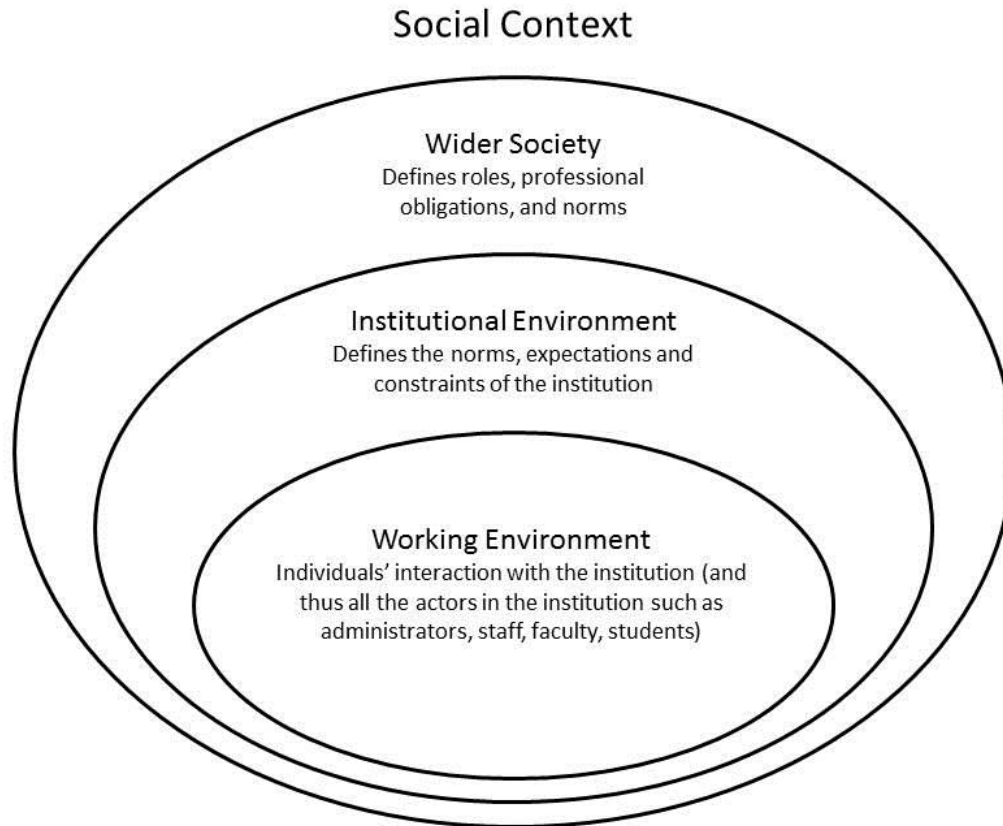
Figure 19: The social context

Figure 19 illustrates my conceptualization of the social context in which individuals in the role of a teacher function within. I discuss three embedded levels of the social context to describe the interaction between the social context and the individual relevant to the findings of this study. The highest level, wider society, which in this case is the U.S. society, defines the roles and professional obligations of teachers, and broadly sets the norms. The second level, the institutional environment, exists within the wider society and varies by type of institution (i.e., primary, secondary, or tertiary school; public or private; two-year college, 4-year institution, or research university) and individual institutions. The institutional environment, further refines the

norms, and sets more concrete expectations and constraints. I view wider society and the institutional environment as operating similarly for all teachers. In contrast the third level, the working environment, which exists within the institutional environment, can vary for individual teachers or groups of teachers (i.e., full- and part-time faculty, tenured and untenured faculty in the case of community colleges). I define the working environment for a teacher as the individual interaction with the institution (and thus all the actors in the institution such as administrators, staff, faculty, students). The working environment then includes how faculty are positioned and treated by the college, department, and colleagues—as an individual, professional, laborer, etc. The working environment seems to be influencing how faculty speak, thus it seems that such environment may have an influence on instructors' expressed agency. It is where the difference between full- and part-time faculty (and untenured faculty) becomes apparent. The working environment of part-time faculty at community colleges is different than that of full-time faculty; part-time faculty are largely alienated by their institution and department. They have different working conditions (i.e., low pay, lack of office space, being paid only for teaching hours) than full-time faculty and are often positioned as outsiders and second-class citizens. Thus the working environment may further constrain the range of possible ways to fulfill professional obligations for different individuals or groups of instructors, especially those with weak connections to the institution.

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