Seventh Graders’ Motivations for Participating in Two Discussion-Oriented Mathematics Classrooms

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Abstract

In this study I examined the self-reported motivational beliefs and goals supporting the participation of 15 seventh graders in whole-class discussions in 2 discussion-oriented Connected Mathematics Project classrooms. Through this qualitative investigation using semistructured interviews, I inductively identified and described the students’ motivational beliefs and goals and relations among them. Results demonstrated beliefs that constrained students’ participation and ones that supported their participation. Students with constraining beliefs were more likely to participate to meet goals of helping their classmates or behaving appropriately, whereas students with beliefs supporting participation were more likely to participate to demonstrate their competence and complete their work. Results illustrated how the experiences of middle school students in discussion-oriented mathematics classrooms involve navigating social relationships as much as participating in opportunities to learn mathematics.

Teachers who aspire to enact the goals of the National Council of Teachers of Mathematics’ (NCTM) Standards (NCTM, 1989, 1991, 2000) provide opportunities for students to communicate about mathematics. Involving students in discussion about mathematics can promote their active sense-making, as they have the opportunity to practice reasoning through speaking aloud, particularly when they are expected to analyze and critique the reasoning of others. Such experiences can help make mathematics meaningful to students, in contrast to learning in more traditional settings in which students are expected to imitate and memorize procedures their teacher presents. Additionally, during whole-class discussions, teachers can informally assess students by
listening to their contributions, scaffold their talk by asking well-formed questions, and “filter” the discussion toward significant mathematical ideas (Sherin, 2002).

Inviting adolescents to participate in whole-class discussions, however, can present unique challenges. “During adolescence, students are often reluctant to do anything that causes them to stand out from the group, and many middle-grades students are self-conscious and hesitant to expose their thinking to others. Peer pressure is powerful, and a desire to fit in is paramount” (NCTM, 2000, p. 268). Students’ attention to social comparison information increases on entry to middle school (Stipek & Mac Iver, 1989) as they become more concerned with physical appearance and relationships become more important to their overall sense of well-being (Harter, 1990). Asking students to describe their thinking about mathematics publicly can exacerbate social comparisons. Middle school teachers have been observed to be more controlling than elementary school teachers at a time when students are more in need of autonomy-supportive environments for developing their academic capabilities (Eccles & Midgley, 1989). These shifts in teacher control generally occur earlier in mathematics classrooms than in other school subjects (Eccles et al., 1993). Although reforms in mathematics education advocate decreasing these controlling practices in order to increase students’ mathematical sense-making and emphasizing discourse and communication in the classroom (Lappan & Ferrini-Mundy, 1993), teachers may not implement these reforms consistently. Examining students’ perspectives on their experiences during mathematics class discussions in multiple settings can provide insights into how to promote involvement.

The purpose of this study was to characterize 15 middle school students’ motivations for participating in whole-class discussions about mathematics in two seventh-grade classrooms. Were these adolescents consistently threatened by participating? If not, how did motivations for participating differ between those who were threatened by the experience and those who were not?

**Theoretical Perspective**

This study was guided by a psychological analysis of students’ motivation as situated in the context of subject matter (math) and a specific classroom activity, whole-class discussion. There is evidence that both psychological factors, such as students’ beliefs, goals, and attitudes, and contextual factors, such as teachers’ instructional practices, affect students’ participation in mathematics classrooms (Turner & Patrick, 2004). Although I acknowledge the importance of contextual factors in shaping students’ participation, in this study I analyzed psychological influences on participation.

The study was guided by the assumption that students’ perspectives can differ across content domains (Buehl, Alexander, & Murphy, 2002) and classroom activities. For example, students may experience increased anxiety during mathematics class (Newstead, 1998), or they may associate epistemological beliefs, such as quick learning (Schoenfeld, 1988, 1989), uniquely with mathematics. Additionally, the nature of the activity occurring in the classroom could affect how students talk about their motivation; a classroom discussion with a focus on correct answers may be more threatening than one that emphasizes understanding each other’s processes for solving mathematics problems (Gordon-Calvert, 2001).

Because there is limited research on students’ motivation in reform-oriented mathematics settings (Middleton & Spanias, 1999), I took an inductive approach and analyzed the content of students’ motivations by examining their talk during interviews, following the work of Dowson and McInerney (2003). Although research on students’ motivation is typically conducted through an a priori approach in which motivational constructs are identified at the beginning of a study, this approach may arti-
ficially limit the range of goals investigated and may not capture students’ experiences from their perspective. Mathematics educators currently characterize an ideal student’s perspective, referred to as a “productive” disposition toward learning mathematics, as follows: “the tendency to see sense in mathematics, to perceive it as both useful and worthwhile, to believe that steady effort in learning mathematics pays off, and to see oneself as an effective learner and doer of mathematics” (Kilpatrick, Swafford, & Findell, 2001, p. 13). These tendencies, perceptions, and beliefs are considered to support individual problem solving, but a productive disposition toward doing mathematics in community through discussion may differ somewhat from this conceptualization.

Literature Review

Students’ Motivation in School

Motivation serves the psychological functions of activating, directing, and regulating persistence of behavior (Ford, 1992). Behavior is activated as students’ beliefs direct their attention. Students’ goals direct their behavior as the basis for the choice of one course of action over another. Additionally, motivation determines whether students persist in the face of challenge. With respect to the three psychological functions of motivation, I will discuss research on students’ beliefs in mathematics classrooms, adolescents’ goals in school settings, and the role of the degree of risk or challenge in learning.

Beliefs in mathematics classrooms. For this study, I defined beliefs as “assumptions from which individuals make decisions about the actions they will undertake” (Kloosterman, Raymond, & Emenaker, 1996, p. 39). Relations have been found between students’ beliefs and their problem-solving behaviors. Schoenfeld (1985, 1988, 1989) found that high school students who believed they should be able to solve mathematics problems in 12 or fewer minutes exhibited a lack of persistence when working on challenging problems. This epistemological belief has been referred to as “quick learning” and has also been found to be a strong predictor of high school grade point average (GPA). Students with higher GPAs did not believe as strongly in quick learning (Schommer, Calvert, Gariglietti, & Bajaj, 1997). Beliefs about learning mathematics and the self as learner have been shown to provide a psychological foundation for problem solving that leads to persistence, or lack thereof, and higher performance in school.

Adolescents’ goals in school. Theorists have made two primary distinctions between students’ goals for learning academic content: the difference between (a) seeking positive evaluations of one’s competence and avoiding negative evaluations of one’s competence or (b) a focus on mastering tasks and increasing one’s understanding of the content. These learning goals have fallen under a variety of labels, including ego-involved and task-involved goals (Nicholls, Cobb, Wood, Yackel, & Patashinck, 1990), performance and learning goals (Dweck, 1986), and performance and mastery goals (Ames, 1992). An additional distinction has been made between two types of performance goals: performance-approach and performance-avoidance goals. Students who hold performance-approach goals want to be recognized positively for their competence, and students who hold performance-avoidance goals try to avoid looking incompetent (Midgley, Kaplan, & Middleton, 2001).

The development of learning goals has been studied among middle school students (e.g., Middleton, Kaplan, & Midgley, 2004). Mastery and performance goals appear to be fairly stable during adolescence. However, students who expressed high self-efficacy and performance-approach early in middle school shifted toward performance-avoidance goals later in middle school. These students may have a need to protect their self-efficacy, and if it is threatened,
they may avoid increased competition or unfamiliar material.

Researchers have only recently begun to address the role of social goals in learning. Dowson and McInerney (2003) suggested that adolescents’ motivation can be conceptualized as a process of managing both academic and social goals. They described five social goals on which students operate in social contexts: social affiliation, social approval, social responsibility, social status, and social concern, in addition to three academic goals: mastery, performance, and work avoidance. Their inductive approach to studying students’ motivational goals revealed students’ simultaneous pursuits of academic and social goals in schools. Social goals may interact with learning goals; Summers, Schallert, and Ritter (2003) found that middle school mathematics students who expressed a low level of mastery goals were more influenced by comparisons to close friends than to other students in the class.

There is evidence that students’ beliefs may moderate their motivational goals. Stodolsky, Salk, and Glaessner (1991) suggested that students’ beliefs about the nature of a school subject are related to their learning goals. Cobb (1985) demonstrated this relation through case studies of two first-grade students. The student with performance goals viewed mathematics problems and procedures as unrelated to one another. In contrast, the student with mastery goals believed in relations between mathematical procedures. Beliefs about the nature of the school subject interacted with learning goals for these students.

Classroom settings can influence students’ goals. Meyer, Turner, and Spencer (1997) studied fifth graders in problem-based mathematics classrooms. They recommended increasing opportunities to discuss alternative solution methods and the process of solving problems, focusing on improvement versus completion of work in order to promote mastery goals. Turner et al. (2002) found that sixth-grade teachers communicated mastery messages to students by encouraging them not to feel inadequate or ashamed when they did not understand; students exhibited fewer avoidance behaviors in classrooms they perceived as emphasizing learning, understanding, effort, and enjoyment.

Degree of risk and challenge. Students’ tendencies toward or against risk-taking also affect their problem-solving behavior. Meyer et al. (1997) examined differences in motivation between 14 fifth graders who were either risk-takers or non-risk-takers in problem-based mathematics classrooms. Students who reported a willingness to take risks and pursue challenges also reported a higher preference for difficulty and taking action compared to those who were less likely to take risks, as well as lower negative affect after failure and higher self-efficacy.

The degree of risk experienced in classrooms not only affects a student’s willingness to take risks but is also a feature of academic work in classrooms. In his review of the role of academic work in students’ learning, Doyle (1983) noted that because academic tasks are embedded in an evaluation system, students work on these tasks under conditions of ambiguity and risk. He suggested that the perception of risk carried by a task is heightened when the task is designed to assess understanding and is less focused on opinion.

Students’ Experiences with Mathematics Classroom Discussions

In this study I defined discussions as talking about mathematics in a whole-class setting. This definition is in contrast to more specific forms of mathematics classroom discussion, including more inquiry-based forms of talk (Goos, 2004). I used a broader conceptualization because the implementation of discussions in mathematics classrooms can vary greatly yet still involve talking about one’s thinking publicly. Examining only classrooms with ideal implementations of reform practices limits understanding of students’ motivation to
participate in discussions, because such classrooms are rare.

Some students avoid participating in mathematics classroom discussions because of social concerns. Lampert, Rittenhouse, and Crumbaugh (1996) described fifth graders’ beliefs about mathematical disagreements in one discussion-oriented mathematics classroom. Students reported the social and personal repercussions of participating during mathematics class. They felt bad about being incorrect or correcting their peers, and some were offended if a classmate said what they had wanted to say. Discussions were less troublesome if fewer students were involved. Students believed that it was at least as important to maintain relationships as it was to argue mathematics.

Other students avoid participating because of their beliefs about authority in the mathematics classroom. With respect to whether middle school students avoid participating, Ridlon’s (2001) case study of a seventh-grade student revealed the influence of family on the student’s beliefs and on his resistance to learning mathematics from a problem-centered program. The researcher determined that the curriculum and teaching style conflicted with the student’s beliefs about the teacher’s authoritative role, which the researcher attributed to the student’s cultural background and rural southern upbringing.

Some adolescents are willing to participate in mathematics classroom discussions, and students’ beliefs about participating may vary within the same middle school classroom. Lubienski (2000a, 2000b) found that middle school students’ views about whole-class discussions differed based on their socioeconomic status (SES). Higher-SES students considered discussions to be a helpful forum for exchanging ideas and were focused on concepts during discussions, whereas lower-SES students preferred more teacher direction and were more often focused on giving correct answers to specific problems. Students’ experiences outside the classroom could affect their participation within the same classroom.

Not all students, even those in middle school, resist involvement. The studies of students’ experiences with mathematics classroom discussions (Lampert et al., 1996; Lubienski, 2000a, 2000b; Ridlon, 2001) have involved relatively few students in a single classroom. A detailed analysis of a larger number of students from more than one classroom could provide a broader range of students’ motivations for participating in discussions. Thus, I pursued the following questions in this study: What are seventh-grade students’ beliefs about learning mathematics in two discussion-oriented classrooms? How do students talk about their motivational goals for participating in mathematics classroom discussion? How do students’ motivational goals relate to their beliefs about learning mathematics through classroom discussions?

**Method**

**Data Collection**

This study took place at Two Rivers Middle School, the single middle school (grades 6–8) in a district serving a rural community in the Midwest. (All proper names are pseudonyms.) The school is located in a small town and enrolls approximately 440 students. In 2001, 98.4% of the student body was white, 0.7% Native American, 0.7% Hispanic, and 0.2% black. About 12.4% of the students received free or reduced-price lunch.

This district had used reform-oriented mathematics curricula for about 9 years at the elementary and middle grades. The middle school used The Connected Mathematics Project (CMP) (Lappan, Fey, Fitzgerald, Friel, & Phillips, 1997), and the elementary school implemented Investigations in Number, Data, and Space (TERC, 1998). CMP is a problem-based textbook series. The problems emphasize mathematical reasoning and communication and flexibility among numeric, verbal, symbolic, and
graphical representations, as well as the opportunity for students to make connections among mathematical ideas and between mathematics and other disciplines.

I spent approximately 100 total hours in two mathematics classrooms at this middle school during the 2002–2003 school year to collect data. Two of the three seventh-grade mathematics teachers at the school volunteered to participate in this study, Ms. Carson and Ms. Evans. I invited these teachers to participate because of their experience with the mathematics textbook series and their involvement in professional development provided by the curriculum developers. Ms. Carson was a fourth-year teacher who had used CMP throughout her career. Ms. Evans had taught for 16 years, and she had used CMP for 9 of those years.

The results presented in this article are part of a larger data corpus that includes videotaped classroom discussions from the fall and spring semesters, survey data from the students in these two classrooms in the fall and spring, and interviews with 15 students from both classrooms in the fall and spring. This article presents results from interviews in the spring of 2003. I selected students for the interviews purposefully (Patton, 1990) to obtain diversity in gender, achievement, and class participation (as observed in the first 3 weeks of school). Eight participants were female and seven were male. A range of students’ mathematical performance was included among this sample, as indicated by their third-quarter course grades: four students earned an A, three had B’s, five earned C’s, three had D’s, and no participants failed the third quarter. All participants were white, as were most of the students at the school. I interviewed students individually, either in the school librarian’s office or in a counseling room in the front office. Interviews (see Appendix) lasted between 30 and 45 minutes. I asked students to discuss their views of a good mathematics teacher and the behaviors of successful mathematics students to obtain evidence of their beliefs about the process of learning mathematics (Spangler, 1992). Additionally, I asked students to elaborate on their responses to four items on a survey instrument.

I also asked students about classroom participation, such as whether they were likely to participate in whole-class discussions. Questions about classroom participation included: (a) Are you more likely to participate during class or listen? Why? (b) What if you contributed an answer during class discussion and it was incorrect? What would your reaction be? I constructed these questions to pursue themes from interviews with the students earlier in the school year.

Data Analysis

I analyzed interview transcripts through a constant comparative process (Glaser & Strauss, 1967), using a framework I developed for studying discourse in interviews. This framework consisted of three types of language cues for assessing evidence of beliefs and goals in students’ talk: (a) modal verbs, (b) expression of affect, and (c) repetition.

**Modal verbs.** To examine students’ beliefs, I noted their verb choices in interview responses (i.e., “I need to . . .” “I have to . . .” “I should . . .”). Bills (1999) used similar linguistic cues, modal auxiliaries (may, might, can, could, shall, should, will, would, ought, need), to study how high school students revealed their attitudes when talking about math. Students’ talk about their idealized views of the world, that is, how it should operate, can indicate evidence of a belief (Abelson, 1979). An example of modal verb choice is demonstrated in the segment below from an interview with a seventh grader (Molly) who was asked to discuss her written responses on a beliefs survey. She used a series of modal verbs (in italics) to describe the importance of understanding in mathematics.

**Interviewer (I):** (reading from survey). Okay. “The math I learn in school is mostly a set of rules to memorize.” You
put 1, not at all true. What do you think?
Molly: It’s not just to memorize, you have to understand it.
I: Okay.
Molly: They’re not just, there are rules, but you have to know, like, why it’s a rule and why it’s so important. So I don’t think it’s true that you just have to memorize it. You also have to know its meaning and understand it.
I: Yeah, so memorizing’s not enough.
Molly: No. Not in math. [10/10/02]

Her repeated use of “you have to” suggests a belief in understanding as an important element in learning mathematics that goes beyond memorizing procedures. Similarly, goals may be expressed in terms of desires or preferences, such as “I want to . . .” or “I hope to . . .” Verb usage could suggest evidence of a belief or goal.

Affect. Carefully attending to participants’ expression of affect can also reveal evidence of students’ beliefs and goals, because beliefs are considered to be closely related to affect (McLeod, 1992), as are goals (Lemos, 2002). If students discuss an emotional reaction, the psychological backdrop to their reaction is evidence of their beliefs. Another excerpt from Molly’s interview illustrates how a student may demonstrate beliefs through her affective statements.

Molly: I like the way she teaches in that class.
I: What do you like about it?
Molly: I like that she put, she makes it funny, and she gets the whole class involved. So, I don’t know, it makes it a little bit more fun to learn to do. [10/10/02]

Molly’s attitude toward learning mathematics is positive because she enjoys her teacher’s approach and her own experience of learning. This enjoyment appears to be connected to her belief that the teacher should express her sense of humor and get the students involved in the class. Stronger evidence for a belief or goal occurs when both affect and modal verbs are involved.

Repetition. Repetition in the students’ interview statements, when considered in conjunction with affective statements or modal verbs, also suggested a belief or goal, because the repetition indicated emphasis. Tannen (1989) noted that one function of repetition in discourse is to aid comprehension. Repetition can also be seen as a form of emphasis in songs, poetry, or oratorical discourse. In Molly’s affective statement above, the comments “she makes it funny” and “makes it a little bit more fun” are repetitious. Also, in her idealized statement, Molly repeats that memorizing is not important, echoing the survey statement. The simultaneous occurrence in students’ talk of cues such as repetition, affect, and verb choice enabled me to identify themes in students’ interview responses.

Results
Classroom Discussion

Ms. Carson’s class. In this classroom, students spent less time exploring ideas during whole-class discussion. Over 10 consecutive observation days in the spring, the class spent an average of 24.5 minutes on seatwork and 15.4 minutes on whole-class discussion each day, out of a 58-minute class period, with the rest of the time spent on class business, grading homework, and introducing the day’s problem. During seat work, students were allowed to discuss problems with the two or three other students at their tables, but they were not required to do so. Discussions typically followed an I-R-E structure (Mehan, 1979), in which the teacher initiated a question, student(s) responded to the question, and the teacher evaluated the response(s). The discussion usually followed the sequence of the problems in the book, and its purpose was for students to check answers developed during seat work. The students rarely shifted the topic of discussion; the teacher directed the content of the talk.

Ms. Evans’s class. In contrast to Ms. Carson’s class, this class spent an average of 8.9 minutes daily on seat work and 21.4 minutes on discussion over 10 days. However, there was considerable variation in
time spent on whole-class discussion in Ms. Evans’s class, with at least 2 days including over 40 minutes of discussion. In contrast, Ms. Carson’s class spent over 30 minutes in class discussion only 1 day. The structure of the whole-class talk in Ms. Evans’s class involved the teacher gathering multiple perspectives from students, then selecting and “filtering” the discussion toward significant mathematical ideas (Sherin, 2002). The teacher was not the sole evaluator, and she asked students to evaluate each other’s thinking with questions such as, “What do we think about that?” The content of discussions regularly shifted based on students’ requests. The discussions in Ms. Evans’s classroom were more aligned with the goals of the NCTM reform movement, because students were more likely to evaluate the thinking of others and seek clarification until they understood (NCTM, 2000).

Although these two teachers implemented classroom discussions differently, both expected students to participate, and discussions in each classroom focused on the same problems from the CMP curriculum. At the beginning of the school year, both teachers told me they valued student participation. Although the contrasting discourse practices in the classrooms could have promoted different student beliefs and goals, students in each class expressed diverse views.

Students’ Beliefs

Based on their talk during the interviews, I classified students’ beliefs as either supporting or constraining their participation. Of the 15 students I interviewed, eight held beliefs constraining their participation, and seven held supporting beliefs. Beliefs about the nature of risk experienced in mathematics class discussions and students’ roles as learners seemed to interact to support or constrain students’ participation. Of seven students from Ms. Carson’s (I-R-E) classroom, five expressed constraining beliefs, and two reported supporting beliefs. Because a diversity of beliefs existed among students within each classroom, I emphasize individual differences among students in reporting results.

Beliefs constraining participation. Eight students who associated high risk with participating in discussions also stated that they learned mathematics most effectively through listening. These beliefs appeared to constrain students’ participation during mathematics class. When I asked these students whether they usually chose to talk during class or listen during class, they mentioned wanting to participate only when they were certain that they were correct. For example, Alyssa said, “Like, if we’re doing something that I really get, and I know the answer, and I know I’m right, then that’s when I’ll raise my hand.” These students mentioned wanting to avoid saying incorrect answers during class.

Alyssa: I think I like to listen more than talking.
I: And that works better for you because why?
Alyssa: Because I don’t want to say the wrong answer.

These eight students associated strong negative emotion with the risk they connected to participating in whole-class discussions. For example, Allen said, “When I’m put on the spot, I kind of go off track. I don’t know how. Every time I’m put on the spot in front of an audience, I just panic and I can’t really think straight.” Tricia mentioned a similar feeling.

Tricia: I’m kind of really shy, so I’m like super conscious about when it comes to answering in front of people. I get, like, all nervous and stuff.
I: So, what do you mean? Can you say a little more about that?
Tricia: Well, like, in math, I used to be, like, if a teacher called on me or something, and I had my hand raised, my face would turn all red. And I’d get really ner-
you, and I’d start sweating, until I got
the answer out. And, like, it, I was, like,
always nervous that it would be wrong.
And, I’m not so much nervous any
more, but I’m still kind of worried about
if the answer’s wrong, like, I’ll get, like,
messed up or something.

Evidence for students’ beliefs about
learning mathematics was also found in
their responses to a question about what
students could do to succeed in their math-
ematics class. For example, Max said, “Do
our homework and listen, pay attention.”
He did not mention any other necessary ac-
tions for success in his mathematics class.
Allen spoke similarly: “you gotta pay atten-
tion so you know what’s going on, and if
you don’t, then you’re pretty much lost, and
you won’t be able to really catch up real
fast, it might take you a while to catch up,
so you gotta really pay attention, and you
gotta listen a lot.”

**Beliefs supporting participation.** The re-
main ing seven participants did not report
avoiding participating during class discus-
sions, nor did they describe high risk asso-
ciated with participation. Rather, they be-
lieved they participated in order to learn
mathematics, as Steve explained below.

I: If a new student moved into your
class and they had to know what they
needed to do to be successful, what
would you say?
Steve: Pay attention. Do all your
work. And, uh, like, don’t be afraid to ask
questions. Don’t be afraid to, you know,
jump right into a question that she asked,
you know. Always try to be in the group,
you know? In the big group discussion.
I: Oh, yeah?
Steve: Yeah. Because then you’ll un-
derstand it more, and you’ll interact with
the question more.

These students also said they contrib-
uted during whole-class discussions to get
feedback on their thinking. For example,
Alex said that participating was important
for him because “You’ve gotta say what you
think so you can hear what other people
have to think about what you’re thinking.”

Allison spoke similarly: “I think I get it, but
then I’m not sure if I have the right answer
or not, so sometimes I’ll raise my hand just
to see if I got it right or not. But then if I
don’t, then, like, I can hear what other
people are doing, too.” These students par-
ticipated in order to have their thinking
evaluated and also when they were not nec-
essarily confident about their own thinking,
as the comments below illustrate.

Steve: You can’t just sit back the whole
time and just let everybody else teach
you. You’ll know how to do it, but you
wouldn’t have tried it, you wouldn’t
know if it would work or not. So, if
you’re out there, trying to throw out your
ideas, you could actually find for all, a
new way of doing a math problem.

Involvement was a key to learning new
mathematics procedures and concepts.

Becky: And when you have to do
problems, don’t just sit there. You have
to get into the conversation in order to
actually get it yourself and make you un-
derstand it, don’t just understand it like
how other kids do it.

Some of these students indirectly expressed
a negative view of those who were not in-
volved in the discussion. They believed this
was how they learned mathematics and that
other students would probably learn the
same way.

Additionally, students with beliefs sup-
porting participation did not view participat-
ing in classroom discussions as risky.
When asked how they felt about being in-
correct in front of their classmates, they did
not mention feeling intimidated. Becky
said, “I guess if I’m wrong, it doesn’t really
bother me. I’m just, I just go on with the rest
of the day, forgetting about that I was
wrong.” Similarly, Allison said, “I feel okay,
because I at least, like, tried to do the prob-
lem instead of just not do it.” For students
whose beliefs supported participation, the
benefit of learning through participating
outweighed the risk of being incorrect in
front of classmates.
Motivational Goals for Participating

All interviewees valued the activity of participating in class discussions, whether or not their beliefs supported or constrained their participation. In their survey responses, all 15 students agreed with statements such as, “When my teacher asks a question in math class, it is important that I explain how I did the problem, not just give my answer,” and, “It is possible to solve math problems in more than one way.” Students mentioned the importance of participating in the mathematics classroom for sharing and learning about multiple solutions for mathematics problems. They seemed to think that individuals had their own unique way of understanding mathematics. For example, Alyssa said, “if there was only one way in the world to do a problem, then one person wouldn’t get it, and another person would, and the other person that didn’t get it would be totally stuck on everything.” Most of these students had attended school together since kindergarten and had been taught using reform-oriented mathematics curricula throughout elementary and middle school. By seventh grade, they seemed to have internalized the expectation to share their solution strategies with one another. Students expressed four goals motivating their participation: demonstrating their competence in mathematics, helping their classmates, behaving appropriately during class, and completing their tasks.

Demonstrate competence. Participating in class discussions to show others what they knew about mathematics was important to 11 of the 15 students. This was a performance-approach goal: pursuing public recognition for achievement or knowledge. For example, Max said, “I want to prove it that I know it better than I was [did before] . . . because last time I didn’t really know a lot, and this time I’m doing pretty good.” Students who expressed this goal also described wanting to be among the smartest students. For example, Pete said, “I was thinking that if I was doing better, like, then, and one of the smartest people, then I would feel good about myself.” However, some students mentioned that they did not consistently act on their goal of demonstrating competence. According to Tricia, “Well, I like to show people that I know what I’m doing, or that I’m smart, but it’s not always happening, because, like, because I don’t always want to, like, brag and stuff, and be really, like, irritating to people.”

Help classmates. Ten students also noted that they were likely to get involved in whole-class discussions if they thought a classmate could benefit from their contribution.

Students who spoke of helping their classmates were concerned with alleviating the frustration or anxiety of other classmates who were confused. Elaborating on a classmate’s explanation was another form of helping.

Behave appropriately. Eight students mentioned that their participation was also guided by how they interpreted their teacher’s expectations for behavior, but their interpretations varied. Some characterized appropriate behavior during discus-
sions as waiting one’s turn to talk. For example, Becky said, “I hate it when people just interrupt and interrupt and interrupt. That bugs me so much.” Hannah behaved by raising her hand before she participated: “You just raise your hand, and, like, just keep your hand up until she calls on you.” Allen’s efforts to behave involved paying attention more than participating: “Pay attention to everything, half of it is because I don’t want to get in trouble, and then the other half is just to listen and see if there’s, like, other ways to figure out a problem.” However, students in Ms. Carson’s class sometimes described participating in order to earn points. Hannah said, “Well, you need to participate, because participation’s part of your grade.” Such comments suggested that students were participating because their teacher expected them to do so. Students’ attempts to behave were enacted differently; some avoided participating in order to behave, whereas others viewed participation as exhibiting appropriate behavior.

Completing the task. Five students were focused on participating because they hoped class discussions would allow them to learn what they needed in order to complete their assignments. According to Molly, “you may be solving a problem that you think is really easy, but then another student will show you a way that’s even easier, that’s really fast and quick.” The class discussions helped these students find more efficient solution methods for problems. They wanted to complete their work during class as well, as Alex noted: “I like to get my homework done before [class is over], so then I won’t have anything to do at, like, home or something.” Students’ emphasis on learning efficient strategies in connection with finishing their assignments suggested a goal focused on completion rather than learning generally.

Beliefs and Motivational Goals

Participants’ motivational goals differed depending on whether their beliefs supported or constrained their participation (see Table 1). The eight students with constraining beliefs were more likely to express goals of helping others and behaving as motivating their participation. The seven participants with supporting beliefs were more likely to be motivated by completing a task. Students were just as likely to participate in order to demonstrate their competence regardless of their beliefs about participation.

Descriptions of four student cases below illustrate relations between students’ beliefs about participation and their motivational goals for participating. These cases demonstrate how beliefs about participation interacted with students’ motivational goals and illustrate the prominence of social issues in students’ talk about participating during mathematics class.

Overcome risk to show what I know and help others. Of eight students who believed participating was risky, six also mentioned that they would participate in order to demonstrate their competence, and seven discussed the importance of participating in order to help others. For example, Allen, from Ms. Carson’s class, said he would rather listen than participate during class discussion. He also said that he did not enjoy being in the public eye during class discussion: “It just makes me nervous.” However, Allen did say that he participated in class discussions sometimes, but only if he was certain about the correctness of his contribution and believed that it was unique.

I: So, how do you decide, “Okay, I’m okay with talking now?”

Allen: Um, it’s, I don’t know. It’s just a come and go thing. Like, if I really know this answer and nobody else does, I’d like to try and get the right answer. And that’s pretty much, it makes you want to raise your hand if you know the answer to a problem. That’s what happens to me. But going up in front of everybody, that just makes me nervous . . . like if they had one way, and they got the right answer, I’d just show them my other way, just to help out other people, and compare them.
Table 1. Motivational Goals for Total Sample and by Beliefs about Participation

<table>
<thead>
<tr>
<th>Goal</th>
<th>Total (N = 15)</th>
<th>Beliefs Constraining Participation (N = 8)</th>
<th>Beliefs Supporting Participation (N = 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Demonstrate competence</td>
<td>11</td>
<td>73.3</td>
<td>6</td>
</tr>
<tr>
<td>Help classmates</td>
<td>10</td>
<td>66.7</td>
<td>7</td>
</tr>
<tr>
<td>Behave appropriately</td>
<td>8</td>
<td>53.3</td>
<td>6</td>
</tr>
<tr>
<td>Complete the task</td>
<td>5</td>
<td>33.3</td>
<td>1</td>
</tr>
</tbody>
</table>

Allen described feeling a sense of responsibility toward his friends in class, wanting to support them if they were struggling. “Um, like, I have a friend in class. He’s kind of a little bit behind me, so I’ll help him out on problems when we’re working together, and, so, I’ll, you know, I’ll help him to find, do ways. And when he gets it, then, you know, I can move on with other things with him. And I’ve got to explain to him how to do things, and I got to make him remember it, so the next time, so far he has.” Students like Allen described helping others as if they were trying to give the kind of help that they would want if they were also confused.

Allen mentioned that he would feel more comfortable discussing his thinking with his classmates during small-group discussions.

I: So what do you think could make it a situation where you felt more like you could talk?

Allen: Um, just if I had a group of five people, that would help me a lot. Just not like a whole big class. I mean, there’s a lot of kids in there. It just makes me nervous. But if I had a group of five, I could easily share my strategies and thoughts. . . . If I work in a five-person group or less, I think it’s just a lot more easier to just, kind of, you know, like, it’s kind of just the way I feel about things. Um, if I’m just working in a five-person group, I can easily just give it out, my brain is running a lot more, and I don’t have to worry about standing up there, worrying about if I get the wrong answer, what they’d all think of me. But, in like a five-person group, they’ll like tell you if that’s wrong or right and then they’ll show you why it’s wrong or right.

Students who generally avoided participating in class sometimes chose to participate in order to help their classmates, if they were confident in their mathematical knowledge or were working in smaller groups.

**Behaving appropriately is more important than participating.** Of the eight students whose beliefs constrained their participation, six expressed the goal of behaving appropriately. Marissa, from Ms. Evans’s class, avoided participating because she believed she learned through paying attention and that participating was risky. One way students demonstrated their concern for others was through efforts to help, as indicated by Allen’s case above. Marissa’s interview statements illustrated that another attempt to be a good community member involved respecting others, which in her case was not participating unless she had a particularly relevant or helpful contribution to make during the discussion, because she did not want to waste the time of her classmates.

She was concerned with the amount of off-task behavior in her class. She wanted her classmates to “pay attention more. . . . People talk too much in my class.” She thought that paying attention was crucial to learning.

I: So, let’s say a student moved into your school, and they wanted to know what they had to do to be successful in your current math class, what would you say?

Marissa: I think, um, they have to pay attention. They have to, um, not be intimidated by all the talking and not be intimidated by what Ms. Evans says, about,
like, stuff she jokes around about, don’t be intimidated. Um, take notes. . . . I think you just have to pay attention. Keep yourself on the ball, keep watching everybody. I think you can learn from others. Even people that are at your grade level, even if they’re lower than your grade level, higher, anything like that. Um, just be respectful, too, because if you be respectful, then everybody else will respect you. And then if you have a question, you can learn from them, too. Um, that’s pretty much it.

Marissa described what was significant to pay attention to during mathematics class.

Um, I think paying attention to most of the things you don’t get, and things that are new, because those things are caught in your brain, those are the ones that you know you’ve got, and then the things that come up, and you’re like, “What? Whoa!” That’s what you have to watch out for. And that’s what you don’t talk during, you don’t, you shouldn’t talk through anything. But I think you just need to pay attention to what is unfamiliar, and what gets you confused, what brings questions, that’s when you pay attention.

She also emphasized the importance of mutual respect in the classroom. “I don’t want to be, to put down or to make people uncomfortable. Because I wouldn’t, I don’t know, I try to be friendly. I don’t know if I am all the time, but, um, it’s [putting people down] not nice. The world doesn’t respect you if you put people down. It doesn’t help your social career or your business career, either.”

Similar to Allen, Marissa was not likely to participate unless she was certain that she was correct. “Um, I don’t know. If I don’t understand things, I’m not going to raise my hand and blurt out an answer. Um, I think one big problem with me is that I’m afraid that the answer’s wrong. I don’t want to be embarrassed by having a wrong answer. That’s why sometimes people don’t involve themselves in the discussions.” Marissa did not always avoid participating; she was willing to offer her ideas when she had a unique contribution. “I think when you have a really relevant detail, when something can really add to the discussion, when something, or, like, when everybody seems like they’re lost, and you feel like you’ve got something that’s right, and you feel like you’ve got the right answer or the right idea.”

Her hesitation to participate also appeared to be related to her ideas about the nature of classroom discussions as something of a combat zone. “I like, just, watching people more than I like jumping right in, arguing, getting in the fight, all that good stuff. I think I’d rather just look and pay attention and just, yeah. . . . I think I like to look at the big picture and both views before I decide my decision. I like to hear both points, because then it brings, well, is she? What ways are they wrong? What ways are they right? Stuff like that.”

Marissa’s effort to listen to multiple perspectives during class may be related to her emphasis on mutual respect; she wanted to gather information before she took sides. She considered paying attention to be participation; Marissa spoke of active listening as a form of involvement during mathematics class, and, as did Allen, mentioned that small-group settings were more inviting for participating. “I think you can kind of be involved when you’re listening. But I think you’re more into the action if you talk more and express your feelings in some way. I like it when we split up in partner groups and work on that, because it’s hard to, like, blurt your answers out when everybody’s trying to raise their hand, everybody’s trying to talk, and I think it’s better when you have just a little group and you guys can take turns just in a little group to talk.” Small groups appeared to appeal to Marissa because it was easier to get the floor, in contrast to Allen’s response in which he was less likely to be concerned with being wrong if the group was smaller.

Similar to Allen, Marissa avoided participating because she might be incorrect in front of the class, was willing to participate
if she thought she was one of the only students who knew how to solve the problem, said that she learned mathematics through paying attention, and preferred discussing mathematics in small groups rather than whole-class discussions. Marissa was particularly focused on appropriate behavior during mathematics class, whereas Allen was motivated to participate to help classmates.

**Participating allows me to feel smart.** Molly, from Ms. Evans’s class, held beliefs supporting participation in both small groups and whole-class discussions. She said, “You have to be able to, um, talk. Yeah, talk and listen to your group, and, like, read the problem and stuff, and go through it so you actually understand it. Like, because you need to understand the problem before you can solve it. So just, like, understand it. Know what it means. And if you don’t, you can ask someone.”

In addition to talking with her group, she reported participating in the large-group discussions regularly. “I talk at least every day, I think. I try to get it so people can hear what I think, because it’s just really easy for me, and it might be easy for some other students, so I try to let them figure out my way, too.”

She said she did not mind being incorrect in front of her classmates. “So that way, like, if I, I’d like to see if I, because I could be right, and even if I’m not, I really don’t feel bad, because other people aren’t always right, either, so it, just, it doesn’t really bother me.”

Molly mentioned enjoying participating during whole-class discussions because she enjoyed the attention. “I think I would like to talk more, just because I like to talk in front of people, so people, like, pay attention to me and everything. So both, but I really like to talk to people and tell them what I think of it.” Participating allowed her to meet her goal of wanting to appear competent. She said, “I like to be the ones who are one of the smartest and stuff.” Students like Molly participated in order to learn and to attain their goal of demonstrating competence.

**Participation supports my learning and the learning of others.** Like Molly, Tim, from Ms. Carson’s class, held beliefs that supported his participation. He did not perceive participation as risky and found that it helped him learn mathematics. In contrast to Molly, Tim emphasized the importance of helping one another through participation.

He spoke about others’ participation as helpful to his learning; he was one of the students who participated the most often in his class and wanted others to participate, too. “Well, in class, what helps me out is when everybody shares their answers. Even though I’ve been answering a lot of the questions, some people have very good ways of doing things, and using their ways can make it even easier. Using their ways and my answers together, it makes it a lot easier than what I do. And I think other people, they got some pretty good ways of doing things, so.”

In response to being asked what students should do to be successful in his mathematics class, Tim said, “I’d say, listen carefully to the teacher and other people when they share ideas and participate by, just participate. Because sometimes when you do answer something, it just clicks in your head, and then you know what you’re talking about after you think about it a little bit. So just listen more in class, and then you’ll be able to come up with more ideas about how easy [it is] to be able to do problems.”

Tim found that his thinking was evaluated through participating. “Well, a lot of times I want to know if my ideas are wrong or right, and if they’re wrong, I want to know, so I can correct the next time that I do it. So I like to be picked on [called on to respond] just to, like, raise my hand, then she picks on me. I like to be picked on just as much as everybody else does. Maybe more.”

Tim appeared to look at having knowl-
edge about mathematics as a responsibility; someone who understands should share that understanding to help others. “Teach other people. Like, if you have a partner or something that isn’t very good in math, kind of point it out to ‘em, show ‘em how to do it, so, and then you could help them out. Sometimes, even when you’re doing it, you see what they do, and you could teach ‘em how to correct that. You can try it yourself, so that might help you out, too.”

To follow up on his description of participating as being “picked on” if he raised his hand, I asked him how often he participated during class: “usually I don’t get picked a lot, because in the beginning of the class, she’ll pick on me on like four questions. And then the rest of the hour, she won’t pick on me, she’ll get other people to answer questions.” Tim’s experience indicated that students do not always control their participation during class discussions.

Tim and Molly’s beliefs supported their participation, because they were not threatened by being incorrect in front of their classmates, and they described participation as central to learning mathematics. Molly was more focused on being recognized for her thinking, whereas Tim was interested in both helping others and receiving help.

Discussion

Of the 15 students I interviewed, seven held beliefs supporting their participation, whereas eight expressed constraining beliefs. Although one might predict that middle school students would generally avoid taking risks in social settings, almost half of the students noted how participating in whole-class discussion increased their learning and was not intimidating. Even the eight students who perceived participating to be risky noted their willingness to participate to meet goals such as helping classmates, behaving appropriately, and demonstrating competence. Students who held beliefs supporting their participation were more likely to participate in order to demonstrate their competence or complete their tasks.

A key contribution of this work is its examination of students’ spontaneously self-reported goals in the context of subject matter (mathematics) and a classroom activity (participation in whole-class discussion). Students described learning goals (Ames, 1992; Dweck, 1986) as among their motivations for participating. Students’ talk about participating to demonstrate their competence was similar to a performance-approach goal. Beliefs supporting students’ participation include a concern for mastery and a desire to learn; students who held beliefs constraining participation suggested performance-avoidance goals because they wanted to avoid being incorrect in front of peers. Although examining students’ motivations to participate inductively provided evidence of learning goals, the importance of social goals in motivating students’ participation was salient in these data as well. Students were motivated to participate to help others and behave appropriately; efforts to help allowed students to meet social responsibility and social concern goals, whereas behaving appropriately allowed them to seek social approval from their teachers (Dowson & McInerney, 2003). These results highlight the importance of using a range of methods to study students’ motivation, following Urdan (2004). Through open-ended forms of data collection and analysis, I learned that some of students’ social goals, such as social responsibility, social concern, and social approval, interacted with their beliefs about learning through participating. The exclusive use of forced-choice surveys when studying adolescents’ motivation may limit results if they do not include social goals.

Students’ descriptions of their beliefs and goals for participating suggested that these motivational processes have both hierarchical and complementary relations. Beliefs about participating provide a foundation for students’ goals. Students reported acting on multiple goals simultaneously,
such as helping their classmates and demonstrating competence. Goals, then, appear to be complementary, and beliefs and goals relate to one another hierarchically. Thus, this study addresses a call from Buehl (2003) for additional research examining relations between beliefs about learning and motivational goals.

Results also suggest refining the notion of “productive disposition” (Kilpatrick et al., 2001) toward learning mathematics by focusing on dispositions to engage in particular tasks rather than on learning or doing mathematics generally. Conceptualizing students’ productive dispositions toward taking part in classroom discussions could include beliefs about learning and the nature of risk that support their participation. For example, a productive disposition toward participating in mathematics class would include the belief that describing one’s thinking leads to mathematical understanding and that participating in discussions is not risky. However, because students whose beliefs constrained their participation were still motivated to participate to meet social goals, a productive disposition toward participating might also include a focus on the needs of the community.

Although research has illustrated that the ways in which students integrate and coordinate their academic and social concerns can significantly affect students’ achievement (Wentzel & Wigfield, 1998), in this study I took a closer look at these concerns in light of classroom participation, which is thought to support students’ learning of mathematics. The importance of the social dimension of mathematics classroom discussions was first raised by Lampert et al. (1996). Their work suggested that students’ concerns with disrupting their social networks affected their participation in inquiry-based discussions. Gordon-Calvert (2001) described how classroom conversations in mathematics can support students’ relationships with others as they seek meaning and coherence, particularly if the interactions focus on what can be learned from others’ explanations, in contrast to discussions in which efforts are made to find faults in explanations. In both classrooms in my study, students reported that their social concerns inhibited their participation because they feared that their potentially problematic thinking would be judged, although teachers varied in their implementations of discussions. Also, some students’ social concerns supported their participation if they thought others would benefit or if participating allowed them to demonstrate their mathematical understandings. Their beliefs and goals may have been influenced by the structure of their classroom discussions.

Motivational Processes and Classroom Contexts

There were diverse beliefs and goals among students in each classroom; however, more students (five of seven) with beliefs supporting participation were in Ms. Evans’s classroom, whereas more (five of eight) of those with constraining beliefs were Ms. Carson’s students. Recall that Ms. Carson’s class discussions tended to follow an I-R-E structure, and Ms. Evans’s discussions were less likely to do so. Although my analysis was not designed to assess contextual factors influencing students’ participation, I believe that the nature of discussions in each classroom could have affected students’ motivation.

Most of the students interviewed from Ms. Carson’s classroom (five of seven) voiced a belief in a high degree of risk associated with classroom discussions and in the importance of paying attention rather than participating in order to learn. Ms. Carson’s role as the primary evaluator and the shorter time spent on discussion could have communicated to her students that the purpose of discussion was to determine who was correct rather than to explore ideas together. In contrast, most students interviewed from Ms. Evans’s class (five of eight) held beliefs that supported their par-
motivation. Her efforts to have students evaluate their classmates’ thinking, her openness to students shifting the topic of discussion, and the longer time spent in discussion may have communicated the importance of participating in order to learn mathematics.

Differences among students in the same classroom, however, emphasize that classroom contexts are not the only influence on students’ motivations. Not all students whose teacher decreases her authoritative role will respond with a willingness to participate in discussions. Students’ experiences with mathematics and with authority prior to and outside their current classrooms, including their lives at home (Ridlon, 2001) and socioeconomic backgrounds (Lubinski, 2000a, 2000b), also affect their motivations to participate. Even if teachers structure their classrooms to foster productive motivations, some students will persist in holding motivations aligned with practices outside of their current classrooms.

Implications

To support students’ motivation to learn mathematics in discussion-oriented mathematics classrooms, it would be productive for teachers to foster social goals among students as well as a desire to approach challenges (Meyer et al., 1997). Although some students are motivated to participate to learn mathematics, others will learn from a more indirect route of participating to meet social goals (Wentzel & Watkins, 2002). If students focus on supporting their classmates instead of protecting themselves, they may take more risks academically. Encouraging a community-centered perspective in the classroom can be productive for some students’ learning if it leads them to participate.

Middle-grades mathematics teachers may want to foster additional opportunities for students to participate in whole-class discussions. Encouraging prosocial behaviors, such as helping classmates, may lead to increased participation. Students may need to be taught how to help one another productively, such as how to offer conceptual explanations (Fuchs et al., 1997). Additionally, students who view whole-class discussions as risky may benefit from time spent discussing mathematics in small rather than large groups. Creating a safe space for students to participate, including emphasizing cooperation rather than evaluation or competition, could reduce the risk students perceive in discussion-oriented classrooms.

Limitations and Future Research

There are several limitations to this study. The sample only included white students and those from a rural area, so generalizability may be limited. Although more research is needed on students in rural areas, studying these motivational issues among students with a broader range of racial and geographic backgrounds is essential. Additionally, these self-reported data may be incomplete. For example, students may have gaps in their memories or may not be aware of all of their reasons for participating, because some may be implicit to them. Future research should also examine students’ motivations to participate in classroom discussions across grade levels, subject matter, and classroom activities. Additionally, researchers could study the range of ways teachers attempt to reduce the risk students experience during mathematics classroom discussions and whether students express differing degrees of risk when classroom activities are less public.

My results illustrate how students’ motivational beliefs and goals support and constrain their participation. The reported experiences of these 15 seventh graders in mathematics classrooms involve navigating social relationships as much as participating in opportunities to learn mathematics content. Teachers who wish to provide their students with opportunities to learn through whole-class discussion would benefit from learning about and attending to students’ social motivations. The social di-
mension of a mathematics classroom may bring some students into whole-class discussions when they might otherwise avoid participating. Although some adolescents may be hesitant to participate, some may overcome this reluctance through their interest in supporting their peers in their classroom. Some adolescents’ efforts to navigate social relationships in discussion-oriented classrooms can create opportunities for them to learn to communicate and reason about mathematics.

Appendix

Interview Protocol

1. How do you feel math has been going for you since the last time I saw you?
2. Say a new student moved into your school and he or she wanted to know what a person had to do to be successful in your math class. What would you say?
3. Say that your school needed to hire a new seventh-grade math teacher and you were asked for advice on what would make a good seventh-grade math teacher. What would you say?
4. Are you more likely to participate during class or listen? Why?
5. What if you contributed an answer during class discussion and it was incorrect? What would your reaction be?

How would you respond to the following statements, on a scale of 1–5, with 5 being strongly agree and 1 being strongly disagree? Explain your response. [Students are given the statements and choices on a sheet of paper.]

6. I want to do better than other students in my math class.
7. When my teacher asks a question in math class, it is important that I explain how I did the problem, not just give my answer.
8. It is possible to approach the same math problem in more than one way.
9. To work on math problems, I have to be taught the rules and steps, or else I can’t solve them.

Note

I would like to thank Jack Smith, Jim Hiebert, Anne Morris, Dawn Berk, James Beyers, and two anonymous reviewers for their helpful comments on earlier versions of this article. The article is based on a paper presented at the 2004 annual meeting of the North American chapter of the International Group for the Psychology of Mathematics Education in Toronto, Ontario, Canada.

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