HONORS WORK AND A STANDARDS-BASED CURRICULUM IN A HETEROGENEOUS MATHEMATICS CLASSROOM

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BIOGRAPHICAL SKETCH

Cynthia Bowers Francisco was born Cynthia Carol Bowers on May 19, 1977, in Gainesville, Florida. She spent much of her childhood moving around the country before settling in Virginia for high school and college. In 1999, she graduated from the College of William and Mary with a B.S. in mathematics.

She came to Cornell in 1999 to pursue a Ph.D. in mathematics. After two years of taking classes and being a teaching assistant, she realized that her true interests were in mathematics education. Thus she switched her field to Education and began working under the supervision of David Henderson. In 2002, she finished her M.S. in mathematics, while she continued to work towards her M.S. in mathematics education.

With the support and encouragement of David Henderson and Maria Terrell, she took on the frightening, but rewarding, task of designing and teaching her own First-Year Writing Seminar in mathematics, titled Experiencing Mathematics through Writing, in Spring 2002. During the summers of 2002 and 2003, she was a mathematics instructor in Cornell's Prefreshman Summer Program.

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To Chris

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1.1 Issues of mathematics education reform

Over the past two decades, mathematics educators have been working to reform our educational system to provide all students with higher quality mathematics education. With the publication of reports such as *A Nation at Risk* (1983) and international studies such as TIMSS (Trends in International Mathematics and Science Study), the calls for reform have been pervasive, urgent, and politically charged. But how we should reform mathematics education, and what the goals of a reform should be, have become controversial issues. What mathematics should students learn? Should we focus on basic, memorized facts, or students' understanding of concepts? How can education be both equitable and challenging for all students? Is tracking appropriate and necessary or unfair and avoidable?

Much of the reform has centered on the vision of the National Council of Teachers of Mathematics (NCTM). In its series of standards (NCTM, 1989, 1990, 2000), the NCTM advocates teaching for understanding; they believe that students should understand, not simply memorize, a variety of important, connected mathematical concepts and computational procedures. Throughout the standards, they suggest that we should create active classroom communities where students solve problems, make and refine conjectures, communicate about mathematics, connect mathematical ideas, utilize a variety of representations of data, and apply mathematics to other contexts. They stress that such an intellectually stimulating environment should be available to *all* students and that all students are capable of meeting high expectations.

The standards primarily propose goals and give guidance for curriculum development; they do not attempt to provide a detailed prescription for teaching school mathematics. Thus, curriculum developers and teachers can decide how to

meet the standards in individual districts or classrooms. In the past decade, researchers and curriculum developers have been working on how to achieve the NCTM's goals and how to implement its recommendations in actual classrooms. In particular, the National Science Foundation (NSF) has funded the development of curricula that put the NCTM standards into practice. This study examines an implementation of one of these curricula. I focus on what progress this implementation makes towards these goals and what we can learn about teaching with a standards-based curriculum from one school's efforts.

1.2 Brief overview of the curriculum

One of the NSF-funded high school mathematics curricula was developed by the Core-Plus Mathematics Project (CPMP). The curriculum attempts to implement the NCTM standards, concentrating especially on helping students understand mathematical concepts and how they can be applied outside of mathematics. It was designed around the theme of "mathematics as sense making," and the curriculum developers believed that students could make sense of mathematics by exploring its use within realistic situations. With this curriculum, students explore mathematics in real-life contexts and "reinvent" important mathematics along the way (Hirsch, Coxford, Fey, and Schoen, 1995).

Another goal of the CPMP curriculum is to achieve the NCTM's equity principle. The NCTM asserts that all students can and should learn challenging mathematics, and Core-Plus seeks to provide a meaningful mathematics curriculum that is appropriate for all high school students. The curriculum includes one three-year sequence for all students and an optional fourth year course for college-bound students. Its developers believe that, since all students can take the same first three courses, the use of such a core sequence allows schools to eliminate all tracking and offer completely heterogeneous math classes (Hirsch and Coxford, 1997). They even

designed the curriculum to facilitate differentiated instruction within heterogeneous classes.

This curriculum has been field tested, evaluated, and published (Coxford, Fey, Hirsch, Schoen, 2003), and it is currently being used in many school districts across the country. In this study, I examine the implementation of the first-year CPMP course in one high school. In particular, I focus on the school's efforts to teach CPMP in heterogeneous classes that have high expectations for all of their students, including the strongest students. Within each heterogeneous CPMP class, all students had the option to sign up for an honors program that offered them extra challenges. I investigated students' and teachers' perceptions and attitudes towards the course and its honors program.

Throughout this thesis, when I use the abbreviation "CPMP" alone, I will be referring to the CPMP *curriculum*. I will specify when I am writing about the developers or other components of the Core-Plus Mathematics Project.

1.3 Background of the study

This study examines the implementation of CPMP at a 9-12 high school of over 1500 students in a small city in upstate New York. Students entering this high school come from two different middle schools, both of which track students into different levels of math classes. Math classes at these middle schools use a variety of different curricula, many of which are relatively traditional. In previous years, the high school tracked most entering ninth graders into one of three ninth grade courses, although ninth graders who had been accelerated in middle school entered in a tenth grade honors course. Most of the high school's mathematics classes used traditional curricula.

Over the previous two years, the high school had piloted CPMP in a few of their ninth and tenth grade courses. The math department was pleased with those

classes, and they decided to begin using CPMP in all of its ninth-grade level courses during the 2002-2003 school year. To prepare for the change, most of the teachers attended a one-week summer workshop; the teachers who had been involved in the pilot program introduced their colleagues to the curriculum and related issues at this workshop.

This math department also decided to make the new ninth grade level classes heterogeneous. Math 9 became one course that all ninth graders took, except for the students who had been accelerated into the tenth grade honors course, and that used the CPMP curriculum. This new heterogeneous course was considered a "Regents level" course because it prepares students for the New York State Regents Math A exam, a new exam that is required of essentially all high school students. The tenth grade courses, including the tenth grade honors course (10H) that consists mostly of accelerated ninth graders, remained unchanged during this first year of Math 9 changes.

Because they wanted to challenge all students, including the strongest Math 9 students, the department designed an honors program within the Math 9 course. Instead of getting "Regents credit" for the course, some students could sign up to get "honors credit." These students had to meet higher expectations, and teachers hoped that the honors credit would be an incentive for those students to learn more in their math class.

I became particularly interested in this honors program because it was an innovative way to challenge students within a heterogeneous class. The CPMP curriculum is designed to allow some students to explore the material in more depth than other students. Thus, students of differing backgrounds, abilities, and motivation can learn together in one course without holding students back or leaving students behind. I wondered, however, how teachers could motivate high school students to

work to their full potential if all students were in the same classroom. How could teachers of these heterogeneous classes avoid simply lowering their standards for most students?

The Math 9 honors program seemed like one realistic solution for differentiating instruction. Early in the planning process, teachers planned to assign different sets of problems to honors students. They would not simply get additional work, but they would work on problems that encouraged them to learn material in greater depth. The CPMP homework assignments are arranged by difficulty, and the honors level students would be assigned more of the difficult problems and fewer of the easier problems than the Regents level students would be assigned.

Teachers also hoped that the honors program would serve as more than a way to differentiate instruction. Another goal of the honors program was to prepare some of the best Math 9 students to enter the traditional accelerated track in the tenth grade. In other words, during their tenth grade year, those students would take the tenth grade honors class along with the ninth graders who had been accelerated into it. The idea was to help students who should have been accelerated in middle school or who developed their mathematical abilities later to transition into the most demanding mathematics track.

I conducted my study during the spring of this first year of the new Math 9 course and honors program. By this time, teachers had developed a clear structure of the honors program. About once per week (usually on Thursdays), the honors students went to a separate classroom with a "floater." The floater was an additional mathematics teacher who was assigned to two Math 9 classes that met during the same class period; most days of the week, this floater helped out in those classes, but once per week, he or she took the honors students out of the regular class and brought them to a separate room to cover honors material. Math 9 teachers and floaters had also

made the decision to teach only traditional algebra in the honors portion of the course. They wanted to prepare those students for the transition to 10H, part of the traditional honors sequence. Since 10H was not using the CPMP curriculum, students would need some traditional algebraic skills that are not covered in the first year of CPMP. Thus, they used the honors program to prepare students to move into the traditional honors track.

Unfortunately, this structure of their honors program did not give me an opportunity to study differentiated instruction *within the CPMP curriculum*. All students did the same problems in the CPMP textbooks (although occasionally honors students were excused from a few CPMP assignments); honors students were not assigned the more challenging CPMP problems.

However, studying Math 9 did allow me to examine one form of differentiated instruction and a practical way to detrack partially and to increase mobility within a tracking system (by providing a transition for students to move up into the traditional honors sequence). I examined students' and teachers' perceptions of Math 9 with the goal of understanding the new course and any problems or issues that arose in this setting.

This research is a case study of the implementation of CPMP in the first year of the new Math 9 course. In the tradition of Stake (1995), I used several methods of data collection, used the data to develop themes, and interpreted the information to draw conclusions that could be relevant outside of this specific case. My goal was to describe Math 9, including the perspectives of students and teachers. Originally, I planned to focus on how the honors program was used to differentiate instruction within the CPMP curriculum. However, since the honors program did not use CPMP, I shifted to a more general question. I sought to understand how CPMP was

implemented in this school and to what extent the goals of the teachers and of CPMP were being met.

My study consisted of three methods of data collection. I administered written student surveys and teacher surveys, and I conducted student interviews. The results of those surveys and interviews, and details of my methods, are summarized in Chapters 3, 4, and 5. In Chapter 6, I make connections among these three sets of data, painting a more complete picture of Math 9. In Chapter 7, I draw some conclusions and suggest some questions for future research.

Chapter 2: Literature Review

2.1 Core-Plus Mathematics Project, a standards-based curriculum

2.1.1 Overview of the curriculum

The Core-Plus Mathematics Project (CPMP) curriculum is a three-year sequence of high school mathematics courses for all students and an optional fourth year course for college-bound students (Coxford, Fey, Hirsch, Schoen, et al., 2003). In 1992, this project and three other curriculum development projects received grants from the National Science Foundation (NSF) to develop high school curricula that implement the first round of NCTM standards (NCTM, 1989, and NCTM, 1991) (Hirsch and Coxford, 1997). The NCTM standards were an effort to address the call for change in reports such as *A Nation at Risk* (1983); the NCTM sought solutions to the problem that so many American students were not performing well in mathematics. They believed that "all students need to learn more, and often different, mathematics and that instruction in mathematics must be significantly revised" (NCTM, 1989).

What mathematics should be taught and how instruction should be changed is a complex, debatable question, but the NCTM's philosophy was in line with the philosophy of other recent reformers. Oakes (1999) asserts that the current school reforms evolved from questioning the modern view that students must first be taught basic facts, handed down by experts, before they can learn or think about complex concepts. Some reformers objected to this modernist perspective in part because it is not clear whose knowledge or culture we should be passing down to our children. These postmodernists believe that students should be involved in constructing "meanings that also reflect the diverse cultures that make up American society" (Oakes, 1999, p. 108). Similarly, the NCTM stresses that students should all develop their own "mathematical power;" they should actively investigate, conjecture, reason,

and solve nonroutine problems (NCTM, 1989). In other words, they should be involved in *doing* mathematics, not just learning the mathematical truths handed down to them from experts.

In general, the NCTM holds a constructivist philosophy that learning is the construction of knowledge in contexts that are meaningful for the learner. Anderson et al. (1994) describe many features of constructivism, and the CPMP tried to implement many of them in their curriculum. For example, according to Anderson (1999) et al., constructivists believe that "learning is dependent upon the prior conceptions that the learner brings to the experience" (p.23). The developers of CPMP agree, saying that their curriculum "acknowledges, values, and extends the informal understanding of data, shape, change, and chance that students bring to situations and problems" (Hirsch & Coxford, 1997, p.232). Each lesson in the CPMP begins with a "launch," a class discussion that provides a context for an upcoming investigation; the goal of the launch is to "assess students' knowledge, to generate students' interest, … and to clarify directions for the group activities" (Hirsch, Coxford, Fey, and Schoen, 1995, p. 695).

Constructivists also believe that learners must construct their own meanings of knowledge (Anderson et al., 1994). Similarly, the CPMP developers say that their curriculum builds on the theme of "mathematics as sense-making." In their curriculum, "Investigations of real-life contexts lead to reinventing important mathematics that makes sense to students and, in turn, enable them to make sense of new situations and problems" (Hirsch, Coxford, Fey, and Schoen, 1995, p.694). This description also suggests that the CPMP developers agree with the constructivist principle that learning is contextual. Constructivists contend that knowledge has little or no meaning when it is not presented in a context (Anderson et al., 1994), and CPMP provides a realistic context for most of its mathematical content.

Another constructivist assumption that is evident in CPMP is the principle that "learning is dependent upon the shared understandings that learners negotiate with others" (Anderson et al., 1994, p. 24). CPMP recognizes this by centering their curriculum on communication in the classroom. Each lesson is organized to support an introductory class discussion (the launch), small-group investigations, and a class discussion of the small groups' results. The developers believe that having students work together and discuss their ideas will help them "find commonality in diversity of ideas" (Hirsch and Coxford, 1997, p.233). In other words, small groups and sometimes the whole class have to agree on common understandings in order to talk about their mathematics. However, to what extent this curriculum actually allows classroom communities to create their own shared knowledge is unclear to me; since lessons are not emergent, but rather have specific, predefined goals, the curriculum put limits on the directions that the class can take. The developers intentionally direct learning in this way (Schoen, Finn, Griffin, and Fi, 2001, p. 232), and students can then construct their own meanings within this framework. Nevertheless, some social constructivists might argue that limiting the directions of the learning paths restricts the shared meanings that the learners can negotiate. Thus, some might contend that the CPMP developers have a somewhat surface belief in this social constructivist principle.

CPMP explicitly addresses the belief that learners have to construct knowledge in an organized conceptual framework, an assumption shared by some constructivists (Anderson et al., 1999). Each lesson includes additional activities after the main investigations. These activities, which are usually used as homework assignments, are organized into four sections: Modeling, Organizing, Reflecting, and Extending (MORE). The Modeling problems ask students to use what they learned in the previous activity, the Organizing problems encourage them to organize what they have

learned and connect it to other mathematical ideas, the Reflecting problems help them to reflect on what they do and do not understand and on how they are thinking about the mathematics, and the Extending problems challenge them to investigate the mathematics more deeply. The consistent structure of these activities suggests that the curriculum developers see these as important steps in the learning process. They particularly emphasize the importance of the Organizing tasks, suggesting that students discuss their solutions in class so that the class can formalize and synthesize what they have learned (Coxford, Fey, Hirsch, and Schoen, 1998). Thus, although they want students to discover math in investigations, they also want students to have specific opportunities to organize the material in ways that makes sense to them.

CPMP's conception of a teacher's role in the classroom also agrees with the role suggested by constructivists and other educational researchers. The teacher is no longer seen as the source of "one-way transmission of information" (Anderson et al., 1994, p.9). Instead, the teacher and the students share a dialogue. CPMP's lesson organization encourages this new role, and the developers of the curriculum even explicitly describe the teacher's role in each portion of the lesson. In the lesson's opening class discussion, the teacher should act as "moderator;" during small-group investigations, he or she should act as "facilitator;" during whole-class sharing of results, he or she again should act as "moderator;" and when students work on individual activities, the teacher should act as "intellectual coach" (Coxford, Fey, Hirsch, and Schoen, 1998, p. 12). These metaphors for a teacher's roles give insight into the details of the pedagogy that the CPMP advocates.

In general, the CPMP curriculum seems to assume that "less is more," another common opinion of constructivists. Instead of asking students to memorize facts, CPMP tries to help students learn how to learn mathematics. In designing the curriculum, the CPMP developers believed that content should be chosen for its

importance, rather than simply for its need as background for the next course; thus, they felt free to delay the "development of certain formal symbolic manipulations … to a point close to their need" (Hirsch and Coxford, 1997, p. 233). In other words, they did not rush the development of material; they focused on depth of understanding instead. The developers advocate pedagogy that keeps this "less is more" philosophy in mind. In the curriculum's implementation guide, they remind teachers, "developing deep understanding is more important than just 'completing activities'" (Coxford, Fey, Hirsch, and Schoen, 1998, p. 16). This statement sums up a general theme of CPMP's philosophy; the primary motivation of the curriculum is a desire to help all students construct deep understandings of mathematics.

In addition to embodying some constructivist principles, the CPMP curriculum seems to be influenced by other perspectives on curriculum development. Posner (1995) describes the structure-of-the-disciplines perspective. Jerome Bruner and others argue that school subjects should reflect the processes and ways of thinking in their corresponding scholarly disciplines. In other words, students should learn the guiding principles and modes of inquiry of each subject. CPMP reflects a belief in this perspective. The developers emphasize that students should learn to investigate, explore, conjecture, and reason, and they suggest that mathematics should be understood as a "science of patterns" (Schoen, Finn, Griffin, and Fi, 2001, p. 5). It encourages students to reinvent mathematical ideas for themselves; in some sense, they are advocating that students act as miniature research mathematicians. However, the way that they implement this goal could be seen as inconsistent with how many mathematicians actually work. CPMP focuses on students' developing mathematics in real-world contexts; however, new mathematics is often developed in abstract settings. The lack of abstractness in the curriculum could be a sign that the developers were only slightly influenced by the structure-of-the disciplines perspective or that they

believe students can best learn the basic principles of mathematics in the context of realistic situations.

CPMP also has elements of what Posner (1995) calls the experiential perspective. The curriculum tries, as Dewey advocated, to relate mathematics to students' experiences, primarily by putting math in real-world contexts. The activities also give students new, mathematically rich experiences. Dewey said that the highest quality experiences are those that help students become more independent in their future learning (Posner, 1995). This curriculum's emphasis on *doing* mathematics is an attempt to promote students' development of mathematical thinking skills. The developers claim that, since the curriculum encourages students to make sense of mathematics, it also "helps them make sense out of new situations and problems" (Coxford and Hirsch, 1996, p.25). Although the curriculum gives students meaningful mathematical experiences, it may be more contrived than some experientialists would support. The curriculum's activities are not emergent; instead, the curriculum developers designed each lesson's path (Schoen, Finn, Griffin, and Fi, 2001, p. 232). They hope that this structure allows enough freedom for students to make sense of mathematics for themselves, while still leading them toward a planned goal.

Another influential factor on the development of CPMP is the principle of equity, a driving force behind mathematics education reform. The NCTM emphasizes that all students should have opportunities to learn challenging, meaningful mathematics and that *all* students can learn mathematics (NCTM, 1989, NCTM, 1991, and NCTM, 2000). Beginning with the first standards, *Curriculum and evaluation standards for teaching mathematics* (NCTM, 1989), the NCTM has attempted to outline a framework for a core curriculum of mathematics that is appropriate and effective for *all* students. CPMP attempts to provide such a curriculum to schools (Hirsch and Coxford, 1997).

The principle that all students can learn important and meaningful mathematics motivates some of the CPMP developers' beliefs about effective instruction. For example, they designed their curriculum to facilitate heterogeneous classes. They contend that the core topics are accessible to all and that the curriculum offers enough flexibility for students to explore ideas at varying depths. They argue that, because of the curriculum's investigative approach, "the depth of student understanding becomes a function of ability, prior experiences, interest, and effort" (Hirsch and Weinhold, 1999, p.236). Students can even be offered some degree of choice on the MORE tasks for homework; the weakest students can focus more of the Modeling tasks, while the strongest students can complete Extending problems. The CPMP developers also believe that cooperative learning increases the interest level and thinking skills of women and minorities and that the use of calculators in the curriculum helps remove the arithmetic barriers that some students face (Hirsch & Coxford, 1997). For the strongest students, CPMP offers open-ended projects that supplement the regular work, and the developers believe that throughout the curriculum "mathematically promising students are not constrained by a particular approach or record of mathematics laid out neatly in a text" (Hirsch and Weinhold, 1999, p. 236).

2.1.2 Research on CPMP implementation

Since field testing of CPMP began in 1994, researchers have been studying its implementation, effectiveness, and impact on students. Overall, the studies suggest that the curriculum achieves its goals when implemented as intended by the developers. Although the data is promising, it is certainly limited and may even be somewhat unreliable. Unfortunately, most of the researchers involved in the studies have been the developers of the CPMP curriculum themselves. Obviously, their biases could affect how they interpret results and what analyses they report. They have devoted time and resources to developing the curriculum, and even if their

intentions are honorable and not motivated by the desire for recognition or money, they want to see their curriculum succeed. Of course, there are benefits of studies conducted by the curriculum developers. They are intimately familiar with the curriculum itself and with the assumptions about implementation that were made during its development.

Some of their studies focus on student achievement. One study examined the effects of CPMP on students' algebra abilities. The study found that, "the CPMP curriculum is more effective than traditional curricula in developing student ability to solve algebraic problems when those problems are presented in real world contexts and when students are allowed to use graphing calculators" (Huntley, 2000). This study's data seem to suggest, not surprisingly, that CPMP students are more successful at CPMP-type problems than students in traditional classes. Because the study considered such specific types of problems, its utility seems minimal. It is certainly important to know that CPMP succeeds at helping students do CPMP-type problems; otherwise, CPMP would seem to be a complete failure. However, these data are far from sufficient to begin making conclusions about CPMP success. This study does gain some credibility from the fact that Huntley, one of the lead authors, is not a curriculum developer, but all but one of the other authors were listed as developers on the CPMP website (Core-Plus Mathematics Project website, 2003).

Another study (Schoen, Cebulla, and Winsor, 2001) did address how CPMP students in field test schools do on assessments that do not necessarily reflect the goals of CPMP, including the SAT, ACT, and university placement exams. This study found that these students were as well as or better prepared for these assessments as students in traditional classes were. Additional evidence for this conclusion is presented in Schoen and Hirsch (2003). These results are particularly promising, especially for political purposes. If future studies consistently suggest that CPMP

students do at least as well or better on such assessments, the curriculum is more likely to be widely accepted. However, these studies are part of the evaluation conducted by curriculum developers; studies by outside observers might appear more credible.

Schoen recently published another study that gives deeper insight into how CPMP should be used (Schoen, Cebulla, Finn, and Fi, 2003). This study compared CPMP students in different classes and schools and considered what teacher-related variables correlated with student achievement. The single factor that correlated most heavily with student achievement was professional development of their teacher. Experience teaching the curriculum in a previous year did not even replace professional development. The study also suggested that teachers who implemented CPMP in ways that were consistent with the standards (or, in other words, consistent with intended implementation) had more successful students. For example, teachers with high-achieving students were less likely than other teachers to have supplemented the curriculum with less open-ended and more skills-based assessments; teachers of high-achieving students were also likely to have devoted more class time to small group investigations and less time to teacher presentation. Again, the study was led by a lead author of the curriculum, which detracts somewhat from its credibility.

Although the data on achievement is promising, more studies are necessary. Studies conducted by researchers who did not help develop CPMP would be helpful, as would more studies that investigate the variety of variables that could affect the effectiveness of CPMP.

Other studies focused on students' and teachers' interactions with and perceptions of the CPMP curriculum. One paper (Lloyd and Wilson, 1998) described a case study of an experienced high school teacher's first year of implementing CPMP. In particular, Lloyd and Wilson examined the teacher's broad, rich conception

of functions and how that conception affected and enriched his instruction of the curriculum.

Another study (Schoen and Pritchett, 1998) focused on students' perceptions and attitudes towards the CPMP curriculum. Since this research is particularly relevant to the present study, I will summarize it in more depth. Schoen and Pritchett surveyed students in both CPMP classes and traditional classes, asking them about their attitudes towards various aspects of their mathematics course, particularly focusing on some views traditionally held by students. They summarize Schoenfeld's (1992) compilation of common student beliefs about mathematics, including that "ordinary students cannot expect to understand mathematics," that "mathematics is a solitary activity," and that "mathematics learned in school has little or nothing to do with mathematics." Schoen and Pritchett used Schoenfeld's list to suggest areas of students' attitudes to consider, especially because the CPMP directly challenges some of those commonly held beliefs. In their surveys of students, they asked specific questions about Course Difficulty; Problem Solving, Reasoning and Sense Making; Learning in Groups; Graphing Calculators; Communicating Mathematics; and Realism and General Interest. They also gave students a writing prompt that asked them to describe their experience in their math class to a friend.

Schoen and Pritchett claim that the students in their study described CPMP "as at least as challenging as traditional college-prep mathematics courses" (Schoen and Pritchett, 1998, p. 17) and that, overall, students were more positive about their CPMP class than students in traditional classes. Specifically, their data indicates that traditional and CPMP students did not differ significantly in their perceptions of their courses' difficulty and the readability of their textbooks. Students in their second year of CPMP had more positive feelings towards their understanding of mathematics and their ability to reason mathematically than students in the second year of a traditional

high school sequence; however, students in their first year of CPMP gave similar responses regarding their mathematical understanding and reasoning as students in their first year of traditional classes. Students in both CPMP and traditional classes both had positive feelings towards group work (of the students who used group work in their class) and positive feelings towards the use of graphing calculators (of the students who used graphing calculators in their course).

CPMP requires that students frequently write and talk about mathematics, and Schoen and Pritchett found that CPMP students believed that their course taught them to write and talk about mathematical ideas, as compared to students in traditional classes. Perhaps surprisingly, given the frequency of writing and talking in CPMP, students did not often discuss this issue in the open-ended writing prompt.

The final areas that Schoen and Pritchett investigated were students' feelings about Realism and Interest in their course. They asked students about their interest in the mathematical ideas of their course, the extent to which they believed that the problems in the course were realistic, and whether or not they would want to take a course like their math class in the following year. Students in the first year of CPMP gave similar responses to students in first-year traditional courses, although more CPMP students believed that problems in their course were realistic. Of students in their second year of high school mathematics, the CPMP students had more positive feelings toward all three components of Realism and Interest than students in traditional courses.

Overall, Schoen and Pritchett conclude that CPMP seems to make some progress towards shifting students' beliefs about mathematics away from the traditional beliefs compiled by Schoenfeld (1992). They also offer some hypotheses that could be studied in future research, including one that relates the realism of CPMP to students' interest in CPMP material; they suggest, "The perceived realism of the

contexts for investigations and problems is perhaps the strongest contributor to students' high levels of interest in continuing to enroll in Core Plus courses."

2.2 Tracking and Heterogeneous Classes

The high school in this study reduced the amount of tracking in their ninth grade mathematics courses and replaced that system with more heterogeneous classes. The math department was unhappy with their current tracking system because they felt their lowest-level classes were unproductive and ineffective and because they felt that some students had not been tracked appropriately during middle school. In particular, they wanted to provide a better education for the lowest group of students, and they wanted to help students who were capable of honors level work make the transition into the traditional honors-level track (populated mostly by students who were accelerated one year ahead of their peers).

2.2.1 What is tracking?

Tracking usually describes an educational system that sorts students into different classes based on ability, usually in a permanent way. The resulting courses are assumed to be relatively homogeneous; thus, classes can be taught at one level, giving the same instruction to all students in the class (Reis et al., 1998). Frequently, students are put into tracks that are either college-preparatory or vocational (Ortiz-Franco and Flores, 2001); thus, which track a student enters can have a large impact on their future education and careers.

A related, but distinct, idea is the concept of grouping. The term "grouping" is often used to describe less permanent, more flexible ways of sorting students (Reis, et al., 1998). Grouping can occur within a classroom, and it may take into account not only ability, but also motivation and interest.

The high school in this study was moving from a system of tracking to a system of some tracking and some grouping. In previous years, most ninth graders

were placed into either one of three ninth grade level math classes or into a tenth grade honors class, depending on which math track they had been in at their middle school. In the new system, students who were accelerated during middle school still moved into the tenth grade honors course, but all other ninth graders entered heterogeneous Math 9 classes. Once in Math 9, any student could choose to enter the honors program for an additional challenge. Thus, students' classes were determined in part by their previous math track, but only to determine which students were accelerated. Other students were grouped based solely on the students' decisions of whether or not to take honors. Because students decided which group they would be in, their abilities were not the only factors considered; students had to be interested, motivated, and/or confident enough to sign up for honors credit.

2.2.2 Arguments against tracking

This math department's reasons for changing their tracking system relate to more general arguments against tracking. Recommendations for educational reforms, including the NCTM standards (NCTM, 1989, 1990, 2000) and *Everybody Counts* (NRC, 1989), emphasize that equity should be achieved by providing high expectations for all students. Tracking is often seen as a barrier to this goal. Low-level, noncollege-prep, or vocational tracks often set low expectations for some students, and there is particular concern that tracking deepens racial, ethnic, and socioeconomic divisions (Oakes, 1990; Oakes and Wells, 1998; Ortiz-Franco and Flores, 2001). The permanent nature of tracking can also mean that a student's future is significantly impacted by tracking decisions early in their life.

Oakes (1990) found that low-income and minority students are deprived of opportunities in mathematics and sciences and that tracking is partially to blame. She argued that tracking reduces opportunities for all students who are placed in low tracks and that minorities, regardless of ability, are more likely to be in low tracks. She gave

evidence that, in part because of tracking, low-income and minority children have less access to mathematics classes, resources, and qualified teachers and that the differences between these students' mathematics programs and the programs of more advantaged students are substantial by secondary school.

Some schools that have eliminated tracking have found success. Oakes and Wells (1998) report on a variety of methods that schools have used to detrack, to challenge all students, and to embrace the diversity of their students. Some of those schools offered extra classes to supplement lower-level students' education so that they could remain in regular classes, while still receiving extra support. Many schools did offer honors programs, but those programs were available to all students; other schools offered honors activities within their usual heterogeneous classes.

Although many are skeptical of the practicality of detracking mathematics classes, a study by Linchevski and Kutscher (1998) gave promising results. They compared the achievement levels of students in heterogeneous and homogeneous math classes. They cited evidence that tracking increases the gap between high-level and low-level students "beyond that expected on the basis of the initial differences between them" (p. 534). In their study, they sought to determine whether this inequality was the result of tracking harming the lower-level students or helping the high-level students and whether heterogeneous classes prevent this inequality. They found that, in the settings they studied, no students were harmed by placing them in heterogeneous rather than homogeneous classes; in particular, high-level students in heterogeneous classes achieved at about the same level as similar students who were in homogeneous classes. Furthermore, the lower-level and average students performed even better in the heterogeneous settings.

2.2.3 Arguments for differentiating instruction

Amid the calls for detracking, some educators are cautioning that we should not treat all students as if they are the same. In *Everybody Counts*, the National Research Council suggests that the best programs for promoting equity "educate all students well not by giving them identical assignments but by setting for each child individually appropriate expectations" (NRC, 1989, p. 29). The NCTM's *Principles and Standards for School Mathematics* reiterate this idea, saying, "Equity does not mean that every student should receive identical instruction; instead, it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students" (NCTM, 2000, p. 11). Recognizing individual needs without the inequity of tracking is a challenge, but some educators have suggested alternatives.

Reis et al. (1998) argue that advocates of detracking overemphasize the need for *equal* education for all. Instead, Reis et al. believe that all students should have access to instruction that is challenging and worthwhile for them. Although they do not advocate predetermined, permanent tracking, they believe that some form of differentiated instruction is crucial.

Tomlinson (1999) and Gregory and Chapman (2002) offer specific strategies for differentiating instruction in heterogeneous classes. Although many of their suggestions are particularly geared towards elementary and middle school classes, some of their suggestions are particularly relevant to teaching with CPMP or other standards-based curricula. Tomlinson (1999) recommends using tiered activities that allow all students to work with the same idea, while providing different levels of complexity and difficulty for students of varying abilities. CPMP's MORE problems are an example of tiered activities. Gregory and Chapman (2002) make a related suggestion by advocating "problem-based learning." They suggest open-ended,

challenging problems that are set in real-life contexts; they believe that students with different abilities can investigate the problems at varying levels, using a wide range of skills. CPMP uses these types of problems throughout their curricula.

Davidson and Hammerman (1993) give some examples of ways to recognize individual differences in heterogeneous mathematics classes. They even argue that it is sometimes appropriate and beneficial to give all students the same problem. If the content of the problem is sufficiently rich, students can learn a variety of lessons from the same problem. Good problems can encourage students to challenge their understandings and to make progress towards deeper insights. Teachers, even when posing one problem to the entire class, can still encourage individuals to concentrate on the aspects of the problem that are most worthwhile for them.

In the present study, the mathematics teachers attempted to differentiate instruction with an honors program that was an optional component of a heterogeneous Math 9 class. They hoped to challenge all students in a productive environment, while also allowing some Math 9 students the possibility of moving upward into a traditional honors-level mathematics track after completing Math 9. In future chapters, I examine students and teachers experiences in this heterogeneous, differentiated Math 9 class.

Chapter 3: Student Survey

3.1 Design

I designed a short student survey to identify key areas that students saw as important to their Math 9 experience. I surveyed students in one teacher's two Math 9 classes. I administered the surveys during class time, and students took about ten minutes to complete them. A total of 33 students responded (all who attended class that day, out of a total of about 40 students), 19 of whom were honors students. Because all of these students had the same teacher, their responses may not be representative of the entire Math 9 population. However, they should represent a significant (although possibly not comprehensive) range of students' opinions and attitudes. I was also able to use the results of this survey to identify areas to explore in more depth in student interviews.

Because I wanted to identify students' concerns and priorities, I designed a survey that required open-ended responses. Rather than ask students to respond to pre-identified questions about Math 9, I wanted to determine what they thought was important and noteworthy about their class. The survey had two, open-ended questions:

1. *Describe your Math 9 course to an 8th grader who will be taking it next year. Try to give him or her an idea of what to expect.*
2. *Your 8th grade friend is trying to decide whether or not he or she will take the class for honors credit. Describe the Math 9 honors program from your perspective to help him or her make a decision.*

The goal of the first question is to elicit students' opinions, attitudes, and/or perceptions of the class as a whole. However, because my study focuses on the honors program, I asked an additional question about students' perceptions of the honors program. All students, including both honors and Regents students, were asked to complete both questions. Out of the 33 students, all but one student responded to the first question, and all but three students responded to the second question. The length

of their responses varied. Most of their responses were only one or two sentences long for each question, although some students wrote longer paragraphs.

3.2 Summary of results

After giving the student survey to those two classes, I compiled the students' comments. For each question, I grouped related comments and began to develop categories of responses. At first, I grouped comments into many, specific categories, a process that Stake (1995) calls categorical aggregation, so that I did not lose information by consolidating ideas into general categories too early. As I became more familiar with the comments and ideas, I refined my evolving categories and looked for patterns to isolate the prominent themes. In the following two sections, I summarize the themes of students' responses to each of the two questions.

3.2.1 Question 1: Comments on the course overall

For the first question on the survey, most comments fit into one of five main themes, listed here in order of their frequencies (as measured by how many students mentioned them): Format of the course, Boring vs. Fun, Difficulty Level, Review vs. New Material, and Amount of Work (see Table 3.1).

Twelve students discussed the format of the course, often emphasizing aspects of the course that were different from previous mathematics classes. Because this theme is so broad, I divided it into subthemes. Students comments on formatting included remarks on the extensive use of writing and language in the course, the use of calculators, the amount of graphing, the use of groupwork, the degree to which the class is "hands-on," and the presence of real-life problems. See Table 3.1 for the number of students who commented on each subtheme.

By far, the most frequently mentioned aspect of the course's format was the use of writing and language. Of the nine students who mentioned writing and/or language, six of them specifically mentioned that students have to write a lot in their

Table 3.1 Question 1 Themes: Comments on the course overall

Theme:	*# of students:*
Format	13*
Writing/language	9
Calculators	3
Graphing	3
Groupwork	2
Degree to which class is hands-on	2
Real-life/Relevance	2
Boring vs. Fun	10*
Boring, not interesting, or not fun	9
Somewhat or sometimes fun	2
"Refreshing"	1
Difficulty Level	8
Easy	2
Difficult	5
Mixed	1
Review vs. New Material	5*
Lots of review	4
A little new material	2
Amount of Work	5
A lot of work	4
"Expect work, pain, …"	1

* Some students mentioned more than one subtheme; therefore, the sum of the responses mentioning any subtheme is sometimes more the total number of students who mentioned the larger theme.

Math 9 class. For example, Student #32 wrote, "By taking this class you have two English classes a day. TOO MUCH WRITING," and Student #12 wrote, "Expect to write a lot." Two other students made similar comments about the extensive use of language, although it was not clear that they were limiting their comments to students' writing. Student #24 stated, "There is more explaining and figurative language involved in this course than you may be used to," and Student #7 stated, "You have to work with a lot of word problems." The remaining student's comment seemed to

focus not on writing, but on verbal communication; Student #17 wrote, "You will work in groups using communication skills."

Five of these nine students' responses about language did not clearly assert an opinion; they simply stated facts such as, "In this course there is a lot of … writing that you have to do" (Student #18). Some of these students seemed likely to have negative opinions about the amount of writing, but I could not be sure based on what they wrote. For example, Student #17's entire response to Question 1 was "You have to work with a lot of word problems. You work with geometry and stuff like that. Overall it's not interesting." His/her last sentence may or may not be connected to his first two; the writing and geometry may be reasons that he/she finds the class to be uninteresting, or they may just be unrelated statements. His/her use of the phrase "have to" may give some support to the conjecture that he/she is not happy about the amount of writing in the class, although high school students might use such a phrase to refer to any work that they are required to do at school, regardless of whether or not they enjoy or appreciate it at all.

Three of the students made unmistakably negative comments about the amount of writing in the class; Student #22 remarked, "I don't like CMC because you have to write a ton of stuff about the math question and I just think that it is a bad way of teaching math." One student's comment about language did seem to be positive; in a completely positive response to the first question, Student #17 wrote, "You will work in groups using communication skills needed for every day life." In the context of a positive response, this statement seems to imply that the student appreciates that the use of language in a math class is realistic and worthwhile.

All of the other subthemes of Format were much less frequently mentioned. Three students commented on the use of calculators, but none of these responses gave more than the simple statement that they use calculators a lot. Similarly, three

students stated that they do a lot of graphing in Math 9. Two students talked about working in groups; Student #13 only stated, "There is a lot of groupwork," without giving an opinion about it, while Student #17's comment "You will work in groups using communication needed for every day life" suggests positive feelings towards groupwork (see the discussion of this quote in the previous paragraph). Two students commented on the degree to which the class is hand-on, although their statements were quite different. Student #3 remarked, "They need to make the class more hands on," but Student #17 wrote, "The course is generally very hands-on." Finally, two students also mention that the course addresses real life or relevant situations, and both of these students seem to appreciate this aspect of the course. Student #3 commented, "You use real life scenarios in math, it's somewhat fun," and Student #17 commented, "Everything serves relevance to something outside class."

Overall, the comments about the format of the course seemed to be attempts to prepare the hypothetical eighth grader for specific tasks that would likely be surprising and different from what the student encountered in previous math courses. In particular, the extensive use of writing stands out as the most frequently mentioned element of the course's format. For whatever reason, to many students writing is noteworthy, unusual, and possibly annoying.

After Format, the second most commonly mentioned theme is what I have titled "Boring vs. Fun." This theme developed from two categories that I initially saw as separate. Eight students indicated that the class was boring or not interesting for them. They made statements such as "It is very boring and you should try to take another class if you can" (Student #10), "The only reason you should take this course is if you feel like dying of boredom" (Student #27), "Overall it is not interesting" (Student #7), "It is boring" (Student #3), and "It is the most boring class I have" (Student #21). I categorized these originally under "Interest Level," although I

noticed that no students mentioned that they found the course to be interesting. In other words, I saw boring and uninteresting as one end of a spectrum, but I did not categorize any responses on the opposite end of that spectrum. However, I did have another category called "Enjoyment Level." One student described their Math 9 class as "not … very much fun" (Student #29), and two students said that their class was occasionally a *little* fun. Student #3 wrote, "It's somewhat fun," and Student #25 wrote, "SOMETIMES we will have a LITTLE fun." Although these are not enthusiastic endorsements, these students did get some enjoyment out of their math class. One other student wrote a positive comment that I could classify under enjoyment and/or interest. Student #17 wrote, "The course feels very personal and you will receive a lot of individual attention…If you are a creative person who sometimes struggles with numbers it is very refreshing."

After looking back at these categories, I felt that something was wrong. I had no students who said that the class was interesting, even though some students clearly had some positive feelings towards the class. I wondered if high school students were unlikely to describe a class as interesting. I discussed the categories with my advisor, and he suggested that I consider combining my "Interest" and "Enjoyment" categories. He suggested that the appropriate spectrum might be "boring vs. fun." To a high school student, boring might be the opposite of fun, rather than being the opposite of interesting or intellectually stimulating. After thinking about his suggestion and discussing it with other graduate students, I realized that the contrast of boring vs. fun was most appropriate. As I looked back at students' responses, I found support for this new theme. Student #3 wrote, "The class could be more fun and less boring." This student is using those words as antonyms, suggesting that it makes sense to categorize statements involving "fun" as a contrast to statements involving "boring." I decided to label this category as Boring vs. Fun because I did not feel comfortable

using a phrase such as “Interest Level” or “Enjoyment Level.” Because some of the students are talking about “fun” or the opposite of fun, “Interest Level” is not appropriate. “Enjoyment Level” seemed better, but I did not want to exclude students’ comments that were or could be referring more to interest than enjoyment. One student used the term “not interesting,” and, although some students clearly meant that boring was the opposite of fun, others might have meant boring as the opposite of interesting.

Regardless of the intricacies of this theme, the main idea to take away from students’ responses is that the overwhelming majority of those who mentioned this theme said that the course was “boring.” The two who said that the class was sometimes fun seemed to have an overall negative opinion of the class; Student #3 wrote, “To me this class is like a 42 min. naptime for me,” and Student #25 wrote, “Expect work, pain, boringness, and bad grades.” Only one student clearly expressed interest in or enjoyment of the class. Student #17 called the class “refreshing” and wrote that it feels “very personal.” It is important to note that not all students addressed this theme. In other words, although the overwhelming majority of students who mentioned their level of interest in or enjoyment of the class made negative statements, not all students indicated whether or not the class was fun or interesting for them.

The third most common theme was Difficulty Level. Of the eight students who mentioned the difficulty level of the course, two said that the course was easy; Student #1 wrote, “To me, this course has been very easy,” and Student #21 wrote, “You will be able to enjoy learning something, understanding it the first time, and going over it for 2 or 3 classes anyway…Generally, the homework is literally exactly the same as the class work, but with a different pretext.” Five students, however, said that the course is difficult; four of them described it as “hard” or “really hard”

(Students #3, 5, 11, and 31), and one student wrote, "You better pay attention this crap is confusing" (Student #8). One student gave a mixed description of difficulty, saying, "This class is easy at some times and hard at others" (Student #15).

The final two themes, Review vs. New Material and Amount of Work, were both mentioned by the same number of students. Five students addressed how much of their Math 9 class was review of math that they had learned in previous years. Four of those students believed that this class was mostly review for them. Those responses were "This course has been…for the most part a review" (Student #1), "Lots of review from 8th grade" (Student #13), "98% of the stuff we do we learned in 3rd or 4th grade" (Student #21), and "You learn the same stuff that you learned in 6th grade" (Student #27). The fifth student did write that the course had some review, but the extent of that review was not clear; Student #2 commented, "It starts off a review of what you did in 8th grade then they slowly teach you new things." Because the student said "slowly," he/she was probably implying that the review was extensive, but the statement does not directly address how much of the course was review. It does suggest that once the review ended, they did not cover a lot of new material. This student and Student #1 both mention that the course taught them some new material, but both imply that the amount of new material is relatively small. Student #1 wrote, "Throughout the course you learn how to do a few new things (depending on what math course they had taken last year)." No other students mentioned new material. Thus, if some students thought that much or most of the course was new material, they did not find it worthy of mentioning (possibly because the course met their expectation that they would learn a significant amount of new material).

Five students discussed the final theme, Amount of Work. Three of those students said that there was "a lot of work" or "lots of homework" (Students #5, 11, 14). One student was more specific; Student #15 wrote, "Working from the book is a

lot sometimes because you have to write a lot." The final student (Student #25) did not explicitly say that the class had a lot work, but he/she said, "Expect work, pain, boringness, and bad grades." Regardless of whether or not he/she thought that there was a lot of work, he/she definitely did not appreciate having to do the work.

3.2.2 Question 2: Comments on the honors program

Question 2 asked students to describe the honors program to an eighth grader who is considering signing up for it. Most comments were in the categories of Difficulty Level, Preparation or Abilities Needed, Amount of Work, Content, and Other Reasons to Take Honors. The number of students who mentioned each theme is listed in Table 3.2.

The most frequently mentioned theme of the Question 2 responses was the level of difficulty of the honors program; thirteen students addressed this issue. Six students believed that the honors program was either easy or it was not harder than the Regents portion of the course. Five of those students were in the honors program, and they all either used the word "easy" and/or the word "simple" to describe honors. For example, Student #7 wrote, "Honors is extremely easy," and Student #27 wrote, "The honors course is only slightly harder, at an 8th grade level. But because it is so simple, you can get an easy grade." The sixth student (Student #29) was a Regents student, and he/she described honors as no more difficult than Regents; he/she commented, "Honors is just extra work, not harder." Two other Regents students did not describe honors as easy, but seemed to believe that it is only slightly harder than Regents. Student #22 wrote, "I think that the honors is just a little harder work," and Student #5 wrote, "It is just a little harder." Two honors students (Student #15 and #17) held similar positions that honors is neither easy nor hard, but they did consider honors to be a challenge; Student #15 said, "The honors program is a challenge…The work varies. Sometimes it's hard but not all of the time," and Student #17 said, "The honors

Table 3.2 Question 2 Themes: Comments on the honors program

Theme:	*# of honors students*	*# of Regents students*	*# of students total*
Difficulty	9	4	13
Easy	5	1	6
A little harder or sometimes hard	2	2	4
Hard	2	1	3
Preparation or Abilities Needed	6	2	8
"Good at math" or smart	2	1	3
Like or can handle more work	2	0	2
Previous courses and success	1	1	2
Access to extra help at home	1	0	1
Amount of Work	4	4	8
A little more work	1	1	2
"More work"	3	2	5
"More work than ever thought possible"	0	1	1
Content	5	1	6
"More regular math"	2	0	2
Exponents and/or factoring	2	0	2
"Only place you will learn"	1	0	1
"Learn just as much" in Regents	0	1	1
Other Reasons to Take Honors	2	1	3
Be with other honors kids	1	0	1
"It sucks either way"	1	0	1
College applications	0	1	1

is sometimes challenging…I honestly don't think that honors makes much of a difference." The remaining three students commented that the honors program is difficult. All three of those students spent some time in the honors program; at the time of the survey, two were in the program and one had been "kicked out" (Student #31) of the program. Their comments were "If you really want to challenge yourself go for honors credit" (Student #12), "Honors is hard and gives you harder tests"

(Student #25), and "Math 9 honors was way too hard, and I got kicked out" (Student #31).

Another commonly mentioned theme is the Preparation or Abilities Needed to succeed in honors program. Because Question 2 asked students to give advice to an eighth grader that would help him/her decide whether or not to take honors, many mentioned certain preparation, innate abilities, and/or circumstances that seem to be necessary qualifications of honors students. Two honors students and one Regents student commented that students need to be "smart" or "good at math" to take honors. The honors students wrote, "Only do it if you are very smart" (Student #25) and "You should take it if you are good at math and want a challenge" (Student #15). The Regents student (Student #22) wrote, "I don't take honors because I am not very good at math." He/she does not explicitly state that others must be good at math to be in the honors program, but he/she implies that being good at math is a necessary quality because she uses it as the reason he/she did not sign up for honors. Two honors students believe students should take honors if they are willing and able to do additional work; Student #19 said, "I would definitely suggest taking honors if you think you are able to handle a little more work," and Student #23 said, "The honors program is best for people who like to do more work." Two other students, one honors student and one Regents student, believed that students should base their decisions on which math courses they have taken or their success in their previous courses. Student #1, an honors student, was concerned that students have enough background in specific content areas; he/she wrote, "If the person has already taken the enriched math course in 8th grade, they should be ok…[The enriched course in 8th grade] would have given them enough background in exponents and factoring to do well in the honors portion." Student #11 seemed to believe that previous success in math was an important factor in the decision, although he/she suggested looking at

their success at the beginning of Math 9; he/she wrote, "Do honors if you have an A or B in Regents." One honors student made a unique assertion about a necessary circumstance for students who want to do honors. Student #17 wrote, "I would not recommend it if there is not someone at home who is able to help or have free time after school."

A theme mentioned just as frequently as Preparation/Abilities Needed was the Amount of Work in honors. Most comments about the amount of work were comparisons to the Regents portion of the course. Five of the eight students who addressed this theme simply stated that honors is "more work" or has "extra work;" three of those students were honors students and two were Regents students. Two students, one honors student and one Regents student, wrote that the honors program is "a little more work" (Student #19, honors student) or "not a lot more homework" (Student #5, Regents student). Finally, one Regents student believed that honors is an enormous amount of work; Student #14 wrote, "There will be more work than ever thought possible."

The fourth most common theme of Question 2 was Content. Six students discussed aspects of the content that is covered in honors. Two honors students compared honors content to Regents content; they saw the honors content as more similar to traditional math. Student #18 wrote, "I would encourage them to take Honors b/c its more regular math." Student #17 wrote, "If you are someone who likes more straight forward, blackboard/textbook math then you might find the honors program very enjoyable." Two other honors students mentioned specific topics that were covered in honors; Student #1 wrote "The honors portion is working with exponents and factoring," and Student #10 wrote, "All you do is factoring the <u>whole</u> year." The final two students, one honors student and one Regents student, did not explicitly write about the content of the course, but they discussed how much students

learn in honors. The Regents student (Student #16) wrote, "You learn just as much when you don't take honors," while the honors student (Student #30) wrote, "Honors is the only place you will learn anything." I decided to classify such responses under Content because both statements imply certain opinions about the honors content in comparison to the Regents content. Student #16 seemed to believe that there is no additional, substantial content in honors that is not in Regents, and Student #30 seemed to believe that there was worthwhile, new content in honors, but not in Regents.

The final theme mentioned in Question 2 was Other Reasons to Take Honors. Three students offered reasons why students might want to take honors that did not fit under any other theme, but seemed worthy of mentioning. Student #19, an honors student, wrote, "Once a week you go to separate classroom during your regular math period and do harder work with other kids! I would suggest taking Honors!!" His/her mention of "other kids" is particularly noteworthy when one also considers his/her response to Question 1: "If you are an Honors student you are in a classroom with other 9th graders that might not be as able as you are. If you are a Regents math student you will benefit much more than Honors students." This student seems frustrated by the lower-ability levels of her peers; thus, her reference to being with "other kids" seems to be a significant benefit of the honors program. Another honors student gave a much more negative response; Student #21 wrote, "You might as well. It sucks either way." To this student, one reason to take honors is that the class is bad regardless; thus, one might as well get honors credit. Finally, one Regents student (Student #16) suggested, "Only take honors if you think it will make your college applications look better."

Chapter 4: Student Interviews

4.1 Design

From the beginning of my study, I planned on interviewing some students to get detailed information about their perspectives on Math 9. I wrote an interview guide and began looking for volunteers. One teacher allowed me to ask for volunteers in his class, and I interviewed one student volunteer. However, during this process of trying to find students to interview, I decided to get a broader view of students' opinions by doing student surveys before doing additional interviews. On these surveys, I asked for more volunteers for interviews, and I hoped that I could use these interviews to help me clarify opinions and ideas that students wrote about on the surveys.

After the surveys, I interviewed four students who volunteered on their survey. I used an interview guide to ensure that I covered certain topics in each interview, but I did not write a script for the interviews. I started each interview with an open-ended question, and I asked follow-up questions. The order and specific content of my questions varied based on the responses of my interviewee. Thus, the interviews were conversational, and I could pursue whatever paths were most relevant for each interviewee. As in my surveys, my goal was to discover what was important to the students. I wanted to find out what questions and issues were important to them, not to hear answers to the questions that I thought would be important.

I had slightly different questions for honors students and for Regents students, so I made two interview guides. With both groups, I planned on using the opening question, "If an eighth grader asked you to describe Math 9 to him or her, what would you say?"

For Regents students, I also wanted to cover the following areas during the interview:

1. *Is the class challenging for you? Is it easy for you? How is the workload?*
2. *If an eighth grader wanted to know whether or not he or she should take Math 9 for honors credit, what would you tell him or her? From your perspective, as a Regents student, what is the honors program like?*
3. *Did you consider signing up for honors? Why do you think other people did sign up for it?*
4. *When the honors students leave the classroom, is class time useful?*
5. *Do you work with honors students in class or outside of class? Do you work with other Regents students?*
6. *Anything else you want to share?*

For honors students, I wanted to cover a similar set of questions:

1. *Is the class challenging for you? Is it easy for you? How is the workload?*
2. *Describe the honors program to an eighth grader who is considering whether or not to take Math 9 for honors credit.*
3. *Why did you sign up for honors? Why do you think that others did not?*
4. *Does the honors program make Math 9 more challenging for you?*
5. *Do you get enough support or help with the honors material?*
6. *Do you work with Regents students in class or outside of class? Do you work with other honors students?*
7. *Overall, do you feel like you are getting an honors level education in your Math 9 class?*

After interviewing students, I assigned a pseudonym to each student and transcribed the complete interviews. I read through each interview multiple times, underlining substantive comments and making notes in the margins about the contents of these comments. I compiled most of these comments into six themes that were each mentioned by multiple students.

Two of the interviewees, Jason and George, were honors students. One, Rachel, was an honors student who dropped out of the honors portion after three quarters of the school year. Two, Diane and Alexis, were Regents students. Because Rachel was an honors student for most of the year, I will frequently refer to my interviewees as being three honors students and two Regents students.

4.2 Summary of results

Because each interview was structured differently, I will not summarize results by considering students' answers to each interview guide question separately. Instead, I will describe and summarize the six prominent themes in the interviews: Perception of Honors as a Separate Course, Expectation that the Honors and Regents Work be Related, Students' Perception of Mathematics and Its Impact on Their Views of Math 9, How to Decide Whether or Not to Take Honors, Reaction to Working in a Heterogeneous Classroom, and Difficulty Level.

Table 4.1 Prominent Themes from Student Interviews

1. Perception of Honors as a Separate Course
2. Expectation that the Honors and Regents Work be Related
3. Students' Perception of Mathematics and Its Impact on Their Views of Math 9
4. How to Decide Whether or Not to Take Honors
5. Reaction to Working in a Heterogeneous Classroom
6. Difficulty Level

4.2.1 Perception of honors as a separate course

The three honors students seemed to perceive the honors portion of Math 9 as a separate course that some students attended one day per week. This perception was most evident in the interviews of two students, Jason and Rachel. At the beginning of my interview with Jason, I asked him to describe his class. He said, "I thought it was

pretty easy… At least the Regents that I was in. The honors was a little bit difficult. If an eighth grader had the option and they think they could do it, just the honors, if that was a possibility." Jason discussed the Regents and honors as separate courses. One was easy for him, and the other was a little bit difficult. He described his experience as taking two courses within Math 9, and he recommended that others take only the honors course, not the Regents course, if they have that option. He reiterated this perception when I asked him whether he thinks he has gotten an honors level education in Math 9; he responded, "Well, it's only like *(short exasperated laugh)*, it's once a week, I mean, so throughout the whole year I've only been there, well there's 40 weeks in the school, so I've only had those classes 40 days. So, it doesn't feel like an honors class because you're not in it every day." Thus, he did not think his Math 9 course was overall an honors course. Instead he saw Math 9 as a Regents course that was supplemented by 40 days of an honors course. In fact, when I mentioned the honors designation that will appear on his transcript, he said, "Yeah, *(chuckle)* which is kind of nice because I got honors for a Regents class." I responded with, "But you feel like it's still a Regents class?," and he replied, "Yeah. Well, cause it is. I take both." Jason may have viewed Math 9 as a Regents course with a small honors supplement in part because the honors material seemed unrelated to the rest of the course. He described the honors material as "pretty much totally different than what we were doing in the Regents class. We have a separate thing at the end of the test that is what we do, and it really doesn't have anything to do with the others, or the Regents test." Because his honors work did not relate to the Regents work, he may have felt that an honors level course would only do material from the honors days; thus, he believed that, by going to honors once per week, he only completed one-fifth of a normal honors course.

Rachel had a similar perception of the honors program. She discussed the separation between honors and Regents at some length. Rachel was an honors student who left the honors program late in the year. When I asked her why she left, she said, "It was difficult. Like I really did not understand any of what we were doing … Regents is way too easy for me. I'm sitting in there knowing everything, and I just get annoyed. But the honors, when you're only there once per week, you don't really get the effect of learning everything. You learn one concept, then you have a worksheet to do, and if you need help you can get it, but you still have to do the other stuff." She described honors and Regents as having "no connection," and when I asked her if she thought she was getting an honors level education in the honors program, she said, "I feel like what I got was, I got a Regents education with a tiny little hint of honors… But in the end of the year, it counts just the same as an honors class. How is that fair? Well, it's not fair. I go to one class every 5 days." Like Jason, she saw honors as a one-day per week supplement that was tacked on to a regular Regents course. From her perspective, she had not been taking a full honors course; she was taking one-fifth of an honors course. She reiterated this position, saying, "It wasn't an honors education. I would feel almost bad taking… saying 'I took honors.' Like, you really didn't. You took an honors extra class. How much did that help you?"

George, the other honors student that I interviewed, also implied that the honors program was a course separate from the Regents course, although he did not discuss it explicitly. He talked about them as separate courses, saying, "I'm more bored in Regents, and less bored in the honors." That statement is consistent with Jason's and Rachel's perception that they take two math classes; one Regents course that they attend four days per week, and one honors course that they attend once per week. When I asked him about whether or not the honors designation of the course on his transcript seemed appropriate, he said, "Yeah, because you learn more than the

other class." His use of the phrase "other class" seems to refer to the Regents students in Math 9, implying that Regents and honors students take separate courses. However, he did believe that his course warranted an honors designation; this opinion suggests that he did not share Jason's and Rachel's belief that they had only completed a fraction of an honors course.

It was not clear from my interviews with the two Regents students whether or not they shared this perception of honors as separate course from the Regents course. Diane did say that honors was "more homework and it's harder," but she did not discuss it as a separate course. She talked about additional work that honors students do, but she talked about it as an extension the regular course material. She said, "You do all the same work that the Regents do, only you take the work a step farther…"

4.2.2 Expectation that the honors and Regents work be related

The perception of the honors program as a separate course seemed to relate to students' general expectation that the honors and Regents work should or would be connected. This expectation emerged in different ways in my discussions with Regents and with honors students. The Regents students revealed this expectation in their descriptions of the honors program. As I quoted in part above, Diane believed that in honors "you do all the same work that Regents do, only you take the work a step farther and learn a couple new equations. And the only time you use them is on tests, you have a couple extra problems. And it's more homework and it's harder, but I don't see a big difference between Regents and honors." Diane described the honors material as emanating from the Regents material. She thought that honors students took the "work a step farther," and that honors was an extension of the Regents course. Alexis, the other Regents students, also believed that honors students learned math that directly related to what they learned in the Regents part of the course. When I asked her to describe the honors program, she said, "You learn how to solve equations

differently than like we do. So we learn the easy way, and you learn the hard way. So you learn two different ways to solve the equations." Alexis, like Diane, saw the honors work as similar to, but more difficult or complex than, the Regents work.

The honors students were obviously more familiar with the content of the honors work, and at least one of them also expected Regents and honors material to be connected. Rachel revealed this expectation by discussing how the honors program did not meet that expectation for her. She repeatedly described the Regents and honors work as having "no connections," and when I asked her advice for teachers, she said, "maybe give the kids, like, I don't even know because they made this so incredibly separate, I don't know, maybe mix them in some way… like, instead of having a separate honors sheet, make them the same sort of questions with harder problems. Like, do this much extra work on this problem." Rachel saw honors and Regents material as disjointed, and she expressed frustration at the lack of connections. In fact, she thought that connections would help honors students learn the Regents material. Our conversation continued,

> **Rachel**: …have like, instead of having a separate honors sheet, make them the same sort of questions with harder problems. Like, do this much extra work on this problem.
> **Cynthia**: I see. So fit it within the context of a Regents problem?
> **R**: Right.
> **C**: Or have a problem that similar to the Regents problems [**R**: But harder] but you have to use the honors material.
> **R**: Right. Like we'd be doing geometry, and we wouldn't be doing geometry in honors. We'd be doing like other stuff.
> **C**: But if you could be doing geometry over there [**R**: It would be] it would have helped you?
> **R**: Right, it would help you with your easier stuff.

Rachel clearly wanted Regents and honors work to be related, and the lack of connection seemed to contribute to her decision to leave the honors program. When I asked her if she would recommend honors to a future Math 9 student, she said, "If you can leave a classroom, learn something for one day, have a little bit of practice, and the next week be prepared to learn something else. Well, yeah. And it doesn't seem like it's that big of a transition and everything, but it really is a big deal."

The disjoint nature of Regents and honors may have contributed to Rachel's feeling that she was only taking an honors class one day per week. If the different material in the honors portion was designated as "honors" mathematics, then she might think that a normal ninth-grade honors course would have nothing to do with what she learns the Regents portion of the class. Thus, she might feel that she learns honors material only once per week. If this disconnect is a source of this perception, Jason too may have had the expectation that honors and Regents would relate if they were considered as one combined course.

George, the other honors student, offered a substantially different view of the honors material, and it was not clear whether or not he expected the honors and Regents material to relate. At times during the interview, he seemed to imply that the material in the two portions of the course did relate. He said of the honors tests, "It's like a step more harder than the Regents." He also made a statement that might imply that the honors material helped him learn the Regents material; he said, "It's just like, 'Uhh, come on.' *(tone of frustrated impatience)* Cause like, since I'm in the honors, it's like once you get back here, you've already learned this stuff, so it's just like, 'Oh, come on, I already learned this stuff.'" There are at least two possible reasons that George's descriptions of honors seemed so different from Rachel's and Jason's. One possibility is that his statements were not meant to imply similarity between the material. By "a step more harder," he might have meant that the honors work is

slightly more difficult, but not that it is related to the Regents work. In the second quote, "since I'm in the honors, … you've already learned this stuff" might have meant that honors students understand the material the first time; after they meet separately with other honors students, they return, and the class is covering the same material that was discussed before their honors day. Another plausible explanation is that the honors portion of Math 9 was slightly different at the time I interviewed George. He was the first student I interviewed, and I interviewed him months before the other students. Although the honors material that I observed (and that teachers described in their surveys) was consistent with Rachel's and Jason's descriptions, the honors work might have been different in the first half of the year, before I began spending time in their school.

4.2.3 Students' perception of mathematics and its impact on their views of Math 9

The third theme from the interviews was Students' Perception of Mathematics and Its Impact on Their Views of Math 9. Students frequently mentioned ways in which Math 9 did or did not match their expectations for a math class, and their views of mathematics had a substantial impact on their opinions of Math 9. Most of these comments related to ways in which the work from the CMC textbook differed from their previous math courses.

In particular, some of the students specifically mentioned the writing and explaining that they had to do. George described "book problems," saying, "The bad thing about them is that it's sort of like English. It's like, um, you just have to write a lot, like paragraphs. It's not actually math. You have to write a lot and explain these things." George did not like doing problems in his textbook because he did not like writing and explaining. Furthermore, he did not think that writing and explaining are a part of math. Later in the interview I asked George to compare Math 9 to his previous math classes:

> **Cynthia**: How does this compare to math courses in previous years?
> **George**: It's *(chuckle)*… They're way apart. It's like… Yeah, in earlier math classes, we just did formulas and stuff. Now we're just learning how to, uh, what like what the actual formulas mean. So we don't really get to use formulas.
> **C**: Which do you like better?
> **G**: I like using the formulas.
> C: You like using the formulas.
> **G**: Instead of writing.
> **C**: And that's why you don't like the writing.
> **G**: Yeah, cause I don't like to explain them.

George seems to expect to learn formulas and to use formulas in math classes. He does not want to learn what the formulas mean or to explain or write about mathematics. George preferred his old math classes and did not like the change that Math 9 provided.

Alexis shared some of George's feelings. When I asked her to describe her class to a future Math 9 students, she said, "I would say, be prepared to write a lot because you have to explain everything you do." Since writing and explaining were the first features of the course that she mentioned, they seemed to be fundamental to her view of the course. After a brief discussion of the difficulty of the class, I asked her, "You said you have to explain everything. Is the workload of the class, is it a lot of work? Because you have to explain everything, does it make more work?" She responded, "It's just annoying because you don't think you have to explain everything in math." Alexis recognized that the class did not fit her expectations for a math class, and she was somewhat frustrated. Writing and explaining seemed to be a burden for her, and she was annoyed that this requirement had been added to her math class.

Diane also thought that Math 9 was different from her previous math courses. I began the interview by asking her what she would say to a student who was going to take Math 9 next year, and she replied, "I'd tell them that I didn't really like it, but it's, I guess it's a good program… but it's not like, I don't know, it's not like the best

course. I'd rather take like Course 1 or 2, like regular math that I understand." When I asked her why she did not like it, she said, "It's different … It's not what we've ever learned in school before." She did not think of Math 9 as "regular math," and she preferred taking math classes that were more similar to her previous experiences. I asked her to explain why she thought it was "a good program," and she explained, "I do think it's good in a way because you're learning how to use like calculators and things for later on, and it's a new course to try, and you should try new things." Diane saw benefits of this different course, although she preferred math classes that fit her expectations.

Rachel complained about the differences between Math 9 and more traditional math classes, and she was quite specific about why she believed that Math 9 was not a good course for her and many other students. When I asked her what she would tell an eighth grader about her class, she said, "I **hate** it. I think it's ridiculous. Because, if Bob has four apples and Suzy has three apples, and they get an apple a day, how many apples will they have in a week? Well, who cares how many apples Bob and Suzy have? How about if you just give me a worksheet, and I'll do the math." Rachel did not like that she had to do problems that were in "real-life" contexts, and she seemed to think that those contexts are not part of mathematics. She went on to explain why she did not like these types of problems. She said, "It's just. It doesn't help. I think that the problem was designed to have real-life situations because kids are always asking, 'well, when am I going to use this?' But we still aren't going to use it. Because in real life, how many jobs are going to have to do with apples?" She recognized that teachers were trying to make mathematics more relevant and useful to students, but she did not think that her class achieved that goal. The contexts did not seem real or useful to her, and she would have preferred leaving them out and

focusing on what she thought of as the real math in the problems. She felt so strong about this issue that she continued discussing it for some time:

> And I hate the way that there was no choice. I had to be in that. I had absolutely no choice. I couldn't be in regular Math 9, which is what I wanted. I did not want to have to be in this class. When we get worksheets like this *(pointing to a recent worksheet that was structured more traditionally)*, I love it. I don't like the way they say, 'Alan and Josh are separately driving south on Route 81.' I hate that. I mean those kinds of problems, I know they have those in regular math and everything, but like all of this and stuff *(contextual stuff)*, no one cares, just skip the crap and ask me the question. It's a lot of extra work that doesn't help.

She again spoke of teachers intentions and the actual outcome, saying, "I think it was also made to want us to do something, to actually be interested in math, and now it's just boring kids."

Jason recognized that his Math 9 course was different from standard high school math classes, and he was concerned about how it would affect his future in mathematics. Towards the end of the interview, I asked him if there were anything else that he wanted to share, and he said,

> Well, when I, like during the beginning of the year, I was a little unsure of the program because really I hadn't dealt with any kind of things, maybe I wouldn't know, based on the future, what you do learn in like precalculus and stuff like that. I have older brothers, so I've seen it before, and I don't understand how this program is going to lead us into that because we don't really work with anything that's similar to that, except for like in the honors part, which is, like I said, it's really totally different from the Regents part…

Jason knew that the math he was learning did not look like the math that his older brothers did later in high school. He worried that his class would not prepare him for the future. He continued, "I'm not sure if it's going to help us… Or if it's going to end up being bad for us." Jason did not complain about having to do work that did not fit

his expectations for math classes, but he feared that he was not learning what he would need to know when he returned to classes that fit those original expectations.

4.2.4 How to decide whether or not to take honors

The fourth theme that students discussed was How to Decide Whether or Not to Take Honors. Four of their five students mentioned that performance in previous math classes had an impact on students' decisions. When I asked Jason why he signed up for honors, he said that he thought he should have taken more advanced courses than he did in middle school. He explained,

> Well, I had made the mistake of not taking, uh, going into 7th grade and 8th grade, I wasn't sure I'd be able to handle the advanced course, which I could have, but at the time I didn't know, and it ended up being a mistake because the advanced course was the same thing as the course that I was in. There wasn't any difference, except they just got to go ahead a year. This year, to Course 2, and we got put in the new program.

Jason wished that he had chosen to be accelerated in middle school so that he would be one year ahead, as some of his peers were. Since he believed that he should have gone into advanced courses before, it made sense for him to try the honors program in Math 9. Rachel also based her decision partially on her middle school math experiences, in particular on the recommendation of her eighth grade teacher. Rachel said, "I was talking to my math teacher last year, and she was like, definitely take honors, you'll definitely be able to handle it." When I asked her why others did not sign up for honors, she said, "I think a lot of the kids, their teachers didn't recommend them for it. Um, they didn't think they were good enough for it."

The two Regents students that I interviewed did use their past performance in math classes to decide not to take honors. When I asked Diane why she did not sign up for it, she said, "math was never my strongest subject, so I like didn't want to take it." When I asked Alexis, the other Regents student, how she would suggest future

students make the decision, she said, “If you didn’t do well in eighth grade, which I didn’t do well with math, then I wouldn’t take it,” and she later said that she did not even consider signing up for honors.

Students also saw other factors to consider. Two students specifically mentioned honors credit as motivation. George explained why he signed up for honors by saying, “I wanted the honors credit because, um, I just wanted more credit towards like college and everything.” Diane mentioned honors credit as a reason why other people signed up for the honors program. I asked her why she thought some students signed up, and she said, “Probably to get honors credit.”

Jason described a few more reasons to sign up for honors when I asked him, “Do you have any sense for why some people signed up for it and why other people didn’t?” He first said, “Maybe some people were, uh, more, uh, ambitious or something, and some people just didn’t feel like doing it or didn’t feel like going ahead.” He believed that ambition and a desire to accelerate through more material were reasons that at least some of the honors students, maybe or maybe not including him, signed up for the program. He went on to describe those that did not sign up, saying, “Some people don’t feel like it. Maybe they’re lazy.” In response to another question later in the interview, he reiterated this idea a bit more firmly: “Maybe honors people maybe understand it a little bit better, because they’re not incredibly lazy… Not to call the other kids lazy, but...” This response gave me the impression that, although he was a bit reluctant to say it, he felt that the Regents students were not doing as much work and/or not doing as well because they were lazy. Thus, they chose not to sign up for honors so that they could avoid additional work.

Alexis reiterated some of Jason’s ideas. When I asked if her fellow Regents students did not sign up for honors for the same reason that she did not (i.e., because of previous performance in math classes), she said, “Some of them, yeah. Some of

them just didn't want to do the extra stuff." She believed that others did sign up for honors "because the Regents was too easy, and they needed something to challenge them."

Two of the students commented that they think more students should try taking honors. When talking about students who did not sign up for honors, Rachel said, "They didn't think they were good enough for it. Which, I really think that pretty much everyone could have been in there, at least in the first half of the year. And then as soon as I got to the second half, I was just so confused." I asked her whether or not she would recommend that most students try it out, and she said, "Oh, definitely, cause it's not hard. It wasn't difficult." She explained that she decided to drop it because "there was no connection" and "it didn't give us enough time to practice." Diane, who did not sign up for honors, wished she had attempted it. When I asked her why she did not take honors, she said, "Math was never my strongest subject, so I like didn't want to take it, but now if I were to go back and take it, I think I would just because it's not really different. They are always in the class with us, mostly, they do the same work, they just take it a step farther." Because she saw honors and Regents as similar, she thought that taking honors would not have been too difficult after all.

Rachel mentioned one additional factor that students should consider. She said that she left the honors program because its structure did not give her enough time to practice the honors material. She said, "I'm smart enough to do it. I'm not smart enough to do it once every 5 days because there's no practice." Thus, instead of focusing on whether students were "smart enough" to take honors, she stressed that the students have to be willing to endure the disjointed material and the small amount of honors class time. When I asked if she recommend that others take honors, she said, "Well, it's based on their personal, like who they are. If you can leave a

classroom, learn something for one day, have a little bit of practice, and the next week be prepared to learn something else. Well, yeah."

4.2.5 Reaction to working in a heterogeneous classroom

The fifth theme that students mentioned was their Reaction to Working in a Heterogeneous Classroom. The two Regents students had primarily positive feelings about the heterogeneity of Math 9. I asked Alexis what she thought about working in groups of both honors and Regents students. She said, "I think it works well because if you don't know something, then the honors student is going to know something. If they don't know something, then the teacher's going to know something. I think it's useful." Alexis enjoyed having students around who could help her. She seemed to think that she did not have to ask the teacher for help as frequently. Diane also felt that working with a mixed group of student was useful. She said,

> I like working with honors students, you know, like in the groups, when we're doing it, because I'm always like, I always get help from the honors kids, I guess, when we're in small groups. And sometimes it's frustrating because sometimes people are below you and you can't go as fast. Um, and some people are ahead of you, so. I think it balances out. We all help each other out.

Although both Diane and Alexis thought that working in mixed groups was helpful, they also appreciated the days when honors students left the classroom. I asked both of them whether or not those days were useful for them. Diane said, "Yeah, a lot more useful, I think… I find that you get more one-on-one time, and you get to ask more questions, and it's a lot, I like class a lot better when it's, because I feel like, since they took it a step farther, then they're ahead of us, and you know, we don't really spend enough time on what we're learning, I guess. So I like class better then." Alexis had a similar opinion; she said, "I think it's more useful then because there's less people, so you can get one-on-one stuff."

The honors students had more varying opinions about the heterogeneity of the class, although all three of them did express at least some frustration with it. Jason seemed to be the least frustrated of the three. When I asked him about what it was like to have Regents and honors students all in the same class, he said,

> It's not a **problem**, I mean, uh, no, I mean it's the same. Everybody's usually the same when we're in the class together. It's just some people leave on Thursdays to go into the honors, and some people don't. Some people don't, but when we're all together… Uh, I think, sometimes, uh, maybe honors people maybe understand it a little bit better because they're not incredibly lazy. Not to call the other kids lazy, but…

Jason did believe that the honors students learned the material better than the Regents students, and he attributed this to the laziness of Regents students. However, overall, he did not think it was a problem to have everyone in one room because they were all learning the same material. George talked about being bored in class and said, "It's just like, 'Uhh, come on.' *(tone of frustrated impatience)* Cause like, since I'm in the honors, it's like once you get back here, you've already learned this stuff, so it's just like, 'Oh, come on, I already learned this stuff.'" He got anxious when he, and possibly other honors students, already understood the material.

Rachel was particularly upset by the heterogeneity of the class. She shared George's feeling of being bored in class. She said, "Regents is way too easy for me. I'm sitting in there knowing everything, and I just get annoyed." When I specifically asked her if it worked well to have Regents and honors students together in one class, she said, "Not really. Because the Regents kids are getting cheated out of their education." I asked her to explain, and she responded,

> **Rachel**: You have, in my group at the beginning of the year, it was two Regents kids and two honors kids…there was me and this kid ---- *(name omitted)*. We were both in honors classes. These other kids were in Regents. When they needed help with something, we'd give them help. But when there was a problem or

> something, we'd fire it off, and they wouldn't have time to finish because our group was done. And then they were just like 'alright, then explain it to me then,' so we'd explain it, but they didn't actually do the math. They weren't getting the work that they needed.
> **Cynthia**: So you'd get ahead of them
> **R**: Right. Because we were faster. We had more practice. We knew what we were doing.

Rachel's perception was that, although she was frequently bored in class, many Regents students were not learning what they should be because honors students got ahead of them. She seemed to believe that this was a substantial injustice, stating it dramatically by saying that they "are getting cheated out of their education."

4.2.6 Difficulty level

The final theme from student interviews was the Difficulty Level of the course. The two Regents students were satisfied by its difficulty. Diane implied that she had some difficulty with Math 9 when she said, "And it's not **a lot** of homework, but it's not like, I don't know, it's not like the best course. I'd rather take like Course 1 or 2, like regular math that I understand." However, when I specifically asked her about the difficulty of the class she said, "It's only hard when you don't stay up with the work… If you let yourself get behind, or if you don't understand it and you just like give up I guess. But it's pretty easy if you keep going along with the work and get help." Alexis echoed this feeling by saying, "Yeah, it's not super hard if you listen and do your homework, you can get it usually." She did explain that the earlier part of the year was more difficult for her: "Um, the first part of it, I was in a different class in the first part of the year. And I wasn't doing very well then [**Cynthia**: But it was another Math 9 class?] Yeah, just a different teacher. But when I moved into this class, I don't know, I started to understand everything better, I don't know."

All three of the honors students made some comments about the course being easy. At the beginning of our interview, when I asked him to describe the course, Jason said, "Overall, I thought it was pretty easy… At least the Regents that I was in.

The honors was a little bit difficult." Later, I asked him if honors made the course more challenging for him, and he said, "A little bit." When I asked him if he were bored during the Regents portions of the class, he said, "At times. There was only one or two units this year, like the past 2, that I hadn't dealt with yet." He thought that the course was easy, in part because much of it was review. Jason also talked about the ease with which he did his homework; he said, "It was actually kind of nice because I could get it out of the way usually during my lunch period and I wouldn't have to do later." At the end of the interview, when he was expressing concerns about his preparation for future courses, I asked him whether he liked his Math 9 class more or less than his previous, traditional math courses. He said, "I liked it more in the sense that it was kind of easy, and it didn't take a lot of effort, but, uh, the fact that I don't know if it's going to benefit me or not, kind of…" Jason enjoyed that the class was not difficult for him, although he worried about the long term effects.

George also felt that the class was easy, although he did not share Jason's opinion that the homework required little effort. When I asked George whether or not the class was challenging for him, he said, "Some of the things are easy and some of the things are difficult, but it's basically more easy." Later in the interview, he said, "I'm more bored in the Regents, and less bored in the honors." He complained about spending class time on material that he already understood: "It's just like, 'Uhh, come on.' *(tone of frustrated impatience)* Cause like, since I'm in the honors, it's like once you get back here, you've already learned this stuff, so it's just like, 'Oh, come on, I already learned this stuff.'" I also specifically asked George about the pace of the course, and he said, "I guess it's about average, but I think it's going a little too slowly." However, unlike Jason, George did complain about the amount of work in the class. He said, "You have to write a lot and explain these things. So I don't really

like the homework, but I get it done. It's easy." He also explained that the homework "takes a long time."

Rachel had strong, but opposite, opinions about the difficulty of the Regents portion and the honors portion of Math 9. She said, "Regents is way too easy for me. I'm sitting in there knowing everything, and I just get annoyed." She described the CMC material (covered in the Regents part of the course) by saying,

> **Rachel**: I think was also made to want us to do something, to actually be interested in math, and now it's just boring kids. Because either you don't know this stuff, or you did it back in 6th grade.
> **Cynthia**: Ok, so some it seems like review?]
> **Rachel: All of it** seems like review… except for like the Now-Next equations, and, cause like when are we going to use those? Never. And, um, the calculators. I really can't think of anything else that we hadn't done before.

Despite her feelings about the Regents part of the course, she decided to drop out of honors because "you learn one concept, then you have a worksheet to do, and if you need help you can get it, but you still have to do the other stuff. So they throw a lot of information on you and expect you to know it when you don't really have time." She did not think that she got enough practice with the honors material, and she said, "If I was still in honors, I would have seriously failed that test at the end of the year. Because I didn't know what I was doing." She attributes her difficulty to the lack of time spent in class, not towards any difficulty that she has with math. She seemed to defend her abilities; she said, "I'm smart enough to do it. I'm not smart enough to do it once every 5 days because there's no practice," and "I don't spend a lot of time on math. It's not hard for me." Towards the end of the interview, Rachel summarized her thoughts about the difficulty of Math 9, saying, "The honors people don't benefit because they're not being pushed hard enough four out of five days. They don't benefit because one day they're being pushed way too hard and don't get any help."

She was frustrated that the Regents portion of the course was boring and easy for her, while the honors portion was too difficult because it was too rushed and disjointed.

Chapter 5: Teacher Survey

5.1 Design

As I studied the Math 9 classes, I had a lot of questions for teachers. I wanted to know what their goals for the course were, how they thought their students were affected by the program, and how they thought the program was working for students and teachers. In general, I wanted to see their perspective on Math 9. From the early stages of this project, I received informal input from some teachers. I observed conversations about Math 9 at a summer workshop, and I discussed the course at length with the department chair and a couple of other teachers. However, I got a limited perspective from these informal impressions. I needed a way to get detailed information from many teachers. Extensive interviews with teachers were infeasible, so I designed a teacher survey that could give me input from a wide range of teachers.

The survey consisted of eight open-ended questions, some with multiple parts. I tried to administer the survey in a way that was both anonymous and convenient for teachers. I gave each teacher a hard copy of the survey to fill it out at his/her convenience and to return to a folder in the math department office. The surveys could be completely anonymous; I did not ask for their names or any identifying characteristics. Recognizing that some teachers might not feel comfortable leaving a completed survey in their department (even though I was the person picking up the surveys), I also offered them the option of mailing the hard copy to me. For those who preferred email, and did not mind revealing their identity to me, I also emailed the survey to the teachers so that they could reply with a response.

I began the survey with a two-part question that was virtually identical to the questions on the student survey:

1. *a. Describe your class to an eighth grader who will be taking it next year so that they have a better idea of what to expect.*

b. Describe the honors program to an eighth grader who is trying to decide whether or not they should take Math 9 for honors credit.

I included these questions to give teachers an opportunity to describe what they saw as important elements of their course. They could highlight the changes that they believe would be most surprising, unexpected, or relevant to new students. I also saw this question as an opportunity to compare students' and teachers' responses to such an open-ended question. I hoped that the question might reveal the similarities and differences between what is important to students and what teachers think is important to students.

The other questions in my survey were more direct. Because I could make a longer survey for teachers than for students, I did not feel limited to a few, broad questions. I chose direct questions because teachers have the maturity and insight to respond to more abstract questions than high school students do. For example, in the second question, I asked about why the course had changed. Teachers, including those who were not active in the department's decision-making, had probably considered this issue before, and if they had not, they could reflect on it thoroughly enough to answer the question thoughtfully.

In the second question, I specifically highlighted the purpose of the changes to ninth grade math:

2. *a. In your opinion, what was the purpose of changing the ninth grade math course this year?*

   b. To what extent do you think the new course achieved the purpose you identified in part (a)?

As I studied Math 9, I realized that there may be many reasons that the changes were made, and I wondered if teachers would disagree on their department's rationale. Asking about the degree to which the course achieved its purposed gave the teachers an opportunity to compare the course's goals to its outcomes.

In the third question, I solicited more details about the success of the course by

asking teachers to think of particular students who either benefited or where harmed by the changes:

3. *a. Which students (if any) do you think have benefited from the changes? In what ways did they benefit?*

   b. Do you think any students have been negatively affected by the changes? In what ways have they been negatively affected?

In the fourth question, I asked about the teachers' professional development for the new course and whether or not they thought that it was sufficient training.

4. *a. Did you participate in the one-week summer workshop?*

   b. Was it sufficient training to prepare you for this year? Please explain why or why not.

The fifth question was similar to the second, although I asked specifically about the goals and success of the honors program.

5. *a. In your opinion, what was the purpose of offering honors credit for this course?*

   b. To what extent do you think the honors program achieved the purpose you identified?

I purposely asked this question after question #3 so that teachers would not think that they necessarily had to consider honors students and Regents students in opposition to each other; I did not want them to limit themselves to thinking about whether honors students benefit and/or whether Regents students benefited. I wanted to give them the freedom to group students in other ways; for example, a teacher might believe that this new course benefited students who had strong language skills, while harming students who have weaknesses in reading and writing.

The sixth and seventh questions asked teachers to highlight some positive and negative features of Math 9:

6. *What is valuable about the current Math 9 course?*
7. *If you could make changes to any aspects of the course, what would they be and why?*

For some teachers, these questions could be redundant, as they might feel that they have addressed these issues sufficiently in previous questions. However, I wanted to give them additional opportunities to add other opinions towards the end of the survey.

I included the final question specifically at the request of teachers. The department was interested in how their floater program had worked; thus, I asked teachers and floaters for their input:

8. a. ***Math 9 Classroom Teachers:*** *Has having a floater been useful? What could be done next year to make the floaters more useful?*

   b. ***Floater only:*** *Have you felt that you have been useful? What could be done to make the floaters more useful?*

Since the department was particularly interested in how they could improve the floater system, I solicited suggestions from teachers.

With the approval of the mathematics department chair, I provided this survey to 14 teachers who were either Math 9 teachers or floaters. The department chair encouraged teachers to respond to the survey. Unfortunately, however, I was only able to get responses from five of those teachers. Because only five teachers completed surveys, I did not get the broad input that I had wanted. This low response rate is somewhat problematic because some teachers' opinions may not be represented. If teachers felt uncertain that their anonymity would be protected, or if they worried about other political implications of criticizing the program, negative comments could be underrepresented. Some teachers may have been particularly uncomfortable writing negative responses because the department chair was encouraging them to respond. On the other hand, teachers who were happy with the program may not have felt as compelled to take the time to fill out the survey; thus, positive comments could also be underrepresented.

Fortunately, the five teachers who responded did seem to hold a variety of opinions about the course. I suspect that teachers who returned the survey were more

likely to be passionate about their opinions than those who did not return the survey; in other words, the teachers who responded seemed to have particularly strong and well-thought-out opinions. As a result, I was able to gain significant insight from a small number of teachers.

5.2 Summary of results

After receiving completed surveys from five teachers, I compiled their responses to each question. As with the student surveys, I grouped similar comments together, looked for patterns, and developed themes to describe their responses.

5.2.1 Question 1: Description of the course and the honors program

1. *a. Describe your class to an eighth grader who will be taking it next year so that they have a better idea of what to expect.*

   b. Describe the honors program to an eighth grader who is trying to decide whether or not they should take Math 9 for honors credit.

All of the teachers' responses to part (a) concerned the format of the course, focusing on how its format differs from the students' previous courses. Table 5.1 summarizes their statements about the course's format.

Two aspects of the course's format were mentioned most frequently: exploration/discovery and reading/writing/talking. Four of the five teachers discussed the exploration and discovery that students would do in Math 9. Teacher 1 explained, "This is a hands-on exploration of math for the real world. You'll work in groups exploring new ideas in math…" Teacher 2 wrote, "You will be in a small group doing investigations … If you like to be told what to think and think math is all about following examples, then you might find this course frustrating." Teacher 3 wrote to the hypothetical student, "You will work … developing the tools you need along the way." Teacher 5, whose short response only included four words, each of which described some aspect of the course's format, simply stated, "Discovery."

Table 5.1 Question 1.a. Themes: Description the course overall						
Theme:	*Mentioned by Teacher #*					*Total # of teachers*
	1	*2*	*3*	*4*	*5*	
Format	✓	✓	✓	✓	✓	5
Exploration/Discovery	✓	✓		✓	✓	4
Reading/Writing/Talking		✓	✓	✓	✓	4
Connections to the real world	✓	✓		✓		3
Mathematical content				✓		1
Expectations for student work			✓			1

Four of the five teachers also wrote about the amount of reading, writing, and talking that students do in Math 9. Teacher 2 wrote, "The investigations are kind of like science labs where you are asked to write and talk about your understanding … There is often more talking and writing than working with numbers." Teacher 3 stated, "Math 9 is based on reading and writing as well as math. There is very little 'teacher talk' in the class." Teacher 4 wrote, "Very much more reading and writing than you've been used to in math," and Teacher 5 wrote, "Writing. Explaining."

The third most commonly mentioned aspect of the courses format was connections to the "real world," which three of the teachers mentioned. Teacher 1's complete response was "This is a hands-on exploration of the real world. You'll work in groups exploring new ideas in math and ways people actually use math to help them answer important questions." Teacher 2 explained, "Almost all of the math is found in real-life contexts and you will be asked to explain what the math shows you about that real-life situation ... You won't have to ask, When would I ever need to know this' because the math is always investigated in an example where it is used." Teacher 4 contrasted the course to students' expectations of it, saying that Math 9 is "Much more applied to real-life problems."

Two other distinct aspects of the course's format were mentioned by just one teacher each. Teacher 4 mentioned the mathematical content of the course and the appearance of that content; he/she wrote, "Much less algebra or formal math than you might have expected." This idea does relate to other elements of the course's format listed above. In particular, Teacher 4 may have been alluding to the real-life connections in the curriculum; he/she immediately followed the statement above with, "Much more applied to real-life problems." It is not clear whether he/she intended those to be relatively separate, although almost certainly related, statements. However, saying "much less algebra or formal math" does add specific details that were not addressed by other teachers' descriptions of real-life connections. The final aspect of format was expectations for student work. Teacher 3 wrote, "Homework is very important, and organization is essential."

Although all five of the teachers focused entirely on the course's format, the overall goals of their responses seemed to differ. All of them were obviously trying to give the hypothetical student a clear expectation of what to expect in Math 9 on a day-to day basis. Two of them, however, seemed to include significant focus on pedagogy and the philosophy of the curriculum. They seemed to address *why* the course was designed with this particular format. Teacher 1 wrote that students would be learning "ways people actually use math to help them answer important questions." Instead of merely stating that students will do real-life problems in Math 9, he/she explained that the problems in Math 9 will help students see how math is useful for answering *important* questions. Teacher 2 made a similar statement: "You won't have to ask 'When would I ever need to know this' because the math is always investigated in an example where it is used." He/she was explaining *why* the course includes real-life problems. Teacher 2 also somewhat justified the amount of writing and talking in the course. He/she wrote, "The investigations are kind of like science labs where you are

asked to write and talk about your understanding." Instead of only stating the expectation that students will write and talk a lot, he/she explained that students will be writing and talking about their "understanding." That additional phrase seems to imply the explanation that students write and talk about math for a reason; they write and talk to share how they understand the course material.

Two others teachers do not seem to include such rationales in their responses. They focus more solely on what students can expect to see and do on a day-to-day basis in Math 9. Teacher 3's complete response was, "Math 9 is based on reading and writing as well as math. There is very little 'teacher talk' in the class. You will work with other students, solving mathematical problems, developing the tools you need along the way. Homework is very important, and organization is essential." He/she gave a detailed account of what Math 9 will be like. He/she told the hypothetical student to expect reading, writing, groupwork, problem solving, and discovery of mathematical tools and not to expect the teacher to do much lecturing; furthermore, he/she warned the student that homework and organizational skills are important to success in the course. Teacher 4's complete response was, "Much less algebra or formal math than you might have expected. Much more applied to real-life problems. Very much more reading and writing than you've been used to in math." This teacher also articulated what a student would see or do in Math 9. He described the mathematical content of the course and mentioned the amount of reading and writing. Unlike Teachers 1 and 2, however, neither Teacher 3 nor Teacher 4 wrote about why Math 9 has these features or expectations.

The final teacher, Teacher 5, gave a short response that also does not include rationale. This response also gives students an idea of what to expect, although it contains less detail. Teacher 5's complete response is, "Group Work. Discovery. Writing. Explaining."

In their responses to part (b), teachers describe the honors program, but the themes in their responses are somewhat different from part (a). Teachers focused less on the course's format and more on the expectations for what honors students should do. The difference in responses likely relates to the wording of question (a) and question (b). In part (a), I asked the teachers to describe the course so that a student *would know what to expect*, whereas in part (b), I asked them to describe the honors program to a student who is trying *to decide whether or not to take the course for honors credit.* The first question lends itself to a description of what a typical day in Math 9 looks like, while the second question suggests that the teacher should give the student suggestions and advice.

I grouped most of the comments into one of the three themes: Workload, Additional Topics Covered, and Student Characteristics Necessary for Success. The few remaining comments all related to other course logistics. See Table 5.2 for a summary of the themes in response to part (b).

Table 5.2 Question 1.b. Themes: Description of the honors program

Theme:	*Mentioned by Teacher #*					*Total # of teachers*
	1	*2*	*3*	*4*	*5*	
Workload	✓	✓	✓	✓	✓	5
Additional Topics Covered	✓	✓		✓	✓	4
Student Characteristics Necessary for Success	✓	✓	✓	✓		4
Other Logistics	✓	✓		✓		3

All of the teachers mentioned, at least briefly, that the honors program has a heavier workload. Some specifically discussed the increased workload, while others just stated that honors students have to do extra assignments. Teacher #3 wrote, "You have to be very motivated in order to take the class for honors credit. The workload is heavier." Teacher 4 gave other details: "A lot of extra responsibility is put on your

shoulders. You do all the regular classwork (a few homework problems are omitted, not much) and in addition get honors assignments on additional topics." Teachers 1, 2, and 5 did not elaborate on the increased workload; they only used either the phrase "extra homework" or "extra assignments."

Four of the five teachers wrote that the honors portion of the course covered additional material that was not included in the Regents portion. One teacher stated only that the honors students learn extra topics; Teacher 2 wrote, "You will learn some different material." The other teachers commented somewhat on the nature of these additional topics. Teacher 1 referred to the material as "more advanced topics." Teacher 5 wrote that the extra work "may not be related to current topics in class." Teacher 4 commented specifically on what mathematics was covered in the honors program; he/she wrote, "The honors includes more of the algebra that was not in the regular class."

The other commonly mentioned theme was Student Characteristics Necessary for Success. Four teachers wrote about which students should sign up for honors. Teacher 2 stated that "every math 9 student gets the chance to decide whether to take the course for honors credit." He/she then described what honors was like, including the increased workload and topics and some other logistics. He/she does not give specific characteristics that students need to have; instead, he/she describes what the course is like and leaves students to determine who would succeed in that environment. Other teachers, however, elaborated on what the expectations for honors students are. Teacher 3 wrote, "You will be expected to keep track of assignments on your own. It is your responsibility to turn in assignments on time, and keep up with all the Regents assignments as well. Excellent attitude and classroom behavior are also requirements for honors credit." Teacher 4 wrote, "A lot of extra responsibility is put on your shoulders. You get one day a week of being taught the honors work (on

average, maybe less), so if you have difficulty with it you must come for help with one of your teachers." Both of these teachers emphasized the need for significant responsibility and maturity; for these teachers, these qualities are essential for success in the honors program. Two of the teachers mentioned other personal qualities that are necessary for honors students. Teacher 1 wrote, "If you like math, like a challenge, and are willing to do some extra homework to learn more, this might be for you." Teacher 3 wrote, "You have to be very motivated in order to take the class for honors credit." These teachers believe that students should only take honors if they are willing to work hard.

Two of the teachers made other statements that explain some of the logistics of the honors program. Teacher 2 explained the consequences of doing well or doing poorly in honors; he/she wrote, "If you do well in the honors material you may want to take Math 10 at the honors level. If your grades fall below a C or you decide you don't want to do the honors work anymore, you can switch back to Regents, but your honors grades will not be changed." Teachers 2 and 4 mentioned the honors portion of tests; Teacher 2 wrote, "There will also be extra honors questions on your tests," and Teacher 4 wrote, "About 20% of each test is on the extra honors topics." Teachers 1, 2, and 4 also explained that the honors students meet in a separate room once per week. Teacher 1 wrote, "One day a week honors students go to a different classroom," Teacher 2 wrote, "If you do, you'll have a special honors class period once a week during your math class," and Teacher 4 wrote, "You get one day a week of being taught the honors work (on average, maybe less)."

5.2.2 Question 2: Goals and progress towards goals

> 2. *a. In your opinion, what was the purpose of changing the ninth grade math course this year?*
>
> *b. To what extent do you think the new course achieved the purpose you identified in part (a)?*

In part (a) of question 2, teachers identified what they believed the purpose of changing Math 9 was. All of the teachers identified at least one of the two themes: Changes in Regents Exams and Making Math More Relevant/Meaningful. A summary of the themes for part (a) is in Table 5.3 below.

Table 5.3 Question 2.a. Themes: Purposes of Changing Math 9

Theme:	*Mentioned by Teacher #*					*Total # of teachers*
	1	*2*	*3*	*4*	*5*	
Changes in Regents Exams		✓	✓	✓	✓	4
Making Math More Relevant/Meaningful	✓	✓		✓		3
More Control of Placement				✓		1
Faith in NSF and Field Testing			✓			1

The most frequently discussed reason for change was New York State's changes in the math Regents exams. Four teachers listed this as at least one of the reasons that their department changed ninth grade math. Two of the teachers discussed the new standards that are in place for lower-level students and how it affected their school. Teacher 2 explained, "ALL regular ed students need to pass a Regents exam to graduate. Our lower-level courses were becoming less and less productive and difficult to teach." Teacher 3 wrote, "There are tougher standards in place for our weakest students, and our old program was not working for them." Both of these teachers believed that their courses were not sufficiently helping their lower-level students, and the new standards for all students provided an increased need to improving that situation. Teacher 2 and Teacher 4 also explained that the Math 9 changes relate to a change in the format of the Regents exam. Teacher 2 commented, "The advent of technology and the NCTM standards and the elimination of the Course 1 Regents exam has made it possible for us to offer a more accessible, relevant, standards-based course." He/she lists the removal of the old Course 1 exam, which was replaced by the Math A exam, as a factor that enabled them to make favorable

changes. Teacher 4 made a related statement, although he/she seems to imply that they made this curriculum change in order to better prepare students for the Math A exam, rather than because the Math A exam gave them the freedom to make changes that they already wanted; Teacher 4 wrote, "To better prepare for the math A exam (which is more verbally demanding, and calculator oriented)." The final teacher, Teacher 5, gave only the response "New Regents standards," so it is not clear how or why he/she thought Regents standards led to the Math 9 changes.

Three teachers believed that Math 9 was changed, at least in part, to make math more meaningful and relevant for students. Teacher 1's complete response was, "To make the mathematics more personal and meaningful - get students invested in learning and build their own understandings. Less drill and practice, more thinking and applications." He/she focused on making mathematics meaningful by getting students to "build their own understandings. Teacher 4 seemed to focus more on making math relevant by teaching applications: "to make the math more practical and 'relevant,' so it's more appealing and useful for them." Teacher 2 also described Math 9 as offering "a more accessible, relevant, standards-based course," although he/she was not specific about what made the course more accessible and relevant.

Two other reasons were mentioned by one teacher each. Teacher 4 believed that one reason Math 9 changed was "to give us more control on who takes what levels, rather than students signing up for whatever they wanted." I found it somewhat difficult to understand that statement. In the new Math 9 course, all students have the option of signing up for honors, which seems to contradict this teacher's statement. However, I suspect that he saw the new system as giving teachers more control over placement because the classes are heterogeneously mixed from the beginning of the year. Thus, teachers can encourage promising students to sign up for honors after getting to know them. At the end of the year, teachers can also look at how honors

students performed over the course of the entire year and decide which of those students should be placed in Math 10 Honors. Thus, some students might be moved up to Math 10 Honors who might have otherwise not signed up for it. Conversely, those who sign up for honors but are not successful can easily be moved back into Regents without having to move them to a new class in the middle of the year.

The final reason for change that was mentioned was a statement about why the department chose the CPMP curriculum. Teacher 3 wrote, "We put a lot of faith in the recommendations of the NSF regarding the field testing of the program, trusting that it would work for our kids, too." This teacher also believed that the program changed to better prepare lower-level students for new, tougher standards, but this part of his statement explains why they made the particular change to this curriculum.

In part (b) of question 2, teachers commented on the extent to which the course achieved the purpose(s) that they identified in part (a). I will summarize their comments by theme from part (a).

Overall, teachers seemed to have mixed feelings about how the changes will help students on Regents exams. It was hard for them to draw many conclusions because they did not have Regents scores for their students yet. However, teachers did see some good progress and promising results, although they still have concerns. Without specifically mentioning the Regents exam, Teacher 2 particularly addressed his/her concerns about the lower-level students. He/she wrote, "the investigations and concepts ARE accessible by the majority of the students and the classroom culture is much more productive than those lower classes ever were." He/she also asserted, "The students are also way ahead of our past students with their use of graphing calculators and understanding some concepts, like linear and exponential models and algebraic expressions," although it is not clear if he/she is making a statement about preparation specifically for Regents exams. Like Teacher 2, Teacher 5 seemed

encouraged by students' progress; he/she wrote, "Students will be ready to explain their answers on the Regents." Teacher 3, however, questioned whether students' learning in Math 9 would be sufficient for success on the Math A Regents exam; he/she wrote, "I think we teach less material, so it seems like the kids are doing better. I'm not sure they will do well on the Math A exam." Teacher 4 had a mix of uncertainty and optimism about progress towards the Regents exams; in reference to the goal of better preparing students for the more "verbally demanding, and calculator oriented" Regents exam, he/she wrote, "hard to tell, but I think they're learning enough to make significant steps towards the math A."

Teachers who had identified Making Math More Relevant/Meaningful also reported mixed results about success. Teacher 1 was quite encouraged; his/her complete response to part (b) was, "Bingo!" Teacher 2 also seemed to have positive feelings about their progress towards this goal, although he did not discuss it directly. He/she wrote, "We are still struggling with working with students of mixed abilities in one classroom, but the investigations and concepts ARE accessible by the majority of the students." He/she does believe that the investigations are accessible to most students; since he/she mentioned accessibility and relevance together in part (a), I suspect that he/she believed that the accessibility of the material also suggests greater relevance to the students. The other teacher who mentioned the goal of relevance in part (a), however, saw some problems. Teacher 4 wrote, "I don't think the students relate to this math any more than to abstract algebra, but it might be more useful for them anyway. I think many of them really dislike this approach." He/she objected to the assumption that practicality or utility necessarily helps student relate to material. In fact, in his experience, the applied setting did not seem to help students relate to the material.

Teachers made other comments about the success of the course that did not directly respond to the goals stated in part (a) but are still quite relevant to the teachers' perceptions of the success of the program. Teacher 3 expressed the concern that the new curriculum created frustration for students. He/she wrote, "The program was frustrating for kids sometimes since it was so different. Some kids found it easier to shut down and misbehave rather than try something new." This teacher attributed the problem to low expectations for classroom behavior at their school. He/she believed, "It's especially hard to implement a successful new program at IHS, since there are no expectations for good behavior … Some kids found it easier to shut down and misbehave, rather than try something new, and the administration enables that behavior by not addressing the inappropriate nature of this behavior."

Two teachers also made comments about the success of heterogeneous grouping in their classes. Teacher 2 wrote, "We are still struggling with working with students of mixed abilities in one classroom." Because he/she went on to describe some of the promising outcomes of the year, he/she seemed optimistic about their ability to have further success with heterogeneous classes in the future. Teacher 4 also saw problems and promise. He/she wrote, "the mix of levels has been a very mixed success. I think the honors program has major problems and needs restructuring." He/she did not elaborate on what has been successful in the mix of levels, but he/she had serious concerns about the honors program. He/she explained those concerns later in more detail, in response to question 3.

5.2.3 Question 3: Students who did or did not benefit from changes

> 3. *a. Which students (if any) do you think have benefited from the changes? In what ways did they benefit?*
>
> *b. Do you think any students have been negatively affected by the changes? In what ways have they been negatively affected?*

Parts (a) and (b) of question 3 asked teachers which students benefited and which students were negatively affected by the changes to Math 9. Teachers grouped students in a variety of ways in this question; however, the most common way to divide up students was by level of achievement. Teachers talked about low, middle, and high achieving (or honors) students. I will begin summarizing the results of this question by discussing which of these achievement groups benefited or were negatively affected, according to teachers' perceptions. Table 5.4 shows teachers' views of the impact of the Math 9 changes on these groups.

Table 5.4 Question 3. Students who benefited and students who were negatively affected, grouped by level of achievement

Theme:	*Mentioned by Teacher #*					*Total # of teachers*
	1	*2*	*3*	*4*	*5*	
Benefited:						
Low-Level Students	✓	✓		✓		3
Middle Students	✓		✓	✓		3
Honors Students	✓	✓				2
Negatively Affected:						
Low-Level Students				✓		1
Middle Students						0
Honors Students		✓	✓	✓		3

For each of these achievement groups, at least two teachers believed that the some students in the group benefited from the changes. Comments about negative impacts were not so widespread; most such comments were about honors students who might have been harmed by the changes.

Three teachers mentioned low-achieving students who benefited from the change. Teacher 1 believed that all students benefited, although he specifically discusses the weaker students; he/she wrote, in response to part (a), "They all have. Weaker kids who get easily frustrated are more involved, and most are more successful. All kids are seeing real applications, and are learning to think about what

math means rather than just perform mechanically." Teacher 2 agrees that, in particular, many weak students have benefited: "Some of the weakest students who would have been in a low performing class have benefited by the more focused classroom." Teacher 4 agreed that the more productive classroom environment benefited some weak students, although he also thought that several of the weakest students did not benefit. He/she believed, "Those students in the lower-middle ability levels were brought up by the math being practical and better general level of student in the class. There were several students at the low end who just couldn't get it and were lost/left behind." In order to fit his use of "lower-middle" into my classification of three groups, I interpreted "lower-middle" to mean students who are either at the high end of the low group or the low end of the middle group; thus, in Table 5.4, I indicated that Teacher 4 believed some low and some middle achieving students benefited. However, since he/she also believed that some low-achieving students were harmed, I also marked that Teacher 4 believed low-level students were negatively affected. One teacher, Teacher 3, only wrote about low-level students for whom the changes did not help in any significant way. He wrote, "The lower level students continue to elude our efforts, except now they are getting Ds instead of Fs."

Including Teacher 4's remark about "lower-middle" students and Teacher 1's statement that all students benefited, a total of three teachers believed that some students in the middle benefited from the changes. The only teacher to address the middle group separately was Teacher 3. He/she wrote, "The students in the middle benefited most. They got to be in a class with some high achieving kids, so they could see the level at which other classes function." His/her stated reason that the changes helped students in the middle was similar to the explanations that other teachers gave for why the low-level students benefited. The only other mention of students in the middle group was "The central bulk of students did about the same" (Teacher 4). This

remark could be a general statement about students in all levels, but its context suggests that he/she was specifically referring to middle-achieving students. Just before this remark, Teacher 4 discussed low-level students, and just after it, he/she discussed honors students.

Comments about the effects of the changes on honors students were more negative than comments about the other groups. Two teachers did believe that at least some honors students benefited. Teacher 1 thought that all students benefited, and Teacher 2 wrote, "Some high achieving students whose understanding was shallow (i.e. They were good at mimicking the teacher's algorithms) are challenged but developing real understanding." Teacher 2 also, however, saw some high-achieving students who did not benefit: "There are a few students who probably should have accelerated in past years who may be less challenged than they could have been. Depending on their temperament, some have been stimulated by the honors program and the finer points of the regular concepts and contexts, but others have been indignant." Teacher 2's statement does suggest that relatively few honors students did not benefit from the changes. However, two other teachers thought that most honors students were harmed. Teacher 3 believed, "The honors students were, at best, deprived of an opportunity to work at a true honors level, and at worst, indentured as teaching assistants, expected to carry the weaker kids in their groups." Teacher 4's feelings were similarly strong; he/she wrote, "The honors students were neglected, and except for a few very bright and self-motivated students, most in my honors section learned little from the extra material while doing worse in the regular class topics." Although these teachers described their honors students quite differently (Teacher 3 described them understanding well enough to be teaching assistants, while Teacher 4 saw honors students who struggled somewhat with regular course material), they both believe that the program seriously failed these students.

Some teachers also discussed students that they did not categorize by achievement levels. Teacher 2 wrote, "The motivated students who historically have performed poorly on very abstract material but have good quantitative skills have excelled." Because the curriculum eases students into abstractions more slowly, these students have been able to use their quantitative skills without being hindered by abstract material. Teacher 5 wrote about a group of students for whom the opposite happened; he/she wrote, "Some students who formerly loved math were turned off by all of the writing." In other words, some students who enjoyed traditional math did not appreciate the changes to the course.

Teachers also mentioned a few general characteristics of the course that seemed to help most students somewhat. Teacher 1 believed that all benefited because "All kids are seeing real applications, and are learning to think about what math means rather than just perform mechanically." Teacher 2 believed, "The increased depth and narrower depth has benefited most." Finally, Teacher 5's complete response to part (a) was "The activities (some investigations) are hands on and engage the students." Although he/she is not specific about which students are engaged in the activities, he/she implies that some activities were a positive experience for most students.

5.2.4 Question 4: Professional development workshop

> 4. *a. Did you participate in the one-week summer workshop?*
>
> *b. Was it sufficient training to prepare you for this year? Please explain why or why not.*

Four of the five teachers attended the one-week summer workshop that was designed to help the department implement the changes to Math 9. Of those four, three wrote that the workshop was at least somewhat helpful. Teacher 2 called it "a great start," Teacher 4 said, "It did give us the basic idea," and Teacher 5 wrote, "It was very helpful."

Two teachers gave specific suggestions for how the workshop could have been more useful or what additional training could happen in the future. Teacher 2 wrote, "We should have had more PEDAGOGICAL training on how to manage heterogeneous classes and group work … I think now that some have truly struggled with these things, such training would be more welcome and more focused." Teacher 3 believed, "It concentrated too much on the technical aspects (subject matter, calculator) which I already knew, and not enough on the group process, how to let go and get the kids motivated to investigate and guide their own learning."

Teacher 5, who found the workshop "very helpful," was open to more training, but also seemed to feel that it was not as necessary now that he/she has experience teaching the course. He/she wrote, ""It was very helpful, but of course more would be better – although now that I've gone through the course once, I expect next year to be even better."

Teacher 4 believed that professional development could not help teachers for one of the major challenges of the course – keeping up with the workload. He/she wrote, ""It <u>did</u> give the basic idea of how the course proceeds <u>BUT</u> nothing could prepare me for this massive workload. As intended, this course requires a <u>staggering</u> amount of work to teach properly."

5.2.5 Question 5: Purpose of the honors program

> 5. *a. In your opinion, what was the purpose of offering honors credit for this course?*
>
> *b. To what extent do you think the honors program achieved the purpose you identified?*

In part (a) of question 5, teachers identified what they thought the purpose of the honors program was. They mentioned three purposes: Challenge Kids, Transition Kids into Traditional Honors Sequence, and Placate Parents. Table 5.5 summarizes the frequency of these themes.

Table 5.5 Question 5. Purposes of Honors Program						
Theme:	*Mentioned by Teacher #*					*Total # of teachers*
	1	*2*	*3*	*4*	*5*	
Challenge Kids	✓			✓	✓	3
Transition Kids into Traditional Honors Sequence	✓	✓		✓		3
Placate Parents			✓			1

Three teachers said that the purpose of offering honors credit was to challenge students. Teacher 1 wrote, "To provide an extra challenge for the kids who are eager to go faster and learn more," Teacher 4 wrote, "To allow the honors-ability students (who would normally be in a separate class) to stretch their abilities and get appropriate challenges, and to allow those that did well in these topics to transition into our traditional honors program," and Teacher 5 wrote, "To allow students who are more interested and/or more naturally talented at math to be challenged."

Three teachers also believed that the purpose of honors credit for Math 9 was to help transition students into the school's traditional, homogeneously-grouped honors sequence. Teacher 2 explained the situations in detail: "Some students' math skills develop late or some miss identification for honors work. We wanted to use the honors portion to find these students AND give them appropriate work to prepare them to succeed in our honors program next year." Teacher 1 echoed this statement, saying that the purpose for honors credit was "to prepare those students to move into our honors sequence next year." Teacher 4 also agreed, stressing that those who do well could move into the honors sequences; he/she wrote that the purpose was "to allow those that did well in these topics to transition into our traditional honors program."

One teacher identified a third impetus for the honors program. Teacher 3 wrote, "We offered honors credit to placate a rabid group of overachieving parents

hiding behind a mantle of political correctness and supposed equity of education." This teacher saw the honors program as a reaction to parents who, in Teacher 3's opinion, insist that their students receive and "honors" education, not simply the standard or average Regents education.

In part (b), teachers addressed the extent to which the program achieved the stated goal or purpose. Two of the teachers believed that the general effectiveness of the honors program was quite good, once the teachers developed a good structure for it. Towards the middle of the year, the teachers agreed on a regular schedule of "honors Thursdays;" honors met once a week, usually on Thursdays. These two teachers seemed to believe that this structure was critical to the honors program's success. Teacher 2 wrote, "When we finally got "honors Thursday" working, I think it went quite well," and Teacher 1 wrote, "It has worked well. Especially as we have gotten our act together better - since January we've had a clearer structure and a better sense of how to make this work."

Two other teachers had more negative opinions about the program. Teacher 4 was concerned about whether or not it would fulfill its goal of preparing students for Math 10 Honors. He/she wrote, "The few students who excelled will do fine in 10H (2H) next year … I <u>think</u>, time will tell. The bulk of the honors students received too little attention and instruction to gain much. The level of maturity required to seek extra help seemed more than most could handle." As this teacher said in his/her response to question 3, he/she believed that the honors students had been neglected, and, therefore, did not achieve their full potential.

Teacher 3 addressed the impact of having an honors program that, he/she believed, was designed to placate parents. He/she thought that the standards for what constitutes honors are too low because of parental pressure, although he/she believed that this problem existed at their school before the changes to Math 9. He/she wrote,

"It worked great. Parents actually believe that their kids got preparation for the honors program at IHS. Seriously, though, this has always been a problem at IHS. Everyone wants honors credit, and they want it to be accessible even to those kids without the talent or motivation, and that doesn't work. The standards for the "honors" class that includes kids who weren't accelerated at the middle school have always been much lower."

5.2.6 Question 6: Valuable aspects of Math 9

6. What is valuable about the current Math 9 course?

Question 6 gave the teachers an opportunity to discuss anything that they found valuable about Math 9. Most of them listed some aspects of the course, but they did not elaborate on them much, presumably because most ideas had been explained in responses to other questions. Teachers mentioned Investigation/Discovery, Technology, Practicality/Utility, Collaboration, Heterogeneity, Honors Options, and Depth of Concepts. Table 5.5 summarizes the frequency of these themes.

Table 5.6 Question 6. Valuable aspect of Math 9

Theme:	*Mentioned by Teacher #*					*Total # of teachers*
	1	*2*	*3*	*4*	*5*	
Investigation/Discovery	✓	✓			✓	3
Technology		✓	✓			2
Practicality/Utility		✓		✓		2
Collaboration		✓				1
Heterogeneity	✓					1
Honors Options		✓				1
Depth of Concepts		✓				1

Investigation and Discovery was the most frequently cited positive aspect of the course. Teacher 1 called the course "hands-on," Teacher 2 mentioned "investigative learning," and Teacher 5's complete response was "Discovery!"

Three teachers mentioned technology. Teacher 2 included "use of technology" in a list of valuable components of Math 9. Teacher 3 explained, "The use of technology is the best part of the course. The kids get a chance to think mathematically without having to do tedious calculating." He/she continued by explaining a drawback of technology: "However, when a kid chooses not to participate, they can get very far behind on calc procedures and miss opportunities to learn."

Two teachers also made remarks about the practicality and the utility of the mathematics in the curriculum. Teacher 1 referred to the course's "practical, hands-on approach," and Teacher 4 explained, "Those who won't be math or science majors in college will find what they learned here more useful and practical. They hopefully will be more mathematically literate citizens."

All of the other positive aspects of the course were mentioned by only one teacher each. Teacher 1 appreciated "the heterogeneous classes for 9th graders." Teacher 2 listed a few other positives of Math 9. He/she mentioned, "collaborative … learning, less concepts at a deeper level," and "honors options."

5.2.7 Question 7: Suggestions for change

> 7. *If you could make changes to any aspects of the course, what would they be and why?*

In question 7, teachers could mention any additional negative aspects of the course and suggest changes. Teachers most frequently discussed suggestions for Substantially Changing the Honors Program and the need for Helping Struggling Students More. Table 5.7 summarizes the frequency of themes for Question 7.

Three teachers believed that the honors program needed to be changed substantially. Teacher 4 and Teacher 5 believed that honors students should not be integrated into the Regents classes. Teacher 4 suggested, "And I think the honors

Table 5.7 Question 7. Suggestions for Math 9						
Theme:	*Mentioned by Teacher #*					*Total # of teachers*
	1	*2*	*3*	*4*	*5*	
Substantially Change Honors Program			✓	✓	✓	3
Help Struggling Students More	✓	✓			✓	3
Improve Pedagogy of Groupwork		✓				1
Decrease Workload				✓		1

should be, after a month or two, separately scheduled out into sections of their own for the rest of the year." Teacher 5 wrote, "NON-INTEGRATED HONORS! NO FLOATER, BUT A MUCH SMALLER CLASS! ('HONORS DAY') Thurs. is the best day of the week in the classroom. The struggling students learn the most w/o honors students there." Teacher 3 agreed that changes needed to be made, but he/she was unsure about what the solution should be. He/she wrote, "It's tough to say. The honors pull-out program didn't work well in my opinion. I would like to see that re-vamped or cut out entirely. On the other hand, I wouldn't want to teach a class that consisted of all low/middle kids, because the behavior would be out of control. I guess I'm damned if I do, damned if I don't."

Three teachers believed that they needed to find ways to help the struggling students more. Teacher 1 saw floaters as a possible solution to the problem. He/she wrote, "We have to figure out a way to better use the floaters to provide more support for the students who are struggling." Teacher 5 believed that the solution was to separate the honors students from the struggling students, leaving a smaller class of struggling students. He/she suggested, ""NON-INTEGRATED HONORS! NO FLOATER, BUT A MUCH SMALLER CLASS! ('HONORS DAY') Thurs. is the best day of the week in the classroom. The struggling students learn the most w/o honors students there." Teacher 2 also agreed that they need to find ways to offer more help to struggling students, although he/she does not elaborate on specific

solutions to the problem; he/she wrote, “I think we have everything we need in place, we just need to get better at the pedagogy, especially … helping the weakest students find access points to the work.”

Two other ideas were mentioned by one teacher each. In the same statement about helping weak students, Teacher 2 also states that teachers need to improve their pedagogy of managing groupwork in class. He/she wrote, “We just need to get better at the pedagogy, especially running the group work and helping the weakest students find access points to the work.”

Teacher 4 expressed concerns about the teacher workload. He/she wrote, “Something has to be done about the workload. It’s really impossible to collect and grade homework all the time, especially if meaningful comments/feedback are to be given, plus the tests, pairs quizzes, etc. Even with floaters, it just is too much.” He did not offer specific suggestions, but he offered teacher workload as an area that needs significant improvement.

5.2.8 Question 8: Floaters

> 8. *a.* ***Math 9 Classroom Teachers:*** *Has having a floater been useful? What could be done next year to make the floaters more useful?*
>
> *b.* ***Floater only:*** *Have you felt that you have been useful? What could be done to make the floaters more useful?*

Question 8 asks classroom teachers and floaters about the floater system. Of the five teachers who responded to the survey, one teacher (Teacher 1) was a floater.

Three of the five teachers found the floater system to be useful overall, while the other two were very unhappy with it. For example, Teacher 3 wrote,

> The floater system sucked. All I witnessed was a colleague getting "credit" for a full section, grading a few homework problems in the first 2 months, and then "floating in" sporadically and teaching one quasi-honors class per week, while I did all the grading, planning, and

> teaching, PLUS had to have a class once a week with all of the highest achieving kids pulled out.
>
> Some people had good luck with the system when the floaters were motivated, but I don't think any floater really kept track of what was going on in the class on a day to day basis, in terms of preparation ahead of time.

The floater system was obviously a source of significant bitterness and frustration for this teacher. Not surprisingly, most of the teachers with positive feelings toward the system did not have such strong feelings. Teacher 1 (a floater) wrote, "My in-class help works well, and the honors piece works well." Teacher 2 wrote, "The floater has been very useful, but more coordination would make them more useful. Honors has been great." Teacher 4 was the most enthusiastic supporter of the floater system; he/she wrote, "Useful? Without a floater this class is unteachable! How about double the number of floaters? Would that the funds allowed it!"

Several teachers offered specific suggestions for the floater system; these ideas are summarized in Table 5.8.

Table 5.8 Question 8. Suggestions for the floater system

Theme:	*Mentioned by Teacher #*					*Total # of teachers*
	1	*2*	*3*	*4*	*5*	
Find ways for floater to help weak students	✓	✓				2
More active role of floaters needed			✓		✓	2
Help ease workload even more				✓		1

Teacher 1 (a floater) and Teacher 2 both wanted to find ways for the floater to help the weak students. Teacher 1 (a floater) wrote, "I wish I were more effective with the at-risk kids." Teacher 2 agreed, saying, "Honors has been great but we need to work out a better system for the floater to monitor and help the weakest students."

Two of the teachers suggested that floaters should be more active in course. They did not believe that the floater system efficiently used teachers. Teacher 3 complained that the floaters did not do as much work as the classroom teachers, and

he/she wrote, “I don't think any floater really kept track of what was going on in the class on a day to day basis, in terms of preparation ahead of time.” The problem of unequal workload, and floaters who were perceived by some as doing an insufficient amount of preparation, seemed to create significant bitterness in some teachers. Both Teachers 3 and 5 were frustrated by the floater situation.

In contrast, one teacher was quite appreciative of the help he/she received from his/her floater. Teacher 4 felt that floaters are necessary to make the classroom teacher’s workload manageable. He/she wrote, “Useful? Without a floater this class is unteachable!” Teacher 4 actually made the suggestion that, since he/she believed that the teachers’ workload is still too heavy, there should be more floaters, if possible. He/she wrote, “How about double the number of floaters? Would that the funds allowed it!”

Chapter 6: Discussion

6.1 Introduction

In the previous three chapters, I have summarized the results of my three methods: student surveys, student interviews, and teacher surveys. In order to give a more complete description of Math 9, in this chapter I will make connections between the results of those methods. First, in Section 6.2, I compare responses in student surveys to what students said in interviews. In particular, I describe themes from the surveys that were clarified in the interviews (Sections 6.2.1 and 6.2.2), and I identify some themes from the interviews that were not apparent in the surveys, including students' perception of honors as a separate course, their expectation that honors and Regents work be related, and their reactions to working in heterogeneous groups (Section 6.2.3). Second, in Section 6.3, I summarize what seemed to be most important to students, using evidence from both surveys and interviews. Overall, students seemed to focus mostly on the course's difficulty and workload, its format (including especially the amount of writing in the course), and the influence of their previous math experiences on their decision whether or not to take honors.

Finally, in Section 6.4, I compare responses from the teacher surveys to students' perceptions of the course. I isolate similarities and differences between the teachers' and students' descriptions of the course and the honors program, and I draw connections between teachers' responses on other parts of the survey to various comments of students. I found that teachers' and students' descriptions frequently agree; both groups mentioned the amount of writing in the class, the lack of traditional algebra in the Regents portion of the course, the additional workload in the honors program, and the differences between the Regents content and the honors content. There were, however, some significant differences between teachers' and students' descriptions. For example, teachers were much more likely to mention the real-world

contexts in the curriculum and the amount of exploration and discovery in the course. Teachers and students also differed in their descriptions of factors that students should consider when deciding whether or not to sign up for honors credit.

6.2 Student Surveys and Interviews

The student surveys and interviews both revealed information about students' experiences in Math 9. The surveys offered more breadth, allowing me to gauge the perspectives of over 30 students, while the interviews offered more depth, allowing me to have extended conversations about Math 9 with five students. Looking at these two methods together gives us further understanding of students' views.

6.2.1 How interviews clarified students' perceptions of the course overall

In my summary of the student surveys, I identified five themes that described students' comments about the course overall. Those themes were Format of the course, Boring vs. Fun, Difficulty Level, Review vs. New Material, and Amount of Work. All of those themes were at least touched on in student interviews, and some student interviews gave me more insight into the themes.

For example, in surveys, 13 students mentioned aspects of the course's format, including the use of writing, calculators, and groupwork. Some students disliked the course's format, while a few others made positive comments about aspects of the course's format. However, most of the students who mentioned this theme simply stated facts about the course's format, without directly discussing their opinion of the format or why they mentioned those aspects of the course. We could guess that the students mentioned what seemed most noteworthy about their class; since most of what they wrote about were not typical components of traditional math classes (e.g., writing, graphing calculators, and groupwork), it would be reasonable to speculate that students described features of the course that they found to be most surprising. The results of the student interviews support that conjecture. In the interviews, students

talked about writing and other aspects of format, but they gave more details about why these aspects of formatting were important to them. Students' discussions of the course's format usually involved contrasting Math 9 to their previous math courses or to their expectations for math courses; thus, I categorized most of these comments under the theme Students' Perception of Mathematics and Its Impact on Their Views of Math 9. By discussing the aspects of Math 9 that were unexpected to them, students revealed some views about mathematics. For example, two students were frustrated by the amount of writing in Math 9; George said of the textbook problems, "It's sort of like English … It's not actually math," and Alexis said, "It's just annoying because you don't think you have to explain everything in math." Because these students did not think math involved writing, they were frustrated by having to write in Math 9. Since nine of the surveyed students also mentioned the use of writing and language, we can assume that others shared views similar to George's and Alexis's.

Difficulty Level was another of the most frequently mentioned themes in the surveys, and students in the interviews discussed it at length. Eight students remarked in their surveys about difficulty level, but their comments were generally brief. Five of them described the course as difficult, two described it as easy, and one gave a mixed description of difficulty. In the interviews, I got a little more insight into students who thought that Math 9 was easy, although none of my interviewees said that the course was difficult. All three of the honors students said that the Regents part of the course was easy for them because they understood the material quickly. They talked about the class being repetitive and about other students not understanding material as quickly as they did. They said that the course was, as a result, boring for them. Thus, their statements not only suggest one reason that some students thought the course was easy, but they also give some information about the Boring vs. Fun theme from the student surveys. Many students wrote in their surveys that Math 9 was

boring; the interviews suggest that some of them may have felt bored because the course was easy for them.

The interviews also offered more information about the Review vs. New Material theme from the surveys. In surveys, four students said that Math 9 included a lot of review from previous years. Some of the interviewees shared that feeling, and two gave more specific details. Jason said there were only two units in Math 9 that he "hadn't dealt with yet." Rachel said that everything was review except the "Now-Next equations" and the calculators.

6.2.2 How interviews clarified students' perceptions of the honors program

The interviews also clarified themes about the honors program. In the student survey results, I consolidated students' responses about the honors program (responses to Question 2) into five themes: Difficulty Level, Preparation or Abilities Needed, Amount of Work, Content, and Other Reasons to Take Honors. All of these themes were also mentioned to some extent in the interviews, and some of them were explained in more detail.

The difficulty level of the honors program was the most frequently mentioned theme from Question 2 in the surveys. Nine honors students mentioned the difficulty level of the honors program; five said that it was easy, two gave a mixed description of difficulty, and two thought that it was hard. The honors students that I interviewed gave more thorough descriptions of the difficulty of honors. Two of them described honors as only slightly harder than Regents. George described honors as "a step more harder than the Regents" and said that he was "less bored" in honors and "more bored" in Regents. When I asked Jason if the honors program made the class more challenging for him, he said, "A little bit. It was totally different." Later in the interview, he also said that the honors program was "a **little** bit more work." Both of these students seem to think that honors is relatively easy, although somewhat more

difficult than the Regents course. Jason seemed to emphasize the difference between the Regents and the honors *content* more than the difference between the Regents and the honors difficulty levels. He mentioned the difference in content almost immediately after I asked whether or not honors made Math 9 more challenging for him, and he emphasized that the difference in difficulty level was small. Rachel, the student who left the honors program, also agreed that the material in honors was not too difficult, but she said that dropped out of honors because the structure of the program did not give her enough time to practice what they learned. She did seem to believe that, in its current format, honors was too demanding; she said of honors students, "one day [per week] they're being pushed way too hard and don't get any help."

In the surveys, the Regents students had mixed perceptions of the honors program's difficulty. Of the four students who mentioned it, one thought that it was easy, two thought that it was a little hard or sometimes hard, and one thought that it was difficult. Only one of the two Regents interviewees directly discussed the difficulty of honors, but both of the Regents students' interviews give some insight into this theme. Alexis and Diane both implied that taking Math 9 for honors credit was not too different from taking it for Regents credit. Alexis said, "You learn how to solve equations differently than like we do. So we learn the easy way, and you learn the hard way." Alexis implies that the two portions of the course are similar, although it is not clear how much harder she believes honors is. Diane discussed difficulty directly, saying, "You do all the same work that Regents do, only you take the work a step farther and learn a couple new equations… And it's more homework and it's harder, but I don't see a big difference between Regents and honors." Diane also said that if she could make the choice again, she would choose to do honors, even though she did not see herself as strong in math. She explained, "I think I would just because

it's not really different. They are always in the class with us, mostly, they do the same work, they just take it a step farther." Both Alexis and Diane believe that the content in honors and Regents is similar, and Diane believes that, because of this similarity, honors is not much more difficult. In general, Alexis's and Diane's description of the honors program's content is quite different from the honors students' descriptions and from the teachers' descriptions. Presumably, Alexis's and Diane's descriptions are not particularly accurate, since they are not as familiar with it. This unfamiliarity might also explain the balance of Regents students' opinions about the difficulty of the honors program; one thought that it was hard, one thought that it was easy, and two thought that it was somewhere in between. Their views might have been educated guesses, and thus there was not a consensus among them. Of course, we cannot infer too much about the distribution of response because there were so few, but it is important to note that they had to base their perceptions on limited information.

In the surveys, students offered a number of reasons to take or not to take Math 9 for honors credit. They wrote about the preparation and abilities that honors students needed and about the advantages of the honors program. Interviewees mentioned many of the same factors. In particular, four of the five interviewees talked about basing the decision (at least in part) on their previous performance in math classes and/or their perception of their own mathematical abilities, which were also common responses in the surveys. Rachel and Jason were specific about their previous experiences with math and how those experiences affected their decision. Rachel said that her eighth grade math teacher told her that she should take honors, and she suggested that Regents students might not have signed up for honors because "their teachers didn't recommend them for it." Jason signed up for honors in part because he regretted not signing up for accelerated classes in middle school. Although Rachel's and Jason's stories might not be identical to the stories of others who based

their decisions on past performances, hearing their reasoning does give us illustrative examples of how some honors students chose the honors program. Diane and Alexis both talked about not signing up for honors because of their past performance and/or perception of their abilities. Diane said, "math was never my strongest subject," and Alexis said, "If you didn't do well in eighth grade, which I didn't do well with math, then I wouldn't take [honors]." These responses echo statements from surveys, although they do not provide substantially more detail.

Students also mentioned in both the surveys and the interviews that honors students must be willing and able to do extra work. Jason said of students who did not sign up for the honors program, "Some people don't feel like it. Maybe they're lazy," and Alexis said, "Some of them just didn't want to do the extra stuff."

In the surveys, students also commented on the content of the honors portion of Math 9. They talked about it being "regular math" and "more straightforward, blackboard/textbook math," and they mentioned the particular topics of exponents and factoring. Jason and Rachel discussed the honors content in more detail. Jason expanded on the idea that honors focused on more traditional math topics. He talked about his fear that Math 9 was not preparing him for the math that his older brothers did, although he felt that honors did give him some preparation for it. He said, "I don't understand how this program is going to lead us into [precalculus and other more advanced classes] because we don't really work with anything that's similar to that, except for like in the honors part, which is, like I said, it's really totally different from the Regents part." Rachel repeatedly discussed the lack of connection between the Regents and the honors material. She said, "There's no connection," and she suggested, "Instead of having a separate honors sheet, make them the same sort of questions with harder problems." Although Rachel complained about the Regents

content, she was particularly upset that the honors material did not relate to the Regents material.

6.2.3 New issues that arose in the student interviews

In addition to further illustrating or explaining themes from the student surveys, the interviews highlighted issues that were not apparent in the short responses of surveys. First, the theme Perception of Honors as a Separate Course only emerged in the interviews. When I discussed this course with students, I became aware of their implicit assumption that the honors and Regents portions were entirely separate courses. Some honors students seemed to believe that they were only getting one-fifth of an honors course because they only went to honors once per week. Instead of thinking of their entire course as honors level because it was a Regents course with supplemental material, they saw themselves as taking two courses, a Regents course and one-fifth of an honors course. They may have held this belief because the honors material looked so different from the Regents material. The difference may have suggested to them that the CMC material was inherently "Regents level" and the more traditional material was what they would see in a regular "honors level" course. They may have seen the supplemental, honors material as hints of what they would be getting in a regular, homogeneously-grouped honors course. This view may have been strengthened by the fact that Math 9 was so different from most other math courses and by the fact that the honors track at their school was more traditional. Understanding this theme from the interviews gives more insight into students' probable reactions to my survey questions. Since I asked about the course overall and then asked about the honors program separately, they were likely envisioning those as more disjoint than I expected. For example, some may not have considered any of their experiences in the honors portion when answering the question about the course overall.

Another theme that the interviews revealed was that many students expected the Regents and honors material to relate. Diane and Alexis, the Regents students that I interviewed, assumed that the material did relate, and Rachel, the student who dropped out of honors, complained that it did not. Although this theme is not evident in the surveys, one response from a Regents student might be associated with it; the student wrote, "You learn just as much when you don't take honors." This student may have shared Diane's and Alexis's assumption that the honors students did similar material on the days when they were in a separate classroom; since all students were together the other four days of the week, that student might have assumed that honors students do not do much additional material.

The last theme that was unique to the interviews was Reaction to Working in a Heterogeneous Classroom. Only one student specifically brought this topic up independently, but I directly asked interviewees about it. The honors students complained about getting bored when they understood and others did not, while the Regents students appreciated that they could get help from other students in the class. This theme may suggest one reason why some surveyed students thought that the course was easy or boring.

6.3 Issues of Greatest Importance to Students

Looking at all of the results from the surveys and interviews can help us understand what issues were most important to Math 9 students. The surveys were more open-ended than the interviews because I could not ask additional or follow-up questions; thus, students were most likely to focus on aspects of their course that were noteworthy, important, interesting, or surprising to them. In the survey, the students wrote about aspects of the course's format that were different from what they expected. They also wrote about the course's difficulty, workload, and amount of new material. They mentioned how fun or boring the course was. When I asked them to

offer advice on deciding whether or not to be in honors, they suggested necessary abilities or preparation, and they explained some advantages of taking the course for honors credit.

The importance of these issues was reinforced in the student interviews. When I began the interviews with an open-ended question, two of the five students immediately discussed the difficulty and/or workload of the course. In conjunction with the survey results, this fact suggests that (not surprisingly) a course's difficulty level or workload is of primary importance to many high school students.

Two of the other interviewees began talking about the amount of writing and explaining in Math 9 early in my interviews with them. They, and the many students who mentioned writing and language in their surveys, were surprised that they had to write so much in a math class. This issue was mentioned so frequently that it seems particularly significant to students' perceptions of Math 9.

In both the interviews and the surveys, when I asked about the choice to take honors, students talked about previous successes or failures in math classes and about their perceptions of their mathematical abilities, which were presumably built by their previous mathematical experiences. They also mentioned that honors students must be willing to do extra work. These responses suggest that students prioritize previous math experiences in deciding whether or not to take honors, and these responses also reiterate how important workload is to high school students.

6.4 Teacher Surveys and Student Surveys/Interviews

Thus far in this chapter we have examined students' perceptions of Math 9. Comparing the student perspective to the teacher perspective will help give us a more complete picture of the course. We can consider teachers' intentions, goals, concerns, and perceptions and how they relate to students' views.

6.4.1 Comparing teachers' and students' descriptions of the course overall

In the teacher survey, I asked the two questions from the student survey; I asked teachers to describe their course and the honors program to an eighth grader. The teachers' descriptions of the course had some similarities to the students' descriptions. Teachers focused on describing the format of the course, and they highlighted particular aspects of its format. In particular, like students, the teachers frequently mentioned the amount of writing, reading, and talking in Math 9. Teachers were aware that this aspect of Math 9 would be surprising to students. Teacher 4 wrote, "Very much more reading and writing than you've been used to in math," and Teacher 5 wrote, "There is often more talking and writing than working with numbers." Teacher 3 even made a statement that was consistent with students' beliefs that writing is not part of mathematics; he/she wrote, "Math 9 is based on reading and writing as well as math." He/she seemed to be using the word "math" as many students would use it; math is the computational part of their work, but Math 9 also includes reading and writing.

One teacher warned students that the content of the course would not be what they expected. He/she wrote, "Much less algebra or formal math than you might have expected." This teacher's warning is consistent with students' expectations that emerged in the surveys and interviews. For example, Diane wished she were in a class that was "regular math." Jason worried that he was not learning enough to prepare him for precalculus. Most of Math 9 did not look like the math that his older brother did in advanced courses. Only the honors material, which was more traditional algebra, fit his expectations for math that would prepare him for the future.

The teachers mentioned other aspects of format that students did not focus on as much. Teachers commented on the amount of exploration and discovery in the course more than on any other aspect of the course's format. In fact, all five of the

teachers wrote about it. However, exploration and discovery were not themes that students mentioned in either the surveys or the interviews. Students did not talk explicitly about discovering or exploring mathematics, although two surveyed students mentioned the degree to which the course was hand-on. Exploration and discovery are popular pedagogical terms in the mathematics education, so it makes sense that teachers would use those words, while students would not. Nevertheless, only two students touched on the idea at all (by mentioning how much the course was "hands-on"). This difference suggests that these concepts are more important, more surprising, or more obvious to teachers than they are to students. This result makes sense because students may be focusing on the surface aspects of the course format. For example, they know that they have to write a lot, so they talk about that in the surveys and interviews. However, the students do not mention that the writing, reading, and talking in the class are sometimes ways for them to explore mathematics; either they are not conscious of the fact that they are exploring or discovering mathematics, or these components of the course are not as interesting or important to them. On the other hand, teachers discuss exploration and discovery because these ideas are central to the pedagogy of CPMP.

Teachers also focused more on the course's connections to the real world than students did. Three out of the five teachers commented on it, while only two out of 33 students mentioned it in the surveys and one out of five students mentioned it in the interviews. Again, the real-world connections in CPMP are a focal point of the curriculum, and teachers find these connections to be important. However, although the course frequently centered on real world contexts, students infrequently talked about this aspect of the class. For some reason, students did not raise the issue. They may not have felt that the real-world contexts had a significant impact on their experience in the course, they may not have been surprised by this aspect of the

course, or other aspects of the course may have been so much more important to them that this one was overshadowed.

6.4.2 Comparing teachers' and students' descriptions of the honors program

Examining the teachers' descriptions of the honors program reveals more similarities between teachers' and students' perceptions. The teachers' and students' descriptions of the honors program were quite similar. All of the teachers mentioned that the honors program had a heavier workload, which was also the third most commonly mentioned theme of the corresponding question in the student surveys. Not surprisingly, teachers emphasized their expectations of honors students when they discussed the workload of the program. One teacher wrote, "You have to be very motivated in order to take the class for honors credit. The workload is heavier," and another wrote, "A lot of extra responsibility is put on your shoulders. You do all the regular classwork (a few homework problems are omitted, not much) and in addition get honors assignments on additional topics."

Teachers and students also both discussed the additional material that the honors program covered, and both groups mentioned that the extra topics may not relate to the Regents portion of the course. One teacher described the material: "The honors includes more of the algebra that was not in the regular class." This description is consistent with students' descriptions. Some students referred to the honors topics as "regular" math, and Jason, an honors student, talked about how the honors portion of the course resembled the work his brothers did in more advanced courses.

Both the teachers and the students discussed the characteristics, preparation, and/or abilities that students need for success in the honors program. However, teachers and students emphasized entirely different qualities. In the surveys, students most frequently mentioned that others should take honors if they are smart or "good at

math." In interviews, when discussing the decision to take or not to take honors, students seemed to focus primarily on their performance in previous math classes. However, none of the teachers mentioned either of these factors. One teacher did say, "If you like math, … this might be for you," but this was the only comment that was even similar to these factors. Teachers instead wrote about personal qualities that honors students need to succeed. While students said that you should take honors if you are smart, teachers wrote that honors students need to be motivated and responsible. Teacher 3 wrote, "You have to be very motivated in order to take the class for honors credit," and Teacher 4 wrote, "A lot of extra responsibility is put on your shoulders. You get one day a week of being taught the honors work (on average, maybe less), so if you have difficulty with it you must come for help with one of your teachers." Teacher 3 also commented, "Excellent attitude and classroom behavior are also requirements for honors credit." None of these qualities is specifically related to mathematical ability. Teachers seemed to prioritize maturity and responsibility. It is also possible that they took for granted that honors students need to be "good at math;" they may have been stressing qualities that students need in addition to mathematical skills and/or previous success in mathematics. However, one teacher's comments suggest that he/she did not want students to base their decisions on their previous performance in math classes. He/she stressed that every student has the option to take the course for honors credit. Teacher 2 wrote, "Every math 9 student gets the chance to decide whether to take the course for honors credit," and he/she then explained the structure of the honors program. This teacher seemed to leave the decisions to the students; he/she gave them factual information about the program so that they could decide whether or not they were interested in signing up.

Overall, the teachers' and the students' descriptions of the course and of the honors program were largely similar, although a few critical differences do highlight some discrepancies between teachers' views and students' views of the course.

6.4.3 Comparing teachers' goals to students' comments

In the teacher survey, the questions that asked for descriptions of the course and honors program were followed by Question 2, "In your opinion, what was the purpose of changing the ninth grade math course this year?" In their responses, teachers discussed goals of the new course. Comparing these goals to the comments of students gives us some insight into the success of some of these goals. In particular, three of the five teachers wrote that their department changed Math 9 in order to make mathematics more meaningful and relevant to students. One teacher wrote that a goal was "to make the math more practical and 'relevant,' so it's more appealing and useful for them," and another teacher wrote that a goal was "to make the mathematics more personal and meaningful - get students invested in learning and build their own understandings." Although the student surveys and interviews are not sufficient evidence for determining whether or not they achieved these goals, the students' comments do give us some information. Few students mentioned that the math they were learning was more practical. Only two out of 33 surveyed students and one out of five interviewed students discussed using math to solve real-life problems, and the interviewed student said explicitly that the real-world contexts did not make mathematics more relevant to her. Similarly, only one student's comments suggested that Math 9 made mathematics more personal or meaningful for him/her; in a survey response, the students said that the course "feels very personal" and was "refreshing." Most students did not say anything about Math 9 making mathematics seem more relevant or meaningful to them. The course may have done that for some of them, but most did not mention it. If the course did achieve this goal for some

students, they may not have been conscious of this change in their view of mathematics.

Four teachers discussed how changes in the Regents exam promoted and/or facilitated their changes in Math 9, and two of those teachers specifically discussed the need to teach the lowest-level students more effectively. Because I did not know which students (either in surveys or interviews) would traditionally have been in low-level classes, I cannot make any conclusions about the experiences of this student group. However, one relevant piece of information came from two interviewees. The two Regents students whom I interviewed both said that they enjoyed having honors students in the class because the honors students could help them with the material. They also said that they enjoyed days when the honors students left the room because they could get more one-on-one attention. These comments may give some insight into the experiences of lower-level students, although these two interviewees may not have been in the lowest-level group that the teachers discussed.

6.4.4 Comparing teachers' perceptions of effects on students to students' comments

Question 3 in the teacher survey asked which students benefited and which students were negatively affected by the changes. Some of the teachers' responses were supported by evidence from students. One teacher said of the middle-level students, "The students in the middle benefited most. They got to be in a class with some high achieving kids, so they could see the level at which other classes function." My interviews with the two Regents students may support this assertion; as I mentioned above, these students appreciated being in a class with honors students.

Three teachers believed that at least some of the honors students did not benefit from the changes, and there is some evidence of this in the student surveys and interviews. One teacher wrote, "There are a few students who probably should have accelerated in past years who may be less challenged than they could have been."

Jason appeared to be one of those students; Jason was generally bored, and he believed that he should have gone into an accelerated course in middle school. Other teachers, however, complained of more widespread problems for honors students. One wrote, "The honors students were, at best, deprived of an opportunity to work at a true honors level, and at worst, indentured as teaching assistants, expected to carry the weaker kids in their groups," and the other wrote, "The honors students were neglected, and except for a few very bright and self-motivated students, most in my honors section learned little from the extra material while doing worse in the regular class topics." Many honors students in the survey did find Math 9 to be easy. In the interviews, all of the honors students complained that they were bored in class because they understood the material more quickly than other students. In addition, the Regents students' comments about getting help from honors students might even support the assertion that honors students were "indentured as teaching assistants." Rachel, the student who dropped out of the honors program, may have been an example of an honors student who "learned little from the extra material while doing worse in the regular class topics." She complained that she had trouble learning the honors material because there was not enough time to practice or get extra help, and she felt that her struggles in honors were hurting her performance in the Regents portion of the course; she said, "They'd give a big worksheet and hand it to us the next day, ask questions, but when you go to ask questions, you're missing stuff that you need to know…, which you do need to know because that's what 80% of the end of the year is… If I was still in honors, I would have seriously failed that test at the end of the year." Although I cannot tell from my data how widespread these problems are, they do seem to be valid concerns. At the very least, some honors students believe that the course does not benefit them.

6.4.5 Comparing teachers' goals for the honors program to students' comments

In Question 5 on the teacher survey, teachers explained the purposes behind the honors program and the extent to which the program achieved its goals. Input from students did not give additional information about many of the themes from this part of the teacher survey. For example, the teachers wrote about using the honors program to help students transition into their traditional honors sequence; however, the students did not mention this possibility. The issue came up in my interview with Jason, and he did not even seem to know that this transition was a possibility.

Teachers did write that one goal of the honors program was to challenge students, and many students echoed this idea. In surveys and interviews, students mentioned that one reason to sign up for honors was to be challenged. At least some honors students found it to be challenging; in surveys, two students wrote that honors was difficult, and two wrote mixed descriptions of its difficulty. However, five students wrote that the honors program was easy; thus, a significant number of honors students did not feel challenged in the program.

In the context of this survey question, one other comment by a teacher related to an issue that came up in a student interview. The teacher was concerned that the honors program was not preparing students adequately to move them into the traditional honors program, and the teacher wrote, "The level of maturity required to seek extra help seemed more than most could handle." This teacher may have been writing about students like Rachel. Rachel complained that the honors program did not give her enough time to practice new types of problems, but she also said in another part of the interview, "I don't spend a lot of time on math. It's not hard for me." On the one hand, she was frustrated that the honors program was constantly moving on to new material without time for additional practice, but, on the other hand, she did not seem to take the initiative to devote extra time to math. However, Rachel

would likely dispute that her problem was lack of maturity or effort. She complained that the teachers had unrealistic expectations for students' getting help outside of class. She complained that teachers always told her to come after school, but she said that she had to come after school frequently for many of her classes; thus, she could only come after school for math periodically.

6.4.6 Comparing what teachers valued about Math 9 to students' comments

Question 6 of the teacher surveys asked what teachers thought was valuable about Math 9. Again the teachers mentioned discovery and investigation. As I discussed above, it is unlikely that students saw these as particularly valuable elements of their class because so few of them mentioned anything related to discovery or investigation. Teachers also thought that the use of technology in Math 9 was valuable. Few students mentioned technology at all. Three did state in their surveys that students should expect to use calculators in Math 9, although they did not give any opinion about the use of calculators. In the interviews, two students did talk about calculators as something new that they had learned in the course, and their comments seemed to be generally positive. Finally, two teachers commented that the practicality or utility of the Math 9 material was valuable, but, as I mentioned above, few students remarked on this feature of Math 9.

6.4.7 Comparing what teachers want to change about Math 9 to students' comments

The last issue from the teacher survey that relates to students' comments comes from Question 7 of the teacher survey. This question asked teachers to make suggestions for changing Math 9. Three of the teachers believed that the honors program needed to be substantially adjusted. Two of them believed that the honors program should not be integrated into the Regents classes. Teacher 5's response was "NON-INTEGRATED HONORS! NO FLOATER, BUT A MUCH SMALLER CLASS! ('HONORS DAY') Thurs. is the best day of the week in the classroom. The

struggling students learn the most w/o honors students there." Alexis and Diane, the two Regents students that I interviewed, agreed that they learned a lot when the honors students left the room. They appreciated that they could get more individual attention on those days. However, they both also did enjoy getting extra help from the honors students on the days that they were all together. Thus, it is not clear if these students would have preferred a non-integrated honors program and smaller Regents classes. In fact, I specifically asked Alexis about her preference because she had said positive things about the honors students being in class and about the honors students being gone, but she said that she did not know which she would like better.

Chapter 7: Conclusions and Questions for Future Research

7.1 Summary of findings

In Chapter 6, I drew detailed connections among the data in my study. Those connections revealed substantial information about students' and teachers' perceptions of Math 9 and how those perceptions compare and interact.

Students' descriptions of their math class give us insight into what they think is important (see Sections 6.2 and 6.3). They focused on aspects of their course's format that were surprising or noteworthy, including particular emphasis on the amount of writing that they had to do in Math 9. Many surveyed students mentioned the amount of writing in the class, and the interview data suggest that students discussed that issue because they do not think that mathematics does or should involve writing. Students also emphasized the difficulty level and workload of both the course and the honors program, and many commented on being bored during class. All of these topics seem relatively superficial, which are perhaps not surprising results from high school freshman. However, as I explore further in Section 7.2, I believe that educators should not simply dismiss these statements as insignificant. In addition to recognizing what students do say about new, standards-based curricula, we also need to notice what they do not discuss, why they do not discuss it, and what implications students' perspectives have on our teaching and its effectiveness.

One way to learn from students' perceptions is to compare them to what teachers think is important to their students. When I asked teachers to describe their class to a student who would be taking it next year, their descriptions had many similarities to the students' descriptions (see Sections 5.2.1 and 5.2.2 and Sections 6.4.1 and 6.4.2). For example, the teachers focused on aspects of the course's format that would likely seem new and different to students. They warned students about the amount of writing and the lack of traditional algebraic manipulation. However, there

were some significant differences between teachers' and students' responses that I explore in Section 7.2. In particular, many teachers discussed the real-world connections in CPMP and the exploration and discovery that are common in the class (see Sections 5.2.1 and 6.4.1), but few students mentioned either of these features (see Sections 3.2.1, 4.2.3, and 6.4.1). This disconnect is particularly relevant to the teachers' (and curriculum developers') goals of using CPMP to make math more relevant and meaningful to students.

Throughout both the student surveys and interviews, I learned about how students chose whether or not to sign up for the honors program (see Section 3.2.2, 4.2.4, and 6.2.2). I found that they based their decisions on their previous experiences in math classes and on their perception of their mathematical abilities (which were built from previous experiences). Teachers, on the other hand, identified different factors that students should consider when making the decision (see Section 5.2.1 and 6.4.2). They talked about personal characteristics that honors students should have, such as responsibility, maturity, interest, and a willingness to do extra work. They did not mention either mathematical abilities or previous experiences in math classes as factors. This disconnect between students' and teachers' responses has implications to the outcome of the open honors policy, and I discuss these further in Section 7.3.

From my discussions with students, I was also able to isolate some other relevant attitudes and perceptions that they did not directly mention in their descriptions of the course or honors program. In particular, I noticed that they perceived the Regents and honors portions of the course as separate classes and that they expected the Regents and honors material to be related (see Sections 4.2.1 and 4.2.2 and Section 6.2.3). Since the content of the honors portion of the course was traditional material and the content of the Regents portion was CPMP material, honors students saw themselves as taking two separate math classes. Most importantly, they

then concluded that they were not taking a true honors course because they were only seeing "honors material" once per week. In Section 7.4, I discuss this conclusion in more detail and suggest broader implications of this issue.

In the remainder of this chapter, I explore some particularly noteworthy conclusions in more detail and discuss questions for future research.

7.2 Disconnects between teachers' and students' descriptions

In all three components of my study (teacher surveys, student surveys, and student interviews), I asked participants to describe Math 9 as they would to an eighth grader who was going to take the course next year. The question was open-ended, and they could write or talk about any aspect of Math 9. Because the audience for their response was supposed to be an eighth grader, we can assume that teachers and students both wrote about what they thought future students should know. Thus, these descriptions of Math 9 give us some insight into what is most noteworthy to each participant and what they think is relevant to future Math 9 students. As I discussed in Section 6.4, the responses of teachers and students had many similarities. However, there were some notable differences that suggest areas for future consideration and research.

7.2.1 Real-life Contexts

One of the most striking disconnects between teachers' and students' descriptions dealt with the use of real-life contexts in the course (see Section 6.4.1). CPMP is built around realistic applications, and three of the five teachers mentioned it in their descriptions of the course and/or their explanations of the course's goals. However, only two out of 33 surveyed students and one out of five interviewed students mentioned it. Two of those three students did make positive comments about this feature of the course; one said, "You use real life scenarios in math, it's somewhat fun," and the other said, "Everything serves relevance to something outside class." In

contrast, the third student, Rachel, said in her interview that the real-world connections were not helpful for her; when I asked her to describe the course, she said,

> I **hate** it. I think it's ridiculous. Because, if Bob has four apples and Suzy has three apples, and they get an apple a day, how many apples will they have in a week?... It's just. It doesn't help. I think that the problem was designed to have real-life situations because kids are always asking, 'well, when am I going to use this?' But we still aren't going to use it. Because in real life, how many jobs are going to have to do with apples?

For Rachel, the realistic contexts did not seem important or relevant to her life, and she felt that they did not help her learn mathematics. This feature of the curriculum was noteworthy to Rachel precisely because she did not like it. Because most students did not comment on the real-world contexts in the curriculum, we do not know whether most students would agree with Rachel or the other two students.

However, the evidence does seem to suggest that, regardless of students' opinions of the real-world contexts, this aspect of the course was not particularly noteworthy, important, or surprising to most of them. For whatever reason, they did not include the issue in their descriptions of the course or in their conversations with me.

This observation raises some interesting questions about the use of real-world problems to teach mathematics. If students do not see realistic contexts as important to their math class, is the pedagogical effectiveness of such a curriculum affected? Developers of the curriculum assert, "The CPMP four-year curriculum builds upon the theme of *mathematics as sense-making*. Investigations of real life contexts lead to (re)invention of important mathematics that makes sense to students" (Schoen et al. 1998, p.3). In other words, the curriculum utilizes real-life contexts as a vehicle for students to make sense of mathematics. However, if these contexts are not noteworthy to the students, are the contexts making a substantial impact on students' learning?

Stephen Brown (2001) raised an objection to recent curricular efforts that focus heavily on applying mathematics to the real world. He suggested that emphasizing mathematical modeling can be limiting because students can be engaged in problems other than those with real-world contexts. He wrote, "Real is not merely what we can touch. It is important to see it as what touches us" (Brown 2001, p. 31). The evidence from the present study raises concerns that the real-life contexts in CPMP may not be "touching" the students, at least not enough that they mention them in their descriptions of the class.

The central question here is why students do not mention this aspect of their course. Do students not mention the realistic contexts because they do not consciously notice this feature of the course? If so, could they learn more if they were more consciously aware of the contexts as central to their math course?

Is it even possible that students have become so accustomed to ignoring "extraneous" real world information in traditional word problems that they try to ignore the contexts in the CPMP curriculum? Rachel did say, "I don't like the way they say, 'Alan and Josh are separately driving south on Route 81.' I hate that. I mean those kinds of problems, I know they have those in regular math and everything, but like all of this and stuff, no one cares, just skip the crap and ask me the question. It's a lot of extra work that doesn't help." To Rachel, the contexts were simply irrelevant distractions. Although other students may not have been as bothered by the contexts as Rachel was, they too might have worked to ignore the context of a problem.

This finding seems to cast some doubt on one hypothesis of Schoen and Pritchett (1998). They suggested, "The perceived realism of the contexts for investigations and problems is perhaps the strongest contributor to students' high levels of interest in continuing to enroll in Core Plus courses." Since students in Math

9 did not mention the realism of the course, it may not have been particularly important to them.

Of course, the real-life contexts might have been useful and meaningful to students, even though they did not discuss the issue in the surveys and interviews. Students may be more likely to mention other aspects of the course, such as workload and difficulty. Another possibility is that students' mention features of the course that they do not like. For example, many students complained about the amount of writing they had to do in Math 9 (see Section 6.2.1). Thus, if students appreciated and learned from real-world applications, they might not focus on them as much as they focus on unpleasant aspects of the course. Future research is needed to isolate students' reactions to real-world applications.

7.2.2 Exploration and Discovery

A related feature of the course, exploration and discovery of mathematics, was also frequently mentioned by teachers and rarely mentioned by students (see Section 6.4.1). Four of the teachers wrote that students in Math 9 explore, discover, or investigate mathematics. Students, however, did not write about exploring or discovering mathematics; two students mentioned the degree to which the class was hands-on, but no other students' comments were related to these issues.

Exploration and discovery is a central feature of the CPMP curriculum; its developers wrote, "Instructional materials are designed to engage students actively in exploring and making sense of problem situations" (Hirsch et al. 1995, p. 694). Teachers' characterizations of the course echoed this idea. For example, one wrote, "This is a hands-on exploration of math for the real world. You'll work in groups exploring new ideas in math," and another wrote, ""You will work … developing the tools you need along the way." Although the curriculum developers and most of the

teachers saw exploration and discovery as a major component of the course, students did not discuss it.

Why did students not mention exploration and discovery? As I pointed out in the previous chapter, exploration, discovery, and investigation are popular pedagogical terms that you would not expect students to use as frequently as teachers do. However, only two students mentioned any similar ideas, and only one of them implied that Math 9 included a lot of exploration. Both of them used the term "hands-on," but they had differing opinions. One wrote, "The course is generally very hands-on," and the other wrote, "They need to make the class more hands on." As with the real-world contexts, we do not know if most students would agree with one of these statements because so few students discussed this component of the course. Instead, what we do know is that most students did not find this issue worthy of mentioning.

Again, there could be many reasons why students did not mention this feature of their math class. It is possible that students did not think about whether or not they were exploring or discovering mathematics. They focused a lot on more superficial aspects of their course, including how difficult the class was, how much work they had to do, and how much they had to write. It is also possible that the students did not think that the class was hands-on or an exploratory; if they held that opinion, most would probably not mention it because they would not expect their math class to be hands-on.

These students may be what Belenky et al. (1986) call received knowers. Received knowers do not see themselves as a source of knowledge. Knowledge must come from the outside, particularly from authorities that pass knowledge down to them. If students do have this epistemology, then they might have significant difficulty with the idea that they are exploring and discovering mathematics for

themselves. This possibility suggests that students might struggle with this aspect of their course, particularly if teachers do not address their view of knowledge.

Regardless of why students did not bring up this aspect of their course, this disconnect between teachers' and students' descriptions is worthwhile to notice. If students do not find the exploration and discovery noteworthy, is the course fulfilling its goals? Could students learn more if they were more conscious of the exploration and discovery process? If so, how can we help students see exploration and discovery as important components of mathematics? What types of exploration and discovery would be meaningful and significant to students? Is it even possible that these students were not actually exploring and discovering in their class, but instead getting enough clues from their teachers that they could avoid true investigations? All of these questions point to a need for further research on how students react to the implementation of new curricula such as CPMP.

7.2.3 Math as Meaningful and Relevant

Both the real-world contexts and the exploration and discovery are vehicles to achieve a larger goal. Three of the five teachers said that one purpose of changing Math 9 was to make mathematics seem more meaningful and/or relevant to students. One hoped that the course would "make the math more practical and 'relevant,' so it's more appealing and useful for them," and another teacher hoped that it would "make the mathematics more personal and meaningful - get students invested in learning and build their own understandings" (see also Section 6.4.3). As I discussed above, only a few students mentioned the utility or applications of the mathematics they were learning, and one of those students said that the real-world contexts did not make mathematics more relevant for her. In addition, only one student implied that the course made mathematics more personal or meaningful; this student said in a survey that the course "feels very personal" and was "refreshing."

This evidence raises some concern that the course may not have been achieving these goals. Most students did not talk about viewing mathematics as useful, relevant, and meaningful. In fact, there is some evidence that when the course and their expectations for mathematics did not agree, students complained about their course rather than changing their view of mathematics. For example, many students complained that they had to write in their math class; George, an interviewee, said, "It's sort of like English … It's not actually math."

If this course did achieve the goal of making mathematics seem more useful and relevant, students did not discuss it. Thus, it was not significant, noticeable, or surprising enough for students to bring it up. Are there ways that we could focus more explicitly on these goals so that students more consciously feel connected to mathematics?

I should also point out that these students were in their first year of CPMP. Changing views of mathematics is a long-term process, and students may not adjust their perspectives in the first year of CPMP. Schoen and Pritchett (1998) offer some evidence that students find the course more practical and interesting after two years in CPMP classes than they do after one year. They asked students in CPMP courses and students in traditional classes whether or not their course was realistic and whether or not their course made mathematics more interesting to them. There was not a statistically significant difference between first-year students in CPMP courses and first-year students in traditional classes, but second-year CPMP students found their courses to be more realistic and interesting than second-year traditional students.

We do need further research to isolate whether or not students views of mathematics actually change in a course like Math 9, regardless of whether or not students are conscious of the change. High school students may not be conscious of their changing views of mathematics, but if shifting their perceptions is an important

goal, we need to focus some research on it. We might also consider researching ways that students can become more aware that they are not only learning mathematical content, but they also learning about the nature of mathematics itself.

In general, we need to be cautious not to assume that we know what will be meaningful and relevant to students. Although this course prioritized real-world applications, exploration, and discovery, students did not emphasize those aspects of the course. Although it might be tempting to dismiss this fact by assuming that students only focus on workload, difficulty, and their complaints about the course, such an attitude will not help us make progress towards changing students' attitudes towards mathematics. A study by John Volmink (1983) suggests that students may actually be looking for meaning in mathematics; he interviewed students and professors of an introductory calculus course at a university, and he found that, although the professors thought that students only wanted to memorize rules, students wanted to understand the subject and find meaning in it. The same may be true of high school students. We are making progress by trying to help them find that meaning, and we need to investigate how we can reach that goal. Only by listening to students can we discover how to make mathematics meaningful and relevant to them.

7.3 Open honors policy and tracking

An important feature of the new Math 9 course is that students choose to enter the honors program more than one month into the school year. Most students, other than those who were accelerated in middle school, enter a Math 9 class and have time to get accustomed to it and to learn about the honors program. After about a month and a half, any student can choose to take the course for honors credit.

Because any student can choose to be in the honors program, this setup seems to have some potential for alleviating the permanent nature of most tracking. Even if

students were in low-level courses in middle school, or if they did not do well in their middle school classes, they can join the honors program.

However, evidence from this study (see Section 6.4.2) raises the question of whether or not this setup actually changes which students sign up for honors credit, particularly when this course follows a system of tracking in the middle school. When I asked students about the decision to take the class for honors credit, most of them talked about their past performance in math courses and/or their perception of their mathematical abilities (i.e., are they "smart" or "good at math.") Thus, although any student can enter the honors program, it seems unlikely that students who have been in low tracks would sign up. They are aware of their previous math tracks, and they likely do not label themselves as honors students.

This setup might benefit some confident, middle-track students. For example, Jason realized that he should have been accelerated in middle school, and he regretted that he had been hesitant to try the more difficult courses in previous years. This honors program setup allows him an opportunity to supplement the Regents course and possibly transition into the accelerated track at the high school. The outcomes of this setup might also shift in future years. Diane, a Regents student, wished that she had tried honors because, in retrospect, it did not seem too different to her; if others agree with her, the reputation of the honors program might make it seem more accessible to a variety of students. For students like Diane, the fact that honors students usually stay in the same classroom as the Regents students might make joining the honors program less intimidating.

7.4 Unintended consequence of teachers' decisions

The data from this study provides an interesting example of an unintended consequence of teachers' decisions. Teachers decided to cover some traditional algebra topics in the honors portion of the course so that those students could

transition into the 10th grade honors course, a class that mostly consists of ninth graders who are in the accelerated track.

This decision seemed to contribute to students' perception of the honors portion of Math 9 as an entirely separate course from the Regents portion of Math 9. In particular, two of the three honors students that I interviewed believed that they were not really taking an honors course because they only left the room with the honors students one day per week. They believed that they were only taking one-fifth of an honors course.

I have conjectured that students might have had this perception in part because of the extreme difference between the honors material and the Regents material (see also Section 6.2.4). Students may have seen the CPMP material as inherently "Regents level" material and the traditional algebra as more serious, "honors level" material. Thus, instead of thinking of their course as honors level because they are learning additional material, they believe that they are taking the standard Regents course and getting a small taste of what they would see in a more standard, complete honors course.

If this conjecture is accurate, it could have implications beyond this unique honors program setup. According to Schoen and Pritchett (1998), it is not uncommon for CPMP classes to be heterogeneous, but excluding the most accelerated students (as is the case in this high school). If those accelerated students use a different, more traditional curriculum, will that affect students' perceptions of the CPMP material? Will students in CPMP classes look at their peers' accelerated mathematics courses and believe that the traditional material is more difficult and worthwhile? In other words, would such a setup devalue the CPMP curriculum? To date, there has been no research investigating this possibility. Studies of schools that exclude their most accelerated students from their heterogeneous, CPMP classes could reveal how that

school structure affects students' perceptions of mathematics and their mathematics classes.

7.5 Other areas for future research

7.5.1 Impact on lowest level students

This study gave us little evidence of how this course has affected the lowest-level students. One of the teachers' main purposes for changing Math 9 was to improve their effectiveness with the lowest-level students. They felt that their previous system of tracking was failing those students, and they hoped that putting those students together with more motivated peers would help them learn (see Section 5.2.2). Since research (Linchevski and Kutscher, 1998) does suggest that heterogeneous grouping can have a positive impact on low level students, this conjecture is reasonable.

More information should be available about these students in future years. These students will take the New York State Math A Regents Exam at the end of their sophomore year. Future research that includes the passing rates of that exam is needed to determine whether the new program helps them.

7.5.2 Impact on honors students

Another concern that the teachers had was the impact of this setup on the honors students (see 6.4.4). Two of the teachers thought that the honors students were negatively affected by the changes to Math 9. They believed that those students got too little attention and were deprived of opportunities. One teacher also thought that many honors students did not learn much from the extra honors material, while they struggled more with the Regents material because they left class once per week. The comments of some honors students do suggest that there were problems. All three of the honors students that I interviewed complained that they were bored during the Regents portions of the class. In addition, Rachel left the honors program late in the

year because she felt that she was being pushed too hard to learn material without much time to practice; in her view, the honors students were not challenged four days per week and then challenged too much one day per week.

A more comprehensive study of honors students is needed to understand the situation more fully. Although some research (Linchevski and Kutscher, 1998) suggests that high-achieving students are not harmed by heterogeneous grouping, there is no research on this type of honors program setup. Because some teachers at this school expressed an interest in switching to a non-integrated honors course, such a study could help their department make future decisions.

7.6 Final Thoughts: Listening to Students

Examining students' and teachers perspectives on Math 9 has raised issues that are critical to current mathematics education reform efforts.

Reforms have focused on active classroom communities in which students construct mathematical knowledge for themselves. Frequently, as in CPMP, teachers and curriculum developers believe that setting mathematics within real-life contexts makes such discoveries more accessible. However, students in these Math 9 courses rarely discussed the real-life connections in the curriculum, exploration or discovery in their classes, or a change in their views of mathematics. These are central features and goals of their course, but students did not notice and/or value them enough to mention them.

This observation raises significant questions. Are real-life contexts necessarily real to students, and do they make mathematics real or relevant to students? If not, should we be more open to other ways to motivate students to connect with mathematics? My hope is that we can listen to students to find such methods, rather than assuming that particular approaches will interest students. Furthermore, since

each class and each student is different, can we actively engage students in finding relevance in mathematics for themselves?

Similarly, are students actually exploring and discovering mathematics in their CPMP classes? If they are, why do they not mention it? We want students to make sense of mathematics by constructing it for themselves, but if they are not conscious of this process, how effective is our approach? In addition, if students believe that knowledge has to be handed down to them by experts, not that it can come from within themselves, what happens when we ask them to create knowledge? We want students to construct mathematics so that it makes sense to them and they see it as meaningful, but we need to address their beliefs to make that possible.

I suggest that we be more explicit about our pedagogy to students. We want students to shifts their views of mathematics, but we never ask them to talk about what their view of mathematics is. We usually do not even formally assess our progress towards this type of goal. Instead, we change our instructional practices and hope or assume that these types of transformations occur in students.

It might help students become more engaged in their mathematical learning if we encourage more reflection, not only on what they have learned, but also on their learning *processes*. CPMP does encourage some reflection, but I suggest that we extend that idea and stress it more in implementation. If we are explicit about our goals and rationales, students can then reflect on their progress.

There is even evidence that taking such an explicit approach could even make teaching with a standards-based curriculum more equitable. Boaler (1999) suggests that students have to notice and understand implicit, subtle expectations to be successful in school and that, for a variety of reasons, minorities and students from low socioeconomic backgrounds struggle more with this aspect of school. Boaler offers evidence that teachers can help make reform curricula accessible to all students

by engaging students in discussions about the meanings of problems, the meanings of the real-world contexts that they must consider, and about the teachers' expectations (including, for example, what it means to explain and justify).

Most mathematics educators agree that all students should learn meaningful mathematics and understand its relevance. Achieving this goal is challenging and complex, and the solution does not simply lie in adopting the perfect set of textbooks. This study has suggested that listening to our students is a key to assessing our progress and to suggesting future directions for mathematics education.

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