

## STUDYING THE ASSUMPTIONS TEACHERS MAKE WITHIN VIGNETTES

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### Introduction

There is a need in the field to assess mathematics teachers' professional knowledge for teaching. There has been substantial progress in the development of assessments of the cognitive aspects of such knowledge (Grossman & McDonald, 2008). However, we argue that there is more to teaching not encompassed within the cognitive aspects, such as practical knowledge and professional judgment. Vignettes are widely used to assess judgment in other professional fields, such as medicine, police work, army tactics, and human resources (Weekly & Ployhart, 2006). Some have argued such instruments are desirable to measure instructional practice as they usher teachers into possible classroom events and in this way provide valid evidence for teachers' actual instructional practices (Stecher et al., 2006) and offer a more economical alternative to classroom observation (Kennedy, 1999). Such assessments unavoidably contain some degree of ambiguity. Brooks and Highhouse (2006) suggest individuals are rarely bothered by situational ambiguity and confidently construe additional details they need to make judgments regarding the scenario. However, participants' construals regarding critical aspects of the scenario differ across

persons, then item validity can suffer. Our group has been developing vignettes to gauge mathematics teachers' justification of actions and wondered what sort of construals participants make when they consider the classroom scenarios in our instruments.

In this study we reviewed a set of open-ended responses from teachers following forced-option ratings regarding instructional actions shown within scenarios of K-12 mathematics classrooms. In total we analyzed responses from 107 teachers to 63 items. We looked for additional aspects of the vignette that teachers considered critical in deciding whether an action was appropriate. The following research questions guided our inquiry: 1) What sorts of assumptions do teachers make in order to justify as appropriate an instructional decisions within a vignette? 2) How well does the theory of practical rationality, particularly, the four professional obligations of mathematics teaching help account for those assumptions? Our purpose with this session is to provide insight to the field regarding the types of assumptions teachers make within vignettes and consider the implications this has for the design and use of such instruments.

### **Theoretical Framework for Research**

Teachers' decisions have often been modeled as a function of personal resources such as beliefs and knowledge (Calderhead, 1996; Schoenfeld, 2013), but another strand of research argues that teaching is at least as much a cultural activity (Stigler & Hiebert, 1999). The theory of *practical rationality* (Herbst & Chazan, 2012) attempts to synthesize personal and social resources by proposing that while teachers have personal resources such as knowledge and beliefs, they also play roles in activity systems (e.g., algebra instruction) with customary norms (Much & Shweder, 1978) while enacting a professional position defined by four professional

obligations--to the discipline of mathematics, to individual students, to the classroom community, and to the institutions of schooling. While actions following customary norms may be enacted without reflection, a teacher's deviations from those norms need justification (Buchmann, 1986). The theory asserts the four professional obligations provide for the sources of justification.

Since teachers' actions are tied to culturally acceptable ways of managing classroom work, it follows that an assessment of the resources available for warranting those actions will have greater validity if it is embedded in depictions of these situations rather than the evaluation of generic belief statements. In 1979, Peter Rossi outlined the use of vignettes for conducting social research, stating that vignettes are useful for "understanding the principles underlying judgments of complex circumstances" and "especially appropriate where the judgments involved are those made with comparative frequency" (p. 184). *Situational judgment tests* (Lievens, Peeters, & Schollaert, 2008) have been extensively used by personnel departments for this reason. These tests present participants with a typically encountered workplace scenario and ask them to make a decision about what to do next at a critical moment. They have been used to measure practical knowledge in domains as varied as airline piloting (Hunter, 2003) and medical school admissions (Lievens, Buyse, & Sackett, 2005). While such assessments have historically relied on prose narratives to present the scenario, multimedia-based assessments (Olson-Buchanan & Drasgow, 2006) have been argued to have greater face validity and improved reliability between subgroups. We similarly use storyboard representations to assess teachers' judgment but we also build on existing work by examining the sources of justification used by teachers.

## Methods

We conducted our study on data collected from K-12 inservice mathematics teachers on items designed to measure teachers' recognition of each of the four professional obligations. Each instrument had between 15 and 18 items. Within each item, participants examined a vignette in which a teacher departs from a norm and that departure could be justified on account of a target obligation (see Figure 1). Participants rated the extent of their agreement with the teacher's alternative action instead of the normative action and were then asked to comment on their rating. While they were not required to provide additional comments, the majority of the responses included a follow-up ranging from a rationale for the rating, greater elaboration on what the depicted teacher should have done, or a description of circumstances that might have influenced their choice. The present analysis is primarily concerned with the last category of response. In particular, we found that a number of comments, albeit a minority, suggested that the participant's response was conditional on some element of context that did not appear in the vignette itself.

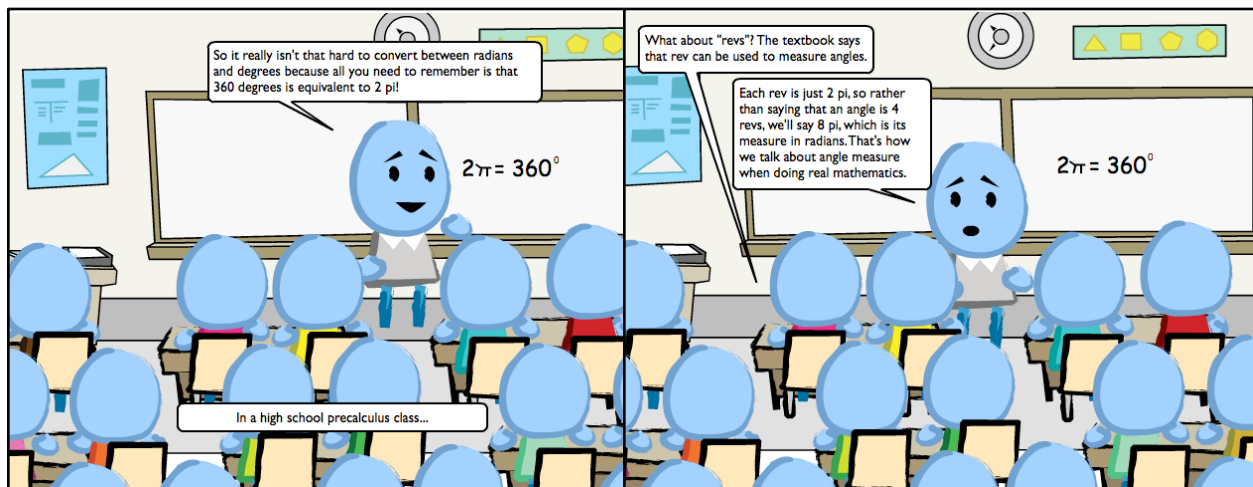


Figure 1: A storyboard targeting the professional obligation to the discipline of mathematics.  
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In order to assess the extent and nature of these construals, we analyzed the content of the follow-up comments (n = 15,436) for evidence that in order to make their rating, teachers decided between alternative assumptions about the vignette, a phenomena we call a *conditional construal*. In order to identify conditional construals, we located *circumstances of contingency* (Halliday & Matthiessen, 2004, p. 271) using linguistic markers such as “depending on” and “as long as”. We analyzed the ability of such markers to act as a proxy for conditional construals, accounting for both false positives -- instances where the proxy is present but a conditional construal is not --and false negatives -- instances where the proxy is absent and yet a conditional construal is present. Next, we coded conditional construals according to the four professional obligations (Herbst & Chazan, 2012). Finally, using grounded theory, we examined the conditional construals found within each of the professional obligation categories to suggest possible sub-categories of each obligation domain.

## **Findings**

Using the obligations to categorize each conditional construal, we have two findings to share. First, while we designed four instruments to tap into each of the four professional obligations, this analysis of the open responses has allowed us to gather more evidence about how teachers consider the obligations as they make their decisions. For example, consider an item (A1141) designed to assess recognition of the disciplinary obligation, in which a teacher decides to explore mathematical theory rather than to review additional practice problems. In particular, at the secondary level, the teacher presents the theorem that allows for the Euclidean Algorithm for polynomials rather than reviewing an actual polynomial division problem. We found that 36 out of 227 participants stated that their decision depended on assumptions they

made about the scenario. The majority of these responses stated that characteristics of the individual student would determine the decision, but a subset of the responses also took time constraints into consideration. The following are examples of both types of responses,

*It depends at what level the students are at. If they can handle theory then by all means explain that to them. If not, more practice problems would be beneficial.*

*Presenting this theory may actually help students with their practice problems, and it orients the class around mathematical thinking rather than rote practice. Connecting the problems to this particular theorem could be something a mathematician would do, and it encourages students to do the same. Depending on the time left in class and the ability levels of the students, this appears to be an excellent time to introduce an interesting theorem.*

We classify the first response under the individual obligation as it is concerned with the “level” of the students. Despite the fact that the participant refers to multiple students, we do not classify it under the interpersonal obligation because there is no concern in evidence for how the students interact with one another or the heterogeneity of the class in general. The phrasing of the first response suggests that the class as a whole can either “handle theory” or not, and that this should determine the teacher’s decision. We classified the latter response as individual for the same reasons as the first, but in addition we also classified it as institutional due to the reference to the amount of time left in class.

The responses recounted above help demonstrate how conditional construals bring to light interactions between the professional obligations. We operate under the premise that the decision central to the vignette is purely disciplinary inasmuch as a concern with mathematical theory reflects a desire to present mathematical content in as general a form as possible. The two responses quoted above suggest that a teacher might decide not to respond to the disciplinary obligation if they did not feel that their students had the necessary “ability level” or if there was not enough time in the class. Thus we have evidence that there is not just a conflict between norms and obligations, but there can also be conflicts between different categories of obligation.

The obligations in question vary depending on the vignette as can be seen in Figure 2. In particular, while the vignette (A114) described above elicited 30 references to the individual obligation, another vignette (A101) in which the teacher allows a student to make a computational mistake on the board in order to keep the focus on the problem-solving process only elicited 9 conditional construals that referenced the obligation to the individual. While we have no definitive explanation for the difference in construals associated with these two items, it is worth noting that a review of the 30 respondents who included individual conditional construals for item A114 reveals that only one of them was concerned with the individual obligation for item A101. Some of the participants said that it would be confusing or misleading to leave a mistake on the board and others said that it would be productive to have students discover the mistake for themselves, but most of the participants did not say that the students' ability or knowledge would be a deciding factor. The importance of this analysis is supported by the fact that such a discrepancy can be seen in teachers' responses to vignettes that are both intended to evoke the disciplinary obligation.

Item Name	Individual	Interpersonal	Institutional	Disciplinary
A114	30	0	5	3
A101	9	2	4	1

*Figure 2: Obligation categories for conditional construals.*

Second, using grounded theory, we found responses provide suggestions for possible sub-domains within each obligation. For example, when we looked across responses calling for an assumption about individual students, we found some referenced the instructor's history with the student and others considered whether the student has a specific characteristic (such as a learning

disability). Responses calling for an interpersonal obligation referred to the instructor's history with the class, particular classroom norms, or the prevalence of a misconception. Those observations suggest sub-domains allowing for further conceptualization of the construct and further design of items.

### **Study's Significance**

This study can help the field in two major ways. First, the methods developed here for detecting conditional construals can be useful for others developing and using vignettes for research. We have used these methods to: 1) explore various dimensions of obligations present in our items and 2) probe the underlying theory. While developed for our work, we suspect the methods may be useful for others using representations of practice to assess practitioner's judgment in professionals field, including teaching. To support this, we examined the effectiveness of various linguistic markers for detecting conditional construals.

Second, our analysis of the categories of conditional construals both supports and provides evidence that can potentially extend the theory of practical rationality with respect to the nature of professional obligations of mathematics teachers. This work provides further evidence for four professional obligations at play in mathematics teachers' justifications and, more generally, further confirms the validity of the theory of practical rationality as a viable model for understanding, describing, and predicting mathematics teachers' justification for action in teaching.

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