(RE)CONCEPTUALIZING AND SHARING AUTHORITY

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In this paper, we argue the necessity of working with mathematics teachers in re-conceptualizing teacher- and textbook- authority in mathematics classrooms. We rely on mathematics education literature and on work with a group of secondary mathematics teachers both to contend that focus on authority is needed and to illustrate the interesting contributions that secondary teachers make that would be absent without the close relationship to classroom practices that they bring.

INTRODUCTION

Questions about authority are central in mathematics and mathematics education because of the discipline's characteristic interest in truth and proof. How are truth and value established in mathematics? Who should decide what mathematical questions are worth pursuing? On what basis should these decisions be made? Though mathematics is a powerful discipline with strong traditions and expectations, including those that relate to authority, students in mathematics classrooms only experience the discipline through their teachers and other mostly textual media.

Most scholarship that investigates such issues of authority in mathematics classrooms draws on qualitative research methodologies. In a recent computer-aided *quantitative* investigation of a large body of transcripts from secondary mathematics classes, however, Herbel-Eisenmann, Wagner and Cortes (2008) also corroborated the prominence of authority in the discourse. The pervasiveness of authority issues in the discourse may seem to suggest that classrooms focus on the kinds of questions listed above, but this study of the discourse showed that authority structures were commonly contingent on social positioning which was encoded in mundane phrases in the classroom discourse.

We contend here that further research on authority in mathematics classrooms needs to be done in conversation with teachers to consider ways of developing teachers' repertoires for handling authority issues at play in their mathematics classrooms. It is time to move beyond description of socio-cultural factors related to authority (though we do not mean to minimise the valuable insights of this work), and to get past simplistic rhetoric that suggests teachers either eschew or establish authority as much as possible. Teachers are well positioned to collaborate in this kind of research because they are situated in diverse contexts, each with its own complexities, and because they alone have the authority to change positioning practices in classrooms.

2009. In Tzekaki, M., Kaldrimidou, M. & Sakonidis, C. (Eds.). *Proceedings of the 33rd Conference of the International Group for the Psychology of Mathematics Education*, Vol. 3, pp. 153-160. Thessaloniki, Greece: PME.

After outlining the relevant literature, we will introduce some artefacts from conversations with teachers to show how they relate to this literature and how the literature has room to develop to address mathematics teachers' needs.

LITERATURE ON AUTHORITY IN MATHEMATICS CLASSROOMS

Authority is one of many resources teachers employ for control and has been defined in an educational context as "a social relationship in which some people are granted the legitimacy to lead and others agree to follow" (Pace & Hemmings, 2007, p. 6). This relationship is highly negotiable. Students rely on a web of authority relations with friends and family members as well as with the teacher (Amit & Fried, 2005).

Teacher Authority

Educational research related to teacher authority often makes distinctions between different types of authority (e.g. Amit and Fried, 2005; Pace and Hemmings, 2007). Most relevant considering the authority questions raised above, are the distinctions made between being an authority because of one's content knowledge and being an authority because of one's position (e.g., Skemp, 1979) – teachers are "an authority [of content] in authority [by virtue of position]" (Russell, 1983, p.30). Many scholars argue that the former is more relevant to teachers because it emphasizes their ability to reach their educational goals. Although these distinctions are made for analytic purposes, Pace (2003) has shown that the types of authority become blended as participants interact in classrooms. This blending is also demonstrated in Herbel-Eisenmann, Wagner and Cortes's (2008) corpus analysis.

Skemp (1979) noted that when authority is gained by position, authority is imposed: the teacher commands, students obey, and instructions are perceived as orders. In contrast, authority by knowledge involves being more like a "mentor." The authority is vested by virtue of the person's own knowledge; instruction is sought and is perceived as advice. Rival and conflicting values complicate authority relations because they are socially constructed in the service of a moral order (Pace & Hemmings, 2006). Moral order, in this case, was defined as "shared norms, values, and purposes" (p. 21).

Regardless of what kind of authority seems to be at play, Wilson and Lloyd (2000) contend that teachers need to develop an internal sense of authority, or a sense of agency, rather than rely on external forces in order to develop their own "pedagogical authority." Wilson and Lloyd make a parallel argument for how teachers help students develop their own sense of mathematical authority. That is, the same kind of reliance on internal authority can help students learn mathematics with meaning. As Schoenfeld (1992) pointed out, however, the development of internal authority is rare in students, who have "little idea, much less confidence, that they can serve as arbiters of mathematical correctness, either individually or collectively" (p. 62).

Teachers can unknowingly undermine their intentions to develop this kind of mathematical authority in their students. For example, Forman, McCormick, and

Donato (1998) examined authority patterns in a classroom in which the teacher was working toward the vision described in the National Council of Teachers of Mathematics (NCTM) standards documents in the United States. The authors found evidence that, although the teacher wanted to solicit, explore, and value multiple solution strategies, some of her discourse practices undermined this goal. They argued that the teacher asserted her authority through the use of tacit language patterns like overlapping speech, vocal stress, repetition, and expansion. Despite the fact that three students in her class presented mathematically correct and different solution strategies, the teacher overlapped a student's explanations only when the student was not using the procedure that the teacher recently taught.

Textbook Authority

Up to this point, we have briefly considered authority relationships between teachers and students. In mathematics classrooms, however, another pervasive presence that influences what and how mathematics is taught is the textbook. Most research on authority in classrooms focused on teacher authority and briefly mentioned that the textbook may have played a role in authority relationships in classrooms (Amit & Fried, 2005). None of those authors, however, seriously considered the interactions among the teacher, textbook, and students in their inquiries, perhaps because, as Olson (1989) argued, textbooks "are taken as the authorized version of a society's valued knowledge" (p. 192).

We draw on two related perspectives about the positioning of the textbook as an authority. First, Olson (1989) argued that the separation of the author from the text as well as the particular linguistic characteristics of a textbook helped to instantiate the textbook as an authority. Textbooks, thus, constitute a distinctive linguistic register involving a particular form of language (archival written prose), a particular social situation (schools) and social relations (author-reader) and a particular form of linguistic interaction (p. 241). Second, Baker and Freebody (1989) contend that the authority of the text is the result of pedagogy. Their perspective takes as central actual classroom interactions and the authors empirically investigate how "text-authorizing practices…may be observed in the course of classroom instruction" (p. 264), as well as how these practices evolve in relation to the authority of the teachers. To illustrate these practices, they examined the kinds of questions teachers ask and the ways teachers respond to students' answers to their questions. They sought to "describe the intimate connections between talk around text and the social organization of authority relations between teachers and students. Teachers may be shown to use various practices to assign authority to the text and simultaneously to themselves" (p. 266).

The Role of the Mathematics Teacher

The NCTM carries significant authority in setting the agenda for teacher development, among other things (e.g., many textbooks for prospective teachers advertise with the claim that the text is in line with NCTM standards). The NCTM

(2000) standards documents address authority, but are underdetermined. Like the literature described above, the standards promote the development of students' authority, but they are not explicit about how this is to be done (though one could argue that many of the standards' advice for teachers would be positive supports for the development of student authority): "Most important, teachers need to foster ways of justifying that are within the reach of students, that do not rely on authority, and that gradually incorporate mathematical properties and relationships as the basis for the argument" (NCTM, 2000, p. 126).

Even if we agree that students should develop their own sense of mathematical authority, it is problematic to say that teachers need to cede their authority. From our conversations with teachers, we know that they are reluctant to entertain the idea of giving up authority, partly because of the imagined (or experienced) implications on the teacher's necessary social authority, but also because they know that their mathematical authority is necessary for teaching. Chazan and Ball (1999) confront this tension in their in depth descriptions of two situations in which they, as teachers (and expert mathematics educators), were reluctant to express their authority but realized the necessity of it. Although they suggested that the mathematics education community needs to better understand the complexities associated with the decisions they make as teachers, little has been done to date to try to better understand authority and positioning issues in a "reform" mathematics classroom. As Chazan and Ball pointed out, being told "not to tell" is not enough. Our realization of the need for mathematics educators to better understand how to share and use authority in ways most productive for student learning led us into the research that we draw upon here.

TEACHERS' VIEWS ON AUTHORITY

At the outset of our study engaging middle school and high school mathematics teachers in conversation about authority structures in their classrooms, we interviewed each teacher and asked him/her to describe his/her view of authority in his/her classroom. After asking some questions related to authority (e.g., what or whom their students see as authorities in their classrooms, how their students know something is right in mathematics, how their students know what to do in mathematics, how they as teachers know what is right and what to do in mathematics), we drew for each teacher a thick dot on a blank paper or blackboard and asked the teacher to complete the drawing to show how authority works in their classrooms. We learned that teachers have very different ways of thinking about authority, though their different ways of seeing are interrelated.

In the first of the three diagrams below, Dawn completed by drawing icons and other symbols representing the different sources of authority in her classroom (Figure 1) around the black dot representing her. An *x* represents a student, another black dot represents other mathematics teachers, an open dot a tutor, and other symbols represent textbooks, rulers and calculators. As she introduced each source of authority, she drew arrows to show where one looks for authority. For example, the arrow from a student to Dawn indicates that the student looks to her as an authority. When showing her diagram to other teachers later, Dawn noted other sources of authority as well. Her diagram represents some of the relationships, demonstrating that there are many authorities at play.

Dawn's conception of authority in her typical classroom is reminiscent of Amit and Fried's (2005) web of authority relations as she notices a variety of sources of authority. Dawn, however, draws more attention to inanimate objects as authorities – calculators and textbooks, for example. We note that even inanimate objects, such as textbooks, can be considered within human relationship by drawing attention to author choices. Author-ship is an important part of authority structures. Dawn also draws more attention than Amit and Fried to people related to the academic institutions, namely other teachers and tutors, but left family members out.

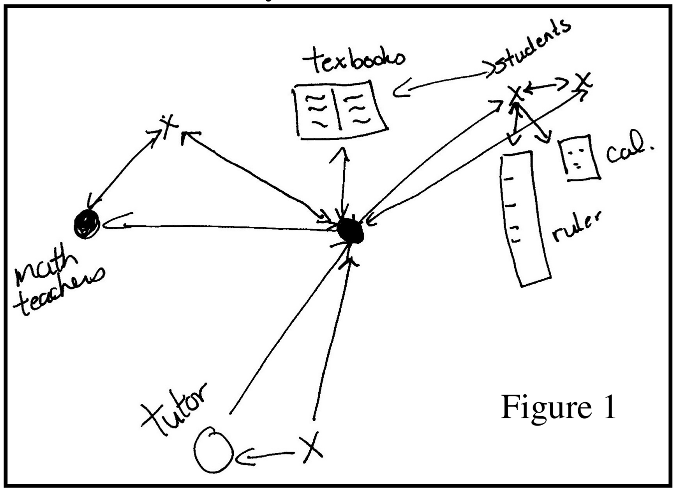

Figure 1

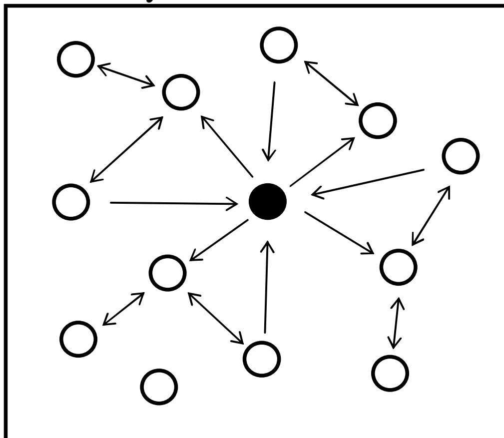

Figure 2

Jill completed the diagram (Figure 2) by drawing empty circles for students around the black dot representing her, and then arrows to show the direction of authority. (Hers was done on a blackboard, so it could not be scanned.) Her arrows are different than Dawn's (in a way they are opposites in terms of direction). Jill talked about the arrows as showing the direction of the communication of understanding. Her descriptions accompanying the drawing of arrows show them to be more complex than representations of just any communication. For example, an arrow from her black dot to a student's open dot, indicates her showing the student something that she understands or knows, and the student understanding and accepting her knowledge. Not all students understand or accept all they hear, thus only some students receive arrows. Similarly, some students who do not understand or accept her mathematics manage to find understanding in conversation with other students, and are able to show Jill their knowledge in a way that Jill accepts.

Jill's diagram is reminiscent of diagrams in education literature showing paths of communication, though her conceptualization of the arrows is more sophisticated. She shows no external influences. She said in the interview that she tries to focus her attention on the students themselves. She listens to them and interacts with them as an individual herself, not as a representative of something beyond the reach of the students. For example, she models what Schoenfeld (1992) refers to as internal authority as she justifies the ideas she wants to communicate in terms of the experiences and prior knowledge of her students, not by appealing to a book for authorization. This is like Harré and van Langenhove's (1999) positioning theory, which focuses analysis only on immanent presences, nothing external.

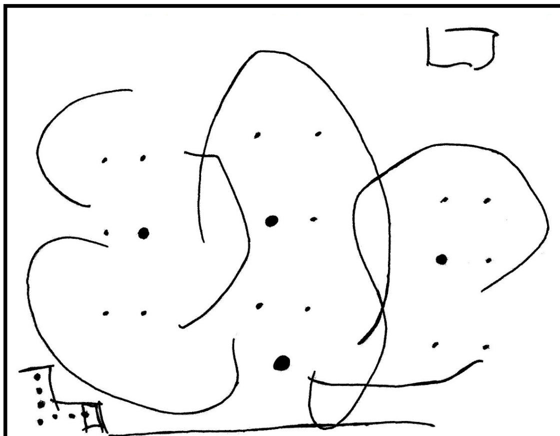

Figure 3

Mark completed his diagram (Figure 3) with a physical representation of the classroom, showing the arrangements of students, who are smaller dots, the blackboard (the straight line), a bookshelf with texts (also authoritative dots) that students can refer to, and his desk at the back of the room. The curvy lines indicate his movement throughout the room. Some students have larger dots because they, like him, are recognized as having more mathematical authority than the others. When drawing, he talked about balance. Authority should be spread throughout the classroom, he said. Thus he arranges seating plans to spread the students regarded as authorities around the room, and he himself moves around to avoid fixing authority in one place. His conceptualization is quite different from anything we have seen in the literature on authority in classrooms, yet we find his elaboration interesting and compelling. It relates to positioning, but unlike most scholarship on positioning that use physical relationships as metaphors for interpersonal relationships, his conceptualization recognizes the effect of physical positioning. We think that physical arrangements are significantly related to human interpretations of relationships in any given situation.

When each of the three teachers described their diagrams to one another, they all found each other's diagrams and explanations informative and true representations of some of their own views on authority. They attributed some of the differences to their different personal experiences and teaching situations. Because Dawn teaches mathematics in a French Immersion setting, there are two disciplines often seen in competition for priority – mathematics learning and language learning. Thus it does not surprise us that her conceptualization of authority shows awareness of multiple sources of authority. Jill has many Aboriginal students, with a culture that is very sensitive to human relations and that has a long history of tension with external colonial powers. Thus we are not surprised that her conceptualization of authority focuses on the human relationships immanent in the classroom. In addition to being a teacher, Mark is a coach who runs sports camps. His conceptualization reminds us of play sheets, and he talked about the need for every student (like every player) to follow the directions of the "coach" at the same time as they make decisions for themselves within the coach's system.

DISCUSSION

These three conceptualizations of authority represented by the mathematics teachers in our study raise a number of important issues, all of which relate to the diversity. First, analyses of authority structures tend to give only partial pictures of a mathematics classroom as each analysis takes a theoretical perspective that illuminates particular things. Thus no such analysis could address every teacher's particular concerns. Second, the scholarship has not yet exhausted the useful ways of conceptualizing authority. Mark's focus on physical positioning makes this clear to us. Third, and most important to us, the work of mathematics teachers differs significantly with their contexts. Thus, it is inappropriate to generalize about what features of authority are the most important to consider in a mathematics classroom. With these complexities, an important question remains: What can one say to mathematics teachers to help them understand better their authority relationships and to equip them to develop their practice to improve these relationships?

We repeat that further work on authority should be done with teachers and not on them because teachers can offer interpretations and identify complexities that we, as researchers and teacher educators (who no longer teach in public schools), may not see. We note that some of the most compelling examples of changing classroom discourse that resulted in empowering students can be found in literature on teachers' action research (e.g., Graves & Zack, 1997; O'Connor, Godfrey, & Moses, 1998). As mathematics educators recognize how they encode the authority structures that are implicit in their classroom practice, it becomes possible to envision alternative authority structures and to consciously choose what values we want to communicate.

Acknowledgment: This research was supported by the National Science Foundation (Grant No. 0347906) and the Social Sciences and Humanities Research Council (Grant title: "Positioning and Authority in Mathematics Classrooms"). Opinions, findings, and conclusions or recommendations expressed here are the authors' and do not necessarily reflect the views of the granting bodies.

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