NORMS FOR PARTICIPATION IN A MIDDLE SCHOOL MATHEMATICS CLASSROOM AND ITS EFFECT ON STUDENT MOTIVATION

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In this article we examine how students engage in learning mathematical concepts in the middle grades of an urban public school in the Southwestern United States. In the context of a 3-year National Science Foundation-funded longitudinal study of the development of students' rational number understanding, we encountered differing levels of engagement among urban youth. We found that these levels of engagement are a by-product of classroom teachers' practices and their expectations for student work in a high poverty, primarily Latino neighborhood school. This article describes ways in which classroom culture, including instruction and teacher expectations, influence the nature and extent of students' experiences and engagement in the middle school mathematics learning environment.

INTRODUCTION

This article illustrates the ways in which teachers encourage student contributions to classroom mathematical practices and the subsequent impact these practices have on student engagement. We examine four cases in a single school, classrooms often containing the very same students, but exhibiting markedly different practices and patterns of engagement. This study grew out of a 3-year longitudinal study primarily focused on illuminating the ways in which middle school children learn and understand mathematical concepts. The social environment is a key element of this learning and understanding, and it is therefore

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Middle Grades Research Journal, Volume 8(1), 2013, pp. 51–76
ISSN 1937-0814

crucial to appreciate the ways in which classroom teaching practices and social setting impact student engagement.

Motivation

Psychologically, whether or not a student opts to engage in a learning environment is a function of his or her motivation. Most research on student motivation falls into two categories: the study of student expectancies, i.e., beliefs about their abilities or about the nature of the task (Eccles, 1983), and the study of values, i.e., how a student perceives the importance, usefulness or interest of a task (Wigfield & Eccles, 1992). Motivations can be thought of as cognitive structures that an individual constructs in order to anticipate the requirements for participation in some activity (Middleton, 1992, 1993), and as such they play a key role in helping students decide when to engage, when to disengage, and how much effort to expend in academic tasks (Middleton & Toluk, 1999; Schoenfeld, 2007). They are a key variable for self-regulation, including the setting of goals, and the modulation of effort and the selection of tasks and long-term academic pursuits (Pintrich & Schunk, 2002).

At a gross level, motivations can be categorized as intrinsic or extrinsic—involving learning "for its own sake," or learning to gain some incentive, but it is clear from both research and experience that for any situation, a combination of intrinsic and extrinsic factors determine the orientation of the learner to the task (see McClintic-Gilbert, Corpus, Wormington, & Haimovitz, this issue). According to Middleton and Spanias (1999; see also Middleton & Toluk, 1999; Middleton & Jansen, 2011), intrinsic motivation is significantly more desirable for student decision making than extrinsic motivation, as it engenders persistence, efficient cognitive processing, and positive affect, while extrinsic motivation affords little if any direct control of these factors. In the middle school mathematics classroom, intrinsic motivation influences decisions about whether to participate actively, to endure passively or to opt out. It is also important to note that students' decisions about whether or not to engage may or may not have to do with learning mathematics. They may be associated with personal interest in a problem's context, need for recognition and approval from the teacher and peers, or for purposes of social interaction.

The aforementioned researchers have viewed motivational outcomes as the product of the individual. This is the prevailing notion of motivation in the current literature. There is a growing body of research, however, that links cognition, motivation and culture (Brophy, 1999; Rogoff, Gauvain, & Ellis, 1984), especially classroom culture (Jansen, this volume). This leads to a view of motivation as a socially negotiated process that results in an observable manifestation of interest, and cognitive and affective engagement (Sivan, 1986). Classroom norms and practices constrain students' behaviors to conform to behaviors associated with competence, collective polity, and power relations among members (Gresalfi, Martin, Hand, & Greeno, 2009). For the purposes of this article, motivation can be understood from the individual perspective as the students' *desire to engage* in the mathematical context, though this desire may be manifested in a variety of forms. Socially, we define motivation as *norms of practice that facilitate positive interdependence* (Johnson, 2003; Johnson & Johnson, 1989)

While student motivation is a key factor in student achievement, the teacher is also a member of the classroom community, and he/she greatly influences the ways in which student motivation can be manifest through sanctioning certain undesired behaviors, rewarding desired behaviors, and through the selection and orchestration of tasks. These behaviors are a function of the teacher's motivation. This is critical to our understanding of how student motivation develops because teacher motivation been shown to greatly affect student achievement (Dusek, 1985). Middleton's (1995) study of teacher and student motivation shows that teachers who are more in tune with certain students' motivations are better able to tailor classroom tasks to those students. Manouchehri (2004), in her study on the effect of teachers' motivation styles on student learning, demonstrated that teachers who are motivated to support student autonomy provided more opportunities for students to examine mathematical thinking, to pose questions, and to try to make meaning of their own thoughts when compared with teachers motivated to gain control of the classroom environment. By implication, teachers who are motivated to *not* support autonomy would provide different opportunities for students, and likely different students would appear motivated under these different rule sets. At the school level, Gigliotti and Brookover (1975) show us that higher achieving schools have higher teacher expectations and greater pressure for achievement. These expectations influence curricular choices, teacher behaviors, and of course, student outcomes. Clearly the development of student motivation flows at least partially through teacher motivations and motivation-related behaviors. A growing body of research points out that these motivation-related behaviors often differ for children of different gender, ethnic, and socioeconomic groups.

Educational Equity

Hispanic children are currently the most segregated group in U.S. schools (Medina, 1988). Nearly a quarter of the students in the United States live in states with a majority of non-White students, yet most White students rarely come into contact with students of color. In their 50th anniversary review of the consequences of the *Brown v Board of Education* decision, Orfield and Lee (2004) reported that in the United States, the average White student attends a school where 79% of the students are White, while the average Latino student attends school where the population is on average 28% White. They further noted that the proportion of Latino students in predominantly minority schools in the west has actually doubled since *Brown v Board of Education*, and now stands at 80%. Furthermore, the "vast majority of intensely segregated schools face conditions of concentrated poverty," conditions "which are powerfully related to unequal educational opportunity" (p. 3). In fact, in 2001-2002, 43% of American schools were "intensely segregated White schools or schools with less than a tenth Latino or black students." While only 15% of these schools were schools of concentrated poverty, 88% of intensely segregated minority schools were schools of concentrated poverty. They asserted that these conditions of poverty are strongly related to educational opportunity and levels of achievement as children in these schools tend to have unstable teaching faculty, weaker preschool experiences, poor educational experiences, and teachers with less experience.

Issues of equity, however, not only exist between schools, but within schools as well. Oakes (1985) indicated that within minority elementary schools, the presence of rigid ability grouping is more likely to be seen, where minority students are segregated into lower ability classes on average, than their White and Asian counterparts. She also indicated that teachers in lower ability classes place a stronger focus on punctuality and student conformity and teachers spend less time on learning within these classes. "If students of color do not exhibit high achievement in math and science early on for whatever reason, they are often placed in remedial tracks, which limit their opportunities to study advanced science and mathematics" (Moses, Howe, & Niesz, 1999). Baron, Tom, and Cooper (1985) and Persell (1979) found that student's race/ethnicity, social class, and language style are important influences on teacher expectations. If "teachers have lower expectations for certain ethnic minorities, for lower socioeconomic students, and for students who speak Spanish-accented English," as Solórzano and Solórzano (1995, p. 304) indicated, how do these lower expectations affect the classroom environment and teaching methods in segregated schools such as the one highlighted in this study? Good (1987) outlined 2 decades of research on teacher expectations and maintained that the research explicitly demonstrates that teachers with lower expectations are less likely to offer praise, wait less time for a response to an answer, and frequently teach less material than teachers with higher expectations.

From initial conditions of lower expectations for mathematics learning and achievement, we can characterize the system of mathematics teaching for minority students, and Latinos in particular, as being a negative feedback loop. Students begin schooling in classes that expect less of them, and when they achieve less than their peers, they are segregated into lower ability classes, where year after year, the amount of learning relative to students in higher ability classes gets proportionately less. As we have shown, the kinds of environments that foster such diminishing returns are functions of both community segregation along lines of race and socioeconomic status, resulting in schools of high poverty and high minority enrollment, and in classrooms within schools of lower academic achievement and high minority enrollment. One of the major questions we explore in this manuscript is just what goes on in these classrooms and how does it impact student motivation and achievement?

Classroom Environment

Classroom environment plays a major role in student participation and in associated learning. Patrick, Turner, Meyer, and Midgley (2003) maintained that participation is important for several reasons: (1) it provides students with opportunities to practice new strategies and test new knowledge, (2) it allows students to verbalize their own thinking processes, and (3) it enables them to determine the need to revise their thinking. In their observational work, they identified three unique classroom environments: supportive, ambiguous, and nonsupportive environments. In supportive classroom environments, teachers expressed enthusiasm for learning and an expectation that all students would learn. Whereas, in nonsupportive environments teachers conveyed that learning would be difficult and frequently exercised authoritarian control. Classroom environment, however, is directly linked to teacher motivation and teacher expectations. Patrick, Anderman, Ryan, Edelin, and Midgley (2001) outlined two unique classroom goal structures and suggested that these goal structures have a direct effect on student participation and learning. In classrooms identified as having a mastery goal structure, teachers expect that all students participate and express support both academically and socioemotionally to help students achieve. Conversely, in classrooms identified as having a performance goal structure, teachers communicated that active participation was not required for learning, that learning would be difficult and that not all students would succeed.

RESEARCH OBJECTIVE

The primary purpose of this article is to explore the nature and extent of student engagement in middle grade mathematics classrooms socioculturally in an urban setting. We are interested in how instructional methods, classroom norms, and teachers' behavior within the classroom influence students' motivation patterns. We understand motivation as both individually and collectively constructed in a classroom environment and as such, it possesses a combination of both cognitive and social features (Middleton, Lesh, & Heger, 2003). Therefore, the process of student motivation in this distributed cognitive environment is influenced by each individual participating in the social context, the available tools, the prior knowledge, and the cultural norms enacted in this setting. The definition of what constitutes appropriate mathematical behavior, what constitutes mathematical competence, and who is expected to be successful is emergent, and thus should display considerable variation among classrooms even within the same school and grade level. Because both teachers and students interpret the social setting in which the school and classroom is situated, it is important to understand the external influences on teacher expectations and students' motivation, including, in this particular instance, segregation, socioeconomic status, and English Learning (Llamas-Flores, 2013). This gives us the opportunity to examine the unique contributions of the teacher, his or her style, their personal goals for instruction and how they manage student contributions as they emerge.

METHODS

This study is an ethnographic account of the natural ways of interacting of teachers and students in an urban public school serving a high poverty, high minority, high immigrant, community in the U.S. Southwest. As an *ethnographic* study, we follow the definition of ethnography promoted by Watson-Gegeo (1988) as an attempt to provide an interpretive-explanatory account of what people do in naturally occurring settings, the outcomes of their interactions, and the meanings they place upon them. The data for this study are drawn from observations done in sixth-, seventh-, and eighth-grade mathematics classes and in a resource class for seventh and eighth graders over the course of 2 years in a 3-year study. Because we are committed to enhancing the mathematics learning experiences of Latino youth, we follow the advice of Ogbu (1981) to keep a holistic perspective—that is, to keep open to how the norms and practices we observed in the classrooms were linked with the local social structure, the economy and political system, and especially the belief system of the participants and the surrounding community. This enabled us to draw distinctions between classes that would impact our participants—largely Latinos—differently than the majority population we might find in a more suburban setting.

Participant Observation

Classrooms were observed, on average, twice per week for the 2 academic years (the school operated on a year-round calendar). Researchers acted as participant observers, conversing with teachers, children, school administrators and parents, visiting school functions, and interviewing a subset of participants outside of class once every 2 to 3 weeks. Two researchers were fluent in Spanish to insure appropriate translation of student conversations, and to interview first language speakers of Spanish. All classroom observations were videotaped, with the camera focused on the teacher in whole-class discussions, and on identified groups of students during group work. Researchers took field notes recording the kinds of language used in the development of norms focused on learning mathematics content. In particular, teachers' questions and the kinds of behaviors and verbalizations students proffered in reaction to those questions were recorded for analysis.

Observers were free to ask teachers and students questions to clarify why they asked particular questions, and what they were thinking when they behaved in particular ways. For the purposes of this study, we recorded teachers' strategic reasons for choosing tasks and representations, and students' mathematical reasoning and affective responses to the teacher, the task, and each other. In addition to the observations, the teachers of these classes were interviewed about their teaching styles and philosophy. Teachers were also interviewed briefly following each class session to follow up on any questions the observer had about the lesson. A target group of 36 students equally distributed across grade levels was interviewed once every 2 weeks for the duration of the study. These interviews focused primarily on students' learning of ratio and proportion, but affective and motivational data was also recorded to tie students' learning to classroom events.

Analyses

The research team met once weekly over the course of the data collection to discuss the classes and to determine patterns in the behaviors of teachers and students that were explanatory for the students' perceived affect and motivation, and to hypothesize the mechanisms that afforded or constrained students' participation in learning ratio and proportion concepts and skills. Additionally, each week observers would view the video record of their observed classrooms and code episodes for instances of the kinds of goals emphasized, the norms evidenced in the classroom, student and teacher affect, and learning opportunities. Together, the data corpus consisted of the video records, participant field notes, student work samples, interview transcripts for teachers and students, and occasional notes from administrator interviews and parent meetings. The intent during analysis sessions was first to obtain a coherent record of, and account for, the social manifestations of teachers' expectations for student behavior, norms for participation, style of teaching in terms of Manouchehri's (2004) two motivational styles (controlling versus autonomy facilitating), and Anyon's (1980) description of working-class schools and the inequities associated with the education of poor, minority students.

The School Setting

Mayberry School is an urban working class pre-K-8 public school located in the southwestern United States. For the years in which these data were taken, its student population was 93% Hispanic (Table 1). Fifty-five percent of its students were classified as English language learners, and 93% of the students were eligible for free or reduced priced lunch. Mayberry's total student population was 931 in 2004 and 834 in 2005 (Arizona Department of Education, 2004-2006). For sixth-, seventh-, and eighth-grade students, 355 instructional minutes were devoted to mathematics in a typical 5-day school week.

The mathematics curriculum adopted by Mayberry was a combination of Mathematics-In-Context (Romberg, 2003) and Arizona Instrument to Measure Standards (AIMS) test preparation materials. Materials were used on an alternating basis with test preparation materials typically being used for review each day, and Mathematics-in-Context units used as worksheets for group discussion or individual seatwork. Sixth-grade students participating in the study were taught in a self-contained classroom, while teachers who specialized in mathematics taught seventh and eighth grades. The school tracked seventh and eighth graders according to ability level as determined by the previous year's teacher as well as students' scores on the Stanford 9.

TABLE 1
Mayberry School Demographics

Mayberry Statistics	*2004-2005*	*2005-2006*
Enrollment	931	834
Average daily instruction (in hours and minutes)	6:25	6:15
Attendance rate	96%	97%
Free/reduced price lunch	96%	93%
English language learners	54%	55%
Ethnicity		
Hispanic	92%	93%
White	5%	4%
Black	2%	2%
Asian	<1%	<1%
Native American	<1%	<1%
Arizona School Achievement Label	Performing	Underperforming

Mayberry School and its parent district have been engaged in literacy and mathematics reform efforts for over a decade. The school has historically supported bilingual education and reform-based mathematics curriculum, pedagogy, and professional development. Changes in state policy, testing practices and teacher turnover have resulted in varying levels of buy-in and skill in implementing these values, however.

Participant Classrooms

The teachers whose students participated in this study were considered highly qualified by their school district. All had completed graduate coursework in Cognitively Guided Instruction (Carpenter, Fennema, Franke, Levi, & Empson, 2000). The depictions of the studied classes we represent constitute what we considered typical class periods whose characteristics could regularly be observed on any given day. In the resource classroom, the episode described below was part of a seven episode teaching experiment conducted by members of the longitudinal research team to introduce students to the use of whiteboards for collaborative group work. As such, it represents a radically different set of expectations, behaviors, and classroom practices than viewed in the more traditional observed classes, and provides a contrasting case by which norms can be seen as originating and flowing from teachers' motivations. Following the documentary sections, we critically examine these observations to better understand the norms of participation in these classrooms and how they affect student motivation, particularly in relation to learning mathematical concepts. Throughout, we raise questions regarding how the norms we saw contribute in some way to equitable opportunities to learn for the students. By extension, our questions reflect on the day-to-day experiences of Latinos in such urban schools to help uncover potential ways in which we can increase opportunity, performance, and enjoyment of school mathematics.

Grade 6. Ms. Timms is a short, dark haired, animated Caucasian woman in her early 30s who has been teaching at Mayberry School for just 1 year. Although she does not speak Spanish, she understands a little. In any case, Mrs. Timms does not consider this a handicap, as hers is an "English immersion" classroom—all subjects must be taught in English. When she is assigned new students designated as English language learners (ELL), she seats them next to "language buddies," students who will be able to translate for them when it becomes necessary.

On a typical day in Ms. Timms' mathematics class, an observer will see a class of about 30 uniformed 11- or 12-year-old boys and girls seated at rectangular tables of five or six students each. Each student has a large black math binder in front of him or her that contains the text, practice workbooks and student worksheets. There is a plastic bin of supplies at the center of the table that holds markers, scissors, glue, rulers and colored paper. Near the front of the room is a small table with an overhead projector upon which the teacher displays the day's worksheet.

Grade 7. Ms. Newhardt has long straight brown hair that reaches almost to her waist. She is a rather stern, serious Caucasian woman in her mid 30s, who has been teaching middle school mathematics at Mayberry School for 2 years. Prior to this teaching assignment, she taught second, third, and fourth grades. She is a fluent Spanish speaker but is rarely heard to speak it in class in spite of the fact that she has a number of students who are largely monolingual Spanish speakers. Like Ms. Timms, she relies on the students with a better grasp of English to help those who are not yet fluent. She is nearly finished with her master's degree in mathematics education.

Ms. Newhardt's Grade 7 mathematics classes are grouped by ability. First and second periods are designated as classes for students of lower ability and third period is for the advanced students. There are 27 students in Ms. Newhardt's first period class. Most students in the advanced third period class go to a resource class twice a week for supplemental instruction. Most of the monolingual Spanish-speaking students are in the first and second period seventh-grade classrooms. Although these students seldom understand the instructions given by the teacher, she typically does not translate for them into Spanish. These students either depend on classmates for explanations or opt out.

Grade 8. Mr. Langley is a cheerful, tolerant brown haired man in his early 30s, who speaks with a lilting Irish accent. He has been in the United States for over 10 years and completed his bachelor's degree at the local state university. His wife grew up in Mexico and he is a fluent Spanish speaker. He frequently engages the English language learners in his classroom in Spanish. He has taught eighth-grade mathematics at Mayberry School for 4 years, and taught elsewhere in the district prior to coming to this school. He is working on his master's degree in mathematics education.

Mr. Langley's mathematics classes are also grouped by ability, with the third period eighth-grade math class described as brighter than the kids in his first and second period classes. There are 27 students in Mr. Langley's third period classroom seated in groups of three to six at round and rectangular tables. A number of students in the third period class are studying for the high school algebra placement exam that is given in the Spring.

Grades 7 and 8 Resource Class. This class consists of a mix of Ms. Newhardt's seventh graders and Mr. Langley's eighth graders, mostly boys, who come to this resource classroom for mathematics twice weekly during third period. The resource teacher, Ms. Barnard, indicated that the group is made up of high performing seventh graders and low performing eighth graders. In this class, students typically work together in small groups to find solutions for word problems, which they write on overhead projector film and present to the class. The episode described in the following vignette is one in which students have a guest teacher who worked with them for about a month during the spring semester, introducing them to the use of whiteboards for small group work. The guest teacher is Ms. Cunnane, an experienced high school physics teacher and member of the longitudinal study's research team. The format of the class was similar to Ms. Barnard's except for students' use of whiteboards.

RESULTS

A Typical Day in the Middle School Mathematics Classroom

Sixth Grade: Miss Timms. Ms. Timms' begins her lesson by reading from the overhead projector, which displays a worksheet the class will be working on. She expands on the task it describes, and then works the first problem as an example of what the students will be asked to do, describing the procedures she uses as she solves the problem, and writing the answer on the transparency in the space provided. She asks if there are questions. There are none. After a pause of about 2 seconds she directs students to work together to complete their worksheets and allows them 15 minutes to complete the task.

Most students look briefly at the worksheet in front of them and then begin talking quietly at their tables. A few students leaf through their textbook, while others quickly fill in answer blanks on their paper. Some of the boys talk to each other quietly about sports or games and occasionally poke at each other, snicker, or grab for one another's pencil or eraser. Several of the girls can be overheard whispering to one another about friends and television shows and writing notes on each other's papers. One or two of the students at each of the tables do not opt into these conversations. They are silent and appear lost in their own thoughts. It is impossible to say whether their thoughts are of a mathematical nature but in any event, they rarely result in written work or any other exterior sign of mathematical reasoning. Sometimes a boy will get up and go talk with someone at another table or go use the pencil sharpener. When this happens, the teacher reminds him of the class rules and the consequences for not following them. Occasionally, when the volume of the conversation or laughter at a table rises, the teacher directs one of the students at the table to move to another table or to sit by themselves in the front of the room. The bulk of writing takes place in the first minute or two after the worksheet is passed out, before or during the teacher's explanation of the task. Once students have filled in the answers they already know, their attention wavers.

During the time in which the students are assigned to complete this task, Ms. Timms moves from table to table, sometimes in response to a raised hand but more often to ask one of the students, usually a boy, how far along he is with the assignment, and to chide him gently if he is behind the other students. This will often evoke a query from the student being addressed, to which she responds by reviewing the procedures outlined at the beginning of the task session. If the teacher lingers at a table, the students at this table will act engaged while she is there—at least to the extent of staring intently at their worksheets with pencil in hand—often they will flip through the pages of their book.

Typically, 70 to 80% of students wait patiently with nearly blank worksheets for the time she has given them to expire. Once this time has passed, the teacher then provides the answers on the overhead projector and the students copy them onto their worksheets. When the review process begins, the teacher asks for students to volunteer answers. Three or four students eagerly raise hands and call out correct answers and she compliments them. Most sit patiently in silence, not looking at the teacher but staring at their nearly blank papers, waiting to hear what the answer will be so that they can fill it in. If no one suggests an answer for a question, Ms. Timms calls on someone at random. The student, often a boy, might guess at a possible answer but more often, he shrugs and remains silent, and eventually she supplies the information along with a refresher on the procedure necessary to compute it.

By and large, the goals of the students in this class appear to have little to do with learning mathematics. Ostensibly, they appear motivated to engage in social interaction (Jansen, 2006; this volume). To occasion this goal they have learned to behave according to the social and sociomathematical norms that prevail in their classroom: (1) the time eventually passes and if you wait quietly, little will be asked of you, (2) knowledge resides in the book—not usually in the teacher nor in peers (although answers may sometimes reside in their peers), (3) if the teacher asks you a question, you may respond by asking her for help, (4) during small group work one should not attract the teacher's attention, (5) there is no penalty for not finishing, (6) there is no penalty for guessing, (7) if the blanks are filled in the task is satisfactorily completed, (8) if everyone remains silent the teacher will eventually supply the right answer.

Their extrinsic motivators in the classroom consist of both incentives and disincentives. The incentives are points, attention, occasional praise and encouragement when students interact with the teacher. The disincentives are rebukes for misbehavior and perhaps removal from the social group when a student's behavior attracts the teacher's attention. All serve to reinforce the cultural norms that have been established in this mathematics class: they serve to free up time to engage in nonmathematical social chatter, providing the students with their goal fulfillment.

As for the teacher, Ms. Timms' motivation style as indicated by her actions are aligned to those teachers with a controlling style of motivation as postulated by Manouchehri (2004). These teachers spend more instructional time attending to the completion of a task and focus less on the quality or manner in which the task is completed. Teachers with a controlling style of motivation also frequently solve problems for the students and request that they use the same method to complete other tasks. Their classrooms tend to have a large number of inactive students, as seen in Ms. Timms' class. Her classroom, as well as other classrooms observed in this school, is exemplary of the working class schools studied by Anyon (1980). In these schools, "work is following the steps of a procedure" (p. 73). Brookover, Beady, Flood, Schweitzer, and Wisenbacker (1979) indicated that higher teacher expectations have a greater impact on minority and low-income students' achievement. Given that students in this sixth-grade class are not required nor expected to engage, we can attribute their general low academic achievement, in part, to these established norms.

Seventh Grade: Ms. Newhardt. At the beginning of each 70-minute class period, students receive a small, one-third page worksheet copied from state test preparation materials. It contains answer spaces for three oral questions that the teacher reads aloud at the beginning of the lesson (i.e., "A football field is one hundred yards long, how many inches is this?" or "Write 9/8 as a mixed number."). There are also half a dozen different review problems—most simple number sentences—and one story problem. The students complete this worksheet while the teacher prepares to begin teaching the class. Mrs. Newhardt reads each of the three questions aloud, slowly and distinctly two or three times from where she is sitting at her worktable. Then the students are left to work quietly while she taps at her computer or tidies her workspace. They remain quiet at their tables for almost 15 minutes, although most students no longer work on their worksheet after the first 2 or 3 minutes. Students can be seen fiddling with their notebooks, drawing on themselves and staring off into space at various times throughout the class.

After about 12 minutes of relative silence, a girl asks Ms. Newhardt a question about the first problem. The noise level in the room rises at this point. When the teacher finishes with the girl, she sends her to the board to put up the answer to the question she was helping her with, and then asks who else would like to go to the board. Half a dozen boys' hands shoot up into the air, and a chorus of "me, me, me!" can be heard. The boys with their hands up are each called to the board to write the answers to different problems, and they join a crowd of students talking and laughing at the front of the room. They pick up markers and a few begin attempting to solve their problem. One boy asks another sitting at a table near the board "what did you get for number 3" and another boy calls the teacher over and says, "I don't get this one." The teacher comes to the board and joins the milling crowd of about 8 students. Other students at the board help each other with solutions. Most of the students who remain seated appear disengaged from what is going on at the front of the classroom. Some chat quietly while others do homework for other classes or simply wait in silence.

Slowly problems are worked out on the board and answers begin to appear in the blanks the teacher provided. Conversations at tables around the room are louder during this time interval although few focus on mathematics content. The students chat with each other in a mix of English and Spanish. After 10 minutes at the board, the students return to their seats and the teacher, who has now helped roughly half the students who were at the board, begins to survey the work they have left behind. She calls the class to attention and begins going over each problem in turn, in some cases just repeating the answer shown and in others, briefly outlining how the problem was solved. Students fill in the answers on the worksheets before them.

When she comes to two simple ratio problems, she works them out step by step, thinking aloud as she writes on the board, describing each choice she makes and saying why it is the best thing to do. Often it is considered best "because it is quicker" than other ways. After each problem she asks if there are questions, but the students invariably remain silent—some looking at the board, some at their papers, others at each other. She continues, recounting what each student must have been thinking as they arrived at the answers they wrote on the board. With 9 minutes left in the

TABLE 2
Mrs. Newhardt's Ratio Table

100%	10%	1%	5%	50%	25%
425	42.5	4.25	21.25	212.5	

class period1 she *begins* the lesson for the day—a description of how ratio tables can be used to find some percent of a three-digit number, that is, 36% of 425. She asks students to suggest entries for the table and four boys repeatedly call out guesses (Table 2).

Whenever she hears a number she wants, she fills it into the ratio table (10% is 42.5; 1% is 4.25; 5% is 21.25). She sums the values for three 10%'s, a 5% and a 1%, writes the answer, and then asks if there is another way she could have gotten the answer. Much guessing ensues (50%, 40%, 30%, 36%, and 72%) but Ms. Newhardt makes no further entry into the table. It appears that she has not heard the one she has in mind. Finally after further questioning fails to produce the answer she is looking for, she suggests 25% stating that it is an easy one to get because all they have to do is take half and then half again. One boy calls out 212.5 but then he appears stuck on finding half of that in his head. She fills in the answer for him. Then she sums 25%, 10% and 1% and shows them that the two methods she has used on this problem produce the same answer. One student suggests that simply multiplying .36 by 425 takes less time. She agrees that in this case that might be true, but suggests that with larger numbers the ratio table method *could save time*. She does another problem of this type on the board and as she is writing, students begin packing up their books. Class is about to end.

As with the sixth-grade mathematics students, *waiting* is seen as a predominant social norm for most of the students in the seventh-grade classroom. Socializing with peers and passing the time are again observed to be the primary intrinsic motivators. This happens quietly, protracting the time spent without direct instruction and to keep from drawing the teacher's attention. When it is time to go to the board, a handful of students, mostly boys, exhibit a desire to take center stage. As the students who are called to the board look to their classmates (or their teacher) for the answers, it becomes obvious that they are not motivated to participate because they know how to solve the problems, but rather because going to the board means an opportunity to socialize with peers and perhaps have some one-on-one time with the teacher while she helps them with the solution. Many of the students who volunteer to write answers on the board seem excited by the opportunity; none appearing reluctant to do so. For those who remain passively at their desks, the object of the exercise appears to be to *place answers in the blanks* on their papers, and to avoid becoming the object of teacher attention, particularly for the English language learners.

The incentives in this class appear to be blocks of time that are expectation-free, personal attention from the teacher (which only seems to appeal to a handful of students, mostly boys, when they are at the board), and an occasional bonus point recorded next to their name on the board when they offer a good answer to a question the teacher has asked, or when they are willing to guess while the rest of the class remains silent. Another opportunity for points that a few students take advantage of is attendance at homework club. If students are willing to give up their after school time, Mrs. Newhardt allows them to make up work and earn points toward a better grade in math. The disincentives are few and are not seen often. Occasionally the teacher calls out one of the boys for being noisy, and if enough people are noisy and off task at the end of the worksheet, she collects the papers so that she can record their low scores. This is infrequent, however.

Just as in sixth grade, the social and sociomathematical norms are: (1) social interaction is acceptable as long as it is quiet, (2) the object of the exercise is to put right answers on your paper, (3) waiting eventually results in answers being supplied, (4) guessing works since only correct guesses are recorded on the board, (5) students who remain silent with averted eyes are not held accountable for knowing or contributing anything during class. Students in the seventh-grade class can gain access by being aggressive. The same four male students can be seen in each class period, week after week, shouting out answers, and being rewarded for doing so by the teacher.

Much like the sixth grade, the instructional methods are indicative of the working class schools illustrated in Anyon's (1980) work. More than 75% of the time spent in the seventh- grade mathematics class periods is typically spent on the "15-minute warm up" worksheet. The goal for both the teacher and students is finding answers rather than sense-making. The behavior of this teacher reflects low expectations for her students, and there is a lack of attempt to perceive what is happening behaviorally in the classroom and how it relates to student achievement. Unlike autonomy-motivated teachers who insist that students explain their thinking (Manouchehri, 2004), Mrs. Newhardt instead guesses at the thought processes of students as she explains the answers they have written on the board.

Manouchehri (2004) also indicated that the control-motivated teachers that participated in her study viewed the students' backgrounds and social and cultural habits as hindrances to their learning. Similarly, the teachers in the working class schools observed by Anyon (1980) believed that for the students who struggled with particular mathematical concepts, the issue was not in the mode of instruction, but in the student's ability to understand the material (see also Battey, 2013). Generally speaking, teachers who have beliefs that student mathematical abilities are fixed tend to believe that they cannot really influence their students' intellectual abilities. Low achieving students who enter such a fixed mind-set teacher's classroom at the beginning of the school year leave a low achiever at the end of the school year (Dweck, 2007, 2010). Over the course of this study, Mrs. Newhardt remarked on the inability of several ELL students to "get it" and suggested to researchers that she might refer them for special education services, though the researchers' experiences in interviews with these same children indicated that they had no cognitive difficulties with mathematics *when approached in their native language* (e.g., Middleton, Llamas-Flores, & Guerra-Lombardi, 2012).

Eighth Grade: Mr. Langley. As class begins there is much book and binder shuffling. The teacher opens with a few disciplinary remarks—yesterday there was too much talking, not enough listening to each other. If students are loud and inattentive today, they will be asked to stand up and remain standing for the rest of the class. "Open your books to page 37—you have 2 minutes to figure out which of you babies in this classroom has the largest head." There is immediate laughter and talking as they leaf through their *Mathematics in Context* books and talk about babies with large heads. The activity itself deals with body proportions but also serves as a lesson on reading and understanding graphs and using statistical measurements. The graph provides measurements of body length and head circumference of a population of infants.

Some students talk to each other, some call out to the teacher, and some sit silently at their tables waiting. After 2 minutes Mr. Langley resumes the discussion, asking them questions about a table of values that compares head size and body length. He asks questions about trends in the data and a few students call out answers. There is an undercurrent of joking and humor in the teacher's remarks. He directs them to a graph on the next page and tells them to answer Questions 3, 4, and 5. One student protests that they do not have their notebooks and the teacher says, "Yes you do." Then he adds, "If not just write it on the back of your graph." Students look at their books, laugh, and talk to one another. The table nearest the camera has three boys at it who are silent. One just looks at his book while the others dig for writing materials and flips pages in their books. The teacher moves from table to table—sometimes talking, sometimes just surveying the activity taking place. When he comes to the table with the three boys, he asks, "What did you guys figure out?" One of the boys answers that they were just getting started while the others keep their eyes on their books. The teacher moves on to another table. Carlos, the boy that spoke, looks back and forth from the previous page to the page with the graph, while the two boys sitting with him appear to wait. Carlos and Adam, the boy who sits across from him, begin writing in their notebooks in silence while Jorge watches them. Adam looks back and forth from his book to his paper, evidently copying the question from the book into his notes. Jorge continues to watch what his tablemates do. Carlos puts his pencil down and raises his hand, but the teacher, who has just moved to the front of the room, does not see him. After about 25 seconds, he puts his hand down. Mr. Langley signals for the students' attention by running his pen across a wind chime that is hanging from the ceiling at the front of the room and asks Manuel for the answer to question number 3. Manuel responds promptly. During this brief exchange, students look at their books and papers and not at Manuel or Mr. Langley. Then Mr. Langley moves on with a brief explanation of possible data interpretation strategies and the students continue perusing their books and papers.

After another minute, he asks another boy if he has an answer for question number 4 dealing with the ratio of head circumference to body length. He answers, "No." The teacher responds, "Why do you say that?" Adam stares at his book and the teacher waits. Students at other tables continue with their work. After a lengthy pause, Adam ventures that there is information missing from the graph. The teacher says that all the information he needs is there and asks Sandra for the answer. She says "…no baby has the same length of body as circumference of the head." The teacher repeats her answer and asks if the rest of the students agree. Remarks come from around the room and Mr. Langley calls on David, asking him what he thinks. He says that it is not the same because the range for the heads is 30 to 40 and for the body it is 46 to 58. Mr. Langley concludes, "So the biggest head is smaller than the smallest body." David agrees.

Mr. Langley then directs students to look at the next page, which contains a three-dimensional plot of the data in the table along with parts A and B of question number 5. He comes over to Carlos, Adam and Jorge's table, sits down in the empty chair, and begins discussing the problem with Jorge who has yet to write anything on the paper in front of him. He asks Jorge what information he can identify in the graph and keeps pressing him with the question, "what else?" and "what do you think about that …?" When Jorge runs out of answers Mr. Langley draws Adam into the conversation. He refers them back to the first page of the exercise to find out what one of the bars on the chart represents. He talks with them for another couple of minutes drawing their attention to how the three representations of data compare with one another, and then moves on to another table. After 4 minutes of small group deliberations, Mr. Langley convenes the whole group once again with a tap of his pen on the wind chime hanging overhead. He questions them about what various features of the graph mean and asks them what they can tell from the 3-D graph on the page they have just been looking at and what they like about this sort of display. Then he directs two students to read aloud the dialogue on the next page of the book and then asks the entire group to answer the next two questions in their notebooks.

Mr. Langley moves again from table to table. The students can be seen gazing around the room, writing or looking at the book in front of them. Most tables have two or more students quietly conversing. After about 3 minutes he calls the class to attention and asks one of the girls, Barbara, what she thinks is the answer to question 6. When she offers what sounds like a guess, Langley follows up with "because?" She attempts to supply a justification for her answer choice. He asks the class if anyone else agrees with her and a girl at another table speaks, modifying and extending the justification that Barbara initially advances. He gently makes fun of her answer, to the delight of one and all, and as the laughter fades, another student offers an alternate interpretation.

Finally, he spends a moment summarizing their interpretations and then proclaims the lesson ended. Students put their books aside and a few move to other tables. Alex, Carlos, and Jorge talk together quietly, books and papers no longer claiming their attention but still out on the table in front of them. The volume of conversational noise in the classroom increases significantly. Mr. Langley lets people talk for a moment and then takes over, once again talking to them about the graphing poster presentation that students have due in a few days. At last, students are given free time to do a little homework before lunch.

The norms we saw in this classroom were somewhat different from those we observed in the sixth- and seventh-grade classrooms. While cases of waiting can be seen throughout the lesson and throughout the room, it is not allowed to take hold for long. The teacher is constantly moving from table to table during small group work and students who do not appear to be making headway with the problems are eventually engaged directly. Sometimes they slip back into daydreaming or conversations with their friends after the teacher leaves, but often they remain engaged with the problem for a minute or two after the teacher moves on. Students still resort to guessing when they do not know the answer, although in this classroom they are frequently called upon to justify their answers. Classmates often help the guesser by contributing reasons that a student's guessed answer is correct or incorrect. Incorrect guesses are valued if they can be reasoned about and corrected.

Although students sat together in groups, there was little collaboration going on. Each student worked on the paper in front of him or her, and did not look to their neighbors to help them make sense of what they were reading. Although many made a reasonable effort to engage with the material assigned to them, there was a sense that class discussion would eventually uncover the answers students were supposed to be searching for, and little sense of urgency or curiosity was detected among students. Knowledge appeared to reside in the book or in the teacher, and possibly in the students who contributed to the whole group discussion but not unless their answers were affirmed and interpreted by the teacher.

The only public contributions by students to this class were oral. There were no student-produced symbolic or graphical representations shared in class discussions. The teacher did not produce any visual representations either, but merely discussed the ones that were in the book. The answers that students were writing in their notebooks appeared to be merely a copy of those in the text. We interpret this to mean that the value was not in the graphs themselves but in the correct answers to questions about the graphs.

The students in this class are clearly aware of the expectations that Mr. Langley has of them. Anyone might be called upon at any time; the time given students to work in small groups is limited; students may be asked to justify any answer they gave; if they can not justify their answer a classmate may help them; and there is no penalty for not understanding—if they are unable to get a handle on the problem, the teacher will stop by and give them some assistance. While the classroom culture outlined above is different from those of the sixth- and seventh-grade classrooms, Mr. Langley still did not succeed in persuading students to fully engage with the material. His joking and good humor contributed to the general positive affect observed in the students, but the affect was rarely focused on mathematical ideas, strategies, or triumphs. Mr. Langley exhibited behaviors showed characteristics indicative of both control-motivated teachers and autonomy-supportive teachers (Manouchehri's, 2004). While he was frequently focused on obtaining the right answers from students, with the majority of instructional time used to complete worksheets and each student working on the same activities, he also allowed students to work on problems using their own methods rather than dictating how students should solve problems. Mr. Langley's classroom is thus similar to the middle-class schools observed by Anyon (1980), where students are rewarded for having right answers though rarely encouraged to be critical in their analysis. Students in these schools are frequently asked to explain how they finished a problem and what answer they came up with, though school work is not stimulating for the students and is completed for the purpose of obtaining a reward.

Seventh- and Eighth-Grade Resource Class: Ms. Cunnane. As class opens, the students' are seated at round or rectangular tables of three to five students each with a 24" × 32" whiteboard, markers and an eraser cloth on each table. Students' attention is directed to a question on the board: "In your notebook write about the following: "You are taking a trip to Morenci and you need to get some data from the trip to use in your math class. What kind of data could you collect and what would your data collection plan be?" At the beginning, many students have trouble focusing on the task. After the teacher reminds students that there is limited time to finish the assignment, students begin to write quietly in their notebooks. There is some looking around the table at others' notebooks, and some erasing, but many students appear to be making an effort to get something on paper. There are still those who spend more time writing down the question that concentrating on providing answers.

After 3 and half minutes, Ms. Cunnane says, "Okay. Let's talk." First, she indicates that she has seen students doing good thinking on paper about the question and that even those who had just written the question were smart to do so because they could continue to think about it, even after class was over. She also reminds them that they are being graded on their efforts and that class time is at a premium so they cannot wait indefinitely for students to get something down on paper. A discussion ensues when she asks for their suggestions about data sets to collect on the trip. Students begin to offer suggestions including collecting and measuring rocks, collecting the time it takes to get there and the distance traveled, finding the probability of seeing red cars, and determining how many miles it takes to get there and how much gas it would take. After each of the suggestions, the teacher offers some affirmation and repeats aloud an abbreviated version of what the student has said. In general, students look at whichever of their classmates is speaking during this exchange.

Ms. Cunnane calls on another student who had raised his hand but then put it back down. This particular student has exhibited trouble with the collaborative learning environment and is often seen conversing with his neighbor, looking at unrelated picture books, and fiddling with items at his desk. He offered that he would measure how boring the trip was, and she asked him how he would measure that. After some hesitation on the student's part, she asked if he might put it on a 1-to-10 scale of "boringness." Another student at his table says "11," and he says yes, and then changes his mind and says "no—a hundred." Laughter spreads across the classroom. She asks if he would get a boringness reading from every person in the car to which he responds "yes", and then she asks if he would get a reading from them every 5 or 10 minutes and he responds, "every 10 hours." More laughter. The teacher asked the class "how long does it take to get to Morenci? There is a chorus of different responses from 1 to 3 hours, to which she replies, "yes, unless you walk—then it might take a couple days at least."

Several other suggestions are offered and discussion eventually progresses to the kind of measuring tools they would need to measure the variety of items they have come up with: maps, rulers, measuring tapes, thermometers are mentioned by different students. The teacher asks if the car has any measuring tools built into it. Various individuals suggest that a car can measure miles, gas consumption, speed, time, and radio stations. Next, they discuss what they could do with their data when they get back to math class. Suggestions are to table it, graph it, or chart it. At this point 10 minutes of class time have passed.

The teacher then points out two categories that are written on the board: graphing and questioning. She indicates that she wants the days' learning objectives to be about these things, and that the word 'questioning' refers to student questioning—Ms. Barnard chimes in with "effective student questioning". Ms. Cunnane tells them that after they see what they will be doing this day they will revisit these words and the students can propose actual objectives within these categories.

Next comes a demonstration in which a battery powered car travels across the floor at the front of the classroom. Students discuss what they notice about it and eventually identify what they can measure with the rulers and stopwatches available to them—what they can "mathematize." There is brief instruction about whose responsibility it is to record the data they will gather (students chorus that it is everybody's responsibility), the necessity of making sense of whatever data they gather, another attempt at fleshing out the objectives that are on the board, and then students are divided into two groups and head outdoors with cars to take data about time and position. One group has marks for position intervals on the ground, they record how long it takes the car to reach each of the marks, and the other group makes position marks on the pavement every 2 seconds and then transfers the marks to strips of paper that they can take back into the classroom and measure with a tape measure.

After about 10 minutes, they return inside the classroom to measure the spaces between marks and begin preparing whiteboard presentations of their data in groups of three or four students each.

It is clear that many students are unsure about how to read a tape measure but they try to help each other. Eventually Ms. Cunnane demonstrates how to hold and read a tape measure for two of the groups. The groups who used premeasured distances with the times that they have recorded have an easier time getting started on their whiteboard presentations. Data tables and scatter plots are sketched and resketched. The room buzzes with conversations in both English and Spanish, as students work to achieve representations they can all agree upon. Once the general shape of the graph is apparent to them, they being to discuss what colors to use, they redraw axes with rulers, and they title the graph, label axes and indicate units. The teacher periodically tells them how much time they have left, and students can be seen watching the clock as they try to get finished on time. As the class draws to a close and boards are collected for presentation during the next class period, students hurry to add the last few touches. After the bell rings one group asks if they can come in and finish during lunch.

The expectations of both teachers and students are different in this classroom than each of the previously discussed cases. Though there were a few students who still failed to participate in both large and small group activity, *waiting* was not the primary norm for mathematical practice. Many students participated in the whole group discussion at the beginning of class and almost everyone participated in the conversations surrounding data taking and whiteboard preparation. During small group work, they conversed freely in both English and Spanish without evincing much concern over the amount of noise in the classroom. Students appeared aware that they needed to manage their time as they engaged in different tasks, and were periodically reminded of time limitations by the teacher. Although the enrollment in this class is predominantly male, the girls that were present participated more deeply than they did in Newhardt or Langley's classes. In several of the small groups, they took charge of the content that appeared on the whiteboard and set the standards for its appearance. They accepted responsibility for seeing that tasks were completed in a timely fashion and they exhibited some signs of pride in their work as they negotiated their whiteboard presentations—evidenced through redrawing poorly constructed representations, and smiles when their work met their own approval.

In this classroom, as in the others, socialization was certainly a goal of students, but here social interaction was facilitated by the design of the task. Groups had substantive work that needed to be done, and each participant in the groups had a job to do to insure that the work got done. Students' participation seemed motivated by a desire to hear their ideas and suggestions repeated and affirmed by the teacher and also by a desire to make a unique contribution to the list of things that the class was considering. The incentives in this class were affirmation by the teacher, i.e., having their contributions to the discussion repeated and praised or written on the board, working with tools, that is, cars, stopwatches, tape measures, whiteboards and markers, and feedback regarding that they knew what they were doing, that is, that they knew what features they should include in a graph or table in order to be able to justify their claims about the car's change in position with respect to time. Students were also rewarded with "Whiteboard of the Week" in which the students who created the best whiteboard would receive a small prize. The disincentives in this class were difficult to identify. There was some frustration with their inability to read a tape measure but they asked for help and once they obtained it, they moved ahead with their task.

There was little guessing without some reasoning in this classroom in comparison with the other classrooms observed, and there was no apparent concern about "knowing the answer," but this may be due in part to the nature of the task in which they were engaged. Reasoning, sense making, collaboration, and a colorful, complete, neat whiteboard were valued by both students and teachers.

Motivational characteristics in this class differ from the other three classes observed. Though the experimental class only spanned 5 weeks, each class was structured in a different way, keeping the class novel. Students were held accountable for the work they did and were rewarded for creativity and participation. While many of the students adapted quickly to this new teaching style, others were less inclined to participate. This type of transition, from a passive student role to an active role is not easy, and for some seemed uncomfortable. On the whole, this type of classroom environment stood in contrast to the working class environments observed in the 6th and 7th grade classes, more closely resembling the affluent professional school observed by Anyon (1980, p.148) in which work is a creative activity. Similar to the autonomy-supportive classrooms where students participate more in large and small group discussions, ask and answer more questions, and stay on task longer (Manouchehri, 2004), the students' behavior in Ms. Cunnane's class was markedly different from the observed behavior in the other three grades.

Analysis

The data presented in Table 3 provide us with several indicators of the ways teachers and classroom environments affect student motivation to engage in learning mathematics. The table outlines the number of students in each class and the number of those students who actively participated. While we understand that there are various ways in which students can participate, participation in this instance is defined as a demonstration of outward visible and audible contribution whether by responding to questions posed by the teacher or by asking questions of the teacher. Less than half of the students in Mr. Langley's class can be seen actively participating, while in Ms. Timms' classroom, that figure is less than one third and in Mrs. Newhardt's class, less than one sixth. These numbers illustrate the misalignment of students' motivation with the goals of the teacher as witnessed across mathematics classrooms at Mayberry School. It also shows that, even in Ms. Cunnane's class, which was expressly designed to encourage engagement, 15% of the students did not participate actively.

The table also shows the types of questions each teacher asked in their classrooms and the average length of time they waited for student responses. It appears, for example, that Mrs. Newhardt's desire to get through the material and acknowledgement of only "right" answers did little to encourage student participation. The fact that there are only four students who actively participated in class day after day raises real concern for the other 23 students in the classroom. Reflecting research on mathematics teaching for ELL students, language learners in Mrs. Newhardt's class displayed an inability to grasp what was being asked of them because the class did not provide a space in which they were comfortable participating (see Ganesh & Middleton, 2006), allowing for opting out to be acceptable to this classroom environment as long as students did not interfere with classroom "instruction."

While Mr. Langley frequently engaged with students in Spanish or translated directions for students, (so we can assume that all students understood more or less what was required of them), there was still limited participation in his classroom: only 11 out of 26 students were seen actively participating. It is, however, worth mentioning that ELL students observed during the previous year in Mrs. Newhardt's classroom and who chose to remain silent for the most part in her class, were now observed to be participating by vocalizing answers or asking questions a year later in Mr. Langley's classroom. These students were not marginalized for their limited English skills in Mr. Langley's classroom and learning was not sacrificed for the sake of maintaining a strict English-only environment. The implication of this is that students, when enrolled in a mathematics class with different requirements and norms for engagement, will tend to conform to those norms. Further, it provides evidence that attention to participation, and use of strategies for encouraging participation can change the level of engagement of students who previously were observed to opt out in their mathematics class.

The classroom with the highest number of participants was the resource class taught by Ms. Cunnane. As we analyze classroom participation, we must ask ourselves why the same students in Mrs. Newhardt's and Mr. Langley's classroom behaved in a distinct and different manner when observed in the resource classroom taught by Ms. Cunnane? Table 3 demonstrates a striking difference in teacher

TABLE 3
Numbers of Students who Were Participants, Number of Teacher Questions by Type of Question With Their Average Wait Times in Parentheses, and Number of Responses to Students

	Ms. Timms	*Ms. Newhardt*	*Mr. Langley*	*Ms. Cunnane*
Number of students in class	25	27	26	21
Number of participants	7	4	11	17
Request answer (wait time)	73 (<1 s)	82 (2s)	28 (2-3s)	21 (1-2 s)
Request reasoning (wait time)	4 (<1 s)	1 (2s)	14 (3-4s)	5 (5+ s)
Request procedure (wait time)	33 (<1 s)	0	3 (3-4s)	34 (2 s)
Responses to students-explains student thinking (mind-reading)	4	11	9	0
Responses to students-revoicing answers	12	19	5	55
Respond by ignoring	4	54	7	1

behavior, including the types of questions each asks of his or her students and the ways in which they respond to students. Most of the questions asked by both Ms. Timms and Mrs. Newhardt were focused on obtaining numeric solutions, or rudimentary procedures, while Ms. Cunnane and Mr. Langley asked questions that required students to explain how they arrived at answers or how they might attack a problem (request procedure), or questions that require students explain why they chose to use a particular procedure (request reasoning). These are active strategies that encourage participation, and more directly, encourage students to contribute their reasoning to the collective discourse. What is unique to Ms. Cunnane's classroom, however, is her frequent insistence that all students participate, saying things like, "what about this table, I haven't heard from anyone sitting at this table yet," placing social pressure on students who had not yet offered their perspective.

Both Manouchehri's (2004) control motivated and autonomy supportive teaching styles can be seen in the following vignettes.

> **Teacher:** Okay, could I have your attention up here please? Could we cut down on the side conversations please? Thank you. So how would I write six twelfths as a fraction?
>
> **Student 1:** two sixths … I don't know …
>
> **Teacher:** How would I write 6 divided by 12? Six … divided by 12, right? (writes 6/12 on the overhead) And that could be reduced to what?
>
> **Student 2:** One half.
>
> **Teacher:** I need everyone's attention up here so that you know what we're doing.
>
> **Student 2:** One half … one half …
>
> **Teacher:** And then how do I write that as a decimal?
>
> **Many voices:** 6 point … one point 5 … 50 cents
>
> **Teacher:** One half … think about money …
>
> **Student 2:** Point 50 one hundredths!
>
> **Teacher:** Okay. So your filling in this chart, so the decimal is … (writes .50 in the appropriate space on the chart) and the fraction is (writes ½ in the adjacent space on the chart). So, down here they have three divided by four (points to the next line in the chart). Three divided by four. What would be the … fraction?
>
> **Voices**: one … three fourths!
>
> **Teacher:** (writes ¾ in the chart) What would be the decimal?
>
> **Student 1:** 75.
>
> **Teacher:** So that's what you're filling in … here on the chart. So you need to come up with one two three four five more division problems that can be described in decimals and in fractions. Now, they've given you some of the chart already. (12-12-05, 6th grade)

The underlying goal conveyed by the teacher's manner in the 6th grade mathematics classroom was her desire for conformity and cooperation with the established classroom norms. The design of the lesson did not allow for students to structure their own activity or answers. Most of the questions were phrased so that the desired response was a word or two—the typical Initiate, Respond, Evaluate pattern discussed by (Lemke, 1990) not enough for students to reveal what they are thinking.

In Ms. Newhardt's seventh-grade mathematics class, the teacher was listening for words or phrases that correctly completed some sentence in her mathematics monologue—she tossed out questions or partially completed sentences and let the students engage in verbal target practice until she heard the word she wanted and then she moved on.

> **Teacher:** What it is asking you is to give the names to the angle. Where is the angle?
>
> **Julio:** In the middle.
>
> **Teacher:** Right here, this is the angle, and Julio was nice enough to tell me that the angle is an obtuse. Why is it obtuse?

Julio: Cuz it, cuz it …

Teacher: Why is it an obtuse angle? Francisco?

Francisco: Because it is like 90 degrees but backwards …

Julio: It is like a 120 …

Francisco: I forgot.

Teacher: Yes? (calling on student with hand up)

Eloy: (reading from notes) An angle that is greater than 90 degrees.

Teacher: Thaaaaank you Eloy! An angle that is greater than 90 degrees. So now what I want you to do is give the names of the angle. (10-20-05, 7th grade, 1st period)

In this classroom the students' goal appeared to be to get through mathematics class without drawing negative attention to themselves. A few of the students who felt able to engage with the lesson took shots at answering the teachers questions or completing her sentences as the opportunity arose, but many simply waited for others to do it, confident in the knowledge that nothing bad would happen if they did nothing, and that ultimately, if they waited patiently, the teacher would provide the answer.

Mr. Langley's class had more features of an autonomy supportive learning environment. Student were allowed to grapple with open ended questions at times, and the teacher appeared to be monitoring their activities in small groups and encouraging them to think deeply about the questions.

(The students seated at this table are working on a data interpretation problem. The teacher strolls over to their table and stand behind Lana, who seems to be unsure of herself, and looks at her paper.)

Teacher: Did you read the question?

Lana: Yeah.

Teacher: Did you find those two states on the graph?

Lana: (Points to the two states the question is asking about.)

Teacher: So compared to the other red states how are those two different?

Lana: (Long pause as student scrutinizes the graph and makes faces. Finally she shrugs) I don't know.

Teacher: Those two states are what …?

Stephanie: (seated next to Lana) Far away from each other?

Teacher: (he moves over to stand next to Stephanie) They're far away from each other? What about compared to the other states?

Lana: They're over here.

Teacher: What's special about these two red states? (Lana giggles) About their position on the graph? What's special about their position on the graph? (10-17-05, 8th grade, 1st period)

In this vignette he encourages Lana to think for herself about a question rather than just guiding her straight to an answer. However, when the class moves on to a whole group discussion, the usual handful of students participate in the discussion while others wait in silence.

Teacher: Alright, looking at all the states that you colored. What are some things that you guys noticed alter coloring in all of the states? Juan?

Juan: The blue states in the midwest … that they are close to each other.

Teacher: Alright, Juan said the blue states in the mid west are close to each other. Do you guys agree?

Student 1: Yes.

Unidentified student: Yeah.

Student 2: There are more red [states].

Teacher: There are more red states? So the blue states are closer together but there are more red states. Anything else you guys noticed?

Student 1: Um, (inaudible)

Teacher: DC is in the south. You think it should be in the north? Alright. Where are most of the blue states?

Student 2: in the middle

Teacher: Right in the middle right? The question is asking you to look at Maryland and DC and write something about these two states. Compared to the other southern states, these two states are what?

(giggling, looking around)

Teacher: Look at those two states and look at the other red states, what can you say? (10-17-05, 8th grade, 1st period)

In the mathematics resource class the tone of whole group discussions is markedly different. There is an apparent desire on the part of the teacher to find out what students think and to find the mathematics in their thinking, even when the students themselves try to short circuit the process.

Teacher: Who has an idea of something they might record on their trip to Morenci?

Sal: Like maybe I would collect some rocks and maybe I would measure them … and I guess by measuring maybe I could find the weight of rocks …

Teacher: Okay, so you might collect some weight information …yes (calls on Gabriella)?

Gabriella: I would [she is speaking too softly to hear but she mentions time and how far]

Teacher: How much time or how much …

Boy's voice from off camera: Distance?

Teacher: How much distance? Okay … yes (calls on Pedro)?

Pedro: I would find the probability of seeing red cars.

Teacher: Probability of seeing red cars … great answer … yes?

Jorge: How many miles it takes and how much gas you would need to get there?

Jesus: Ahhh …! (Evidently he was disappointed that Jorge had said what he was going to say.)

Teacher: Yes, very good … how many miles, how much gas … very good …

Dan: How much money you spend?

Teacher: How much money you spend? What will you spend money on, driving to Morenci?

Dan: Gas … Food …?

Teacher: Gas … okay … maybe even a soda … maybe you stop for a soda—something like that. What else? You had your hand up.

Tom: *(he hesitates before responding and then smirks)* How boring it was …

Teacher: How would you measure that? … Would you put that on a 1 to 10 scale of boringness?

Tom: Yeah.

Simon: Eleven (his back is to the teacher and he mutters, apparently for the benefit of students sitting at his table).

Anthony: A hundred.

Teacher: A 1 to 100 scale of boringness? … and then would you get a boringness reading from every person in your car?

Tom: Yeah.

Teacher: Would you do that … what? … every 5 minutes, every 10 minutes …? Something like that?

Simon: Every 10 hours.

Teacher: Every 10 minutes?

Simon: Hours.

Teacher: Every 10 … hours?

Anthony: *(laughing)* Oh my goodness!

Teacher: How long does it take to go to Morenci?

Simon: An hour.

Anthony: An hour and a half.

Unidentified student: Three hours.

> **Teacher:** Oh. Okay … unless you walk. Then it might take a couple days at least … yes? (calls on a student at another table to see what he would suggest measuring …)
>
> **Felix:** Traffic … (4-18-06, resource class)

This classroom was an example of an autonomy supportive learning environment. Students' input was not only desired—it was necessary for the lesson to go forward, and the very same students who sat silently in the observed seventh- and eighth-grade mathematics classes engaged with the teacher in this classroom. In this instance the goals of the teacher and the students paralleled one another, exhibiting themselves in coordination of motivation, and overall productive learning behavior (e.g., Scardamalia & Bereiter, 2006).

DISCUSSION

Thesis: the negotiation of goals among students and teachers can be in competition, in cooperation/collaboration, or neutral (meaning both, but not favoring one over the other). The ways in which these goals focus on learning mathematical content, the contingencies and norms that govern accountability of students behavior pattern, and the extent to which teachers' expectations for students are positive with regard to mathematics learning, can create markedly different classroom engagement patterns and individual student motivations.

A performance goal structure was the prevalent model observed in the classrooms involved in this study. Students participated in some instances to show that they were competent, and in many more instances, to show that they were not incompetent. Students in most classrooms were not required to participate and at least two of the teachers, Miss Timms and Mrs. Newhardt frequently expressed expectations that certain students simply could not "get it."

There are obvious differences in students' experiences and performances in the four observed classrooms, even though the student population at this school is highly homogeneous. This illustrates the power of the classroom microclimate in channeling students' behaviors. These students were ostensibly *different people* when engaged in *different norms*. As noted in the analysis above, a number of the students in the seventh- and eighth-grade classrooms were also in Ms. Cunnane's resource class and they behaved and interacted differently in these two learning environments. The students' expressed motivation was a reflection of the social environment in their classrooms. The students in these classrooms were similar culturally and intellectually, differing primarily by age and associated knowledge of mathematics and school norms. The contextualized problems and practice problems students worked on were similar across grade levels, differing not so much by type or structure, but by age and grade level expectations. *The primary marker in the studied classrooms seems to lie in the emergent practices in the learning environment*—what was valued and what was expected by the teacher (and also the students), and how these values were expressed in accepted mathematical practices.

In the sixth- and seventh-grade classrooms the focus of the teacher's motivation is especially problematic as each teacher observed appeared motivated by answer making rather than meaning making, similar to those classrooms observed by Manouchehri (2004), Patrick et al. (2003), and Patrick et al. (2001). In the sixth- and seventh-grade classrooms, students were not required to participate intellectually, and many of them spent the entire year without making a single contribution to the classroom environment during our classroom observations, each teacher relying on the same handful of students to participate in class discussion. The teachers' unequal "calling patterns" limited the ability of certain students to participate and therefore prevent them from being involved in the learning process (Turner & Patrick, 2004). The treatment received by the monolingual Spanish-speaking students also illustrated low teacher expectations. In the seventh grade class alone, monolingual

Spanish-speaking students rarely if ever had an individual *mathematical* encounter with the teacher. These students relied on their classmates to understand what was required of them or, in conformity with prevalent norms, they waited until the answers appear on the board to complete their work. The instruction, teacher behavior and teacher expectations observed in the sixth, seventh, and eighth grades were indicative of the working class schools observed by Anyon (1980, 1995) and the control-motivated teachers outlined by Manouchehri (2004). While students in these classes may have been getting by at the time, it is likely that the cumulative effects of inadequate educational preparation for these Chicano students at the elementary level will greatly affect their educational attainment (Battey, 2013; Solórzano & Solórzano, 1995).

Implications

Implications for Instruction. In analyzing individual students' motivation we cannot ignore the context of the activity, social background and classroom norms as they are all intertwined. The use of an "activity" or "event" as the unit of analysis—with active and dynamic contributions from individuals, their social partners, and historical traditions and materials and their transformations—allows a reformulation of the relation between the individual and the social and cultural environments in which each is inherently involved in the others' definition. Mathematics class in the cases we illustrate above is often marked by rewards for "performing," that is, calling out answers or writing them on the board. Rarely did we see rewards for reasoning—alone or in collaboration with their peers—or for communicating this reasoning process in such a way that the group could examine it, question it, test it, and take what they can from it for use in structuring their own conceptual framework.

Contingencies—incentives and disincentives—are important influences on students' behaviors, directing their activity toward normatively accountable ends. How contingencies are established, the awareness teachers have regarding actions, contingency relations, and the behaviors upon which rewards and punishments focus, were found to be key determinants of classroom engagement patterns, not just of individual motivations.

In today's classroom environment, expectations are critical to students' success. Teachers must be clear within themselves and with their students about what they expect, and students must be held accountable to these expectations. Higher teacher expectations have a greater impact on minority students in part because it contrasts to status quo expectations that are not serving poor and minority communities well (Brookover et al., 1979). Given that higher teacher expectations are directly related to higher student achievement (Gigliotti & Brookover 1975) it behooves educators to make classroom practices coherent with verbal (and policy-level) expectations. All too often we tell our students that we know they are capable, mathematically, and we say that we know that they value dealing with one another fairly and kindly and contributing in positive ways to the learning environment; yet in the course of day-to-day lessons we permit them to languish in silent distraction, copying answers from their classmates and submitting them for credit, in effect, accepting this as proof that they have engaged in learning the lesson of the day. While this study cannot know with certainty what the expectations of the participating teachers were, and whether these expectations were low or high or based on class or race and ethnicity, we do know that when a system has lower expectations of certain groups, they have been found to alter an education-based curriculum to one more concerned with controlling student behavior, in turn reducing student opportunities to learn. Rather than examine the curriculum or teaching practices for explanations regarding lack of student motivation, these same teachers blame student inability, cultural backgrounds or home environments (Ennis, 1995).

Teachers must develop an understanding of the ways in which their own expectations and actions can perpetuate inequities and prove detrimental to the future mathematical learning of their students. Teachers need to be aware of the cultural and social environments in which their students are situated and how issues of equity within these environments affect the learning of students—minority students in particular.

Implications for Further Research. The cultural norms in the mathematics classes described above evolved in an emergent manner (Middleton et al., 2003). They were not designed. Neither the teachers nor the students were overtly aware that they exist. Each individual participated in the learning environment, not deliberately and purposefully, but rather because 'the system' selected them to be together in that place and at that time for that purpose. Further research on the ways in which norms for engagement impact student motivation, in particular, the norms that facilitate the development of intrinsic motivation, mastery goals, and productive incentives for typically underserved communities is critical for teacher education and professional development. If we are to reverse the kinds of inequities that the student participants in our study experienced each day, the system must alter its expectations for these students to ones that are more consistent with productive norms and practices.

Acknowledgment: The research reported in this paper was supported, in part, by a grant from the National Science Foundation (#0337795). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

NOTE

1. This allotment of time for developing new content is typical in Ms. Newhardt's class.

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