Moving from a reform junior high to a traditional high school: Affective, Academic, and Adaptive Mathematical Transitions

Amanda Jansen
Michigan State University

Beth Herbel-Eisenmann
University of Wyoming

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Amanda Jansen
jansenam@msu.edu
Educational Psychology
401B Erickson Hall
Michigan State University
East Lansing, MI 48824

Beth Herbel-Eisenmann
herbelei@uwyo.edu
Division of Natural Sciences
449 Wyoming Hall
University of Wyoming
Laramie, WY 82070

As students leave reform-oriented junior high mathematics programs and move into a high school without a reform-oriented mathematics curriculum, what are students' experiences with respect to learning mathematics? In an attempt to characterize these students' experiences, the NSF-funded Navigating Mathematical Transitions project research team (Jack Smith, Principal Investigator) studies students at the point of multiple transitions with respect to learning school mathematics: (1) Between buildings - junior high to high school (or high school to college, depending on the site); (2) Between teachers; and (3) Between different types of mathematics curricula, reform or traditional, which is of particular interest to our research group. This particular paper focuses on the mathematical transitions[1] of students at one of two high school sites in the Navigating Mathematical Transitions project. The high school highlighted in this paper is in mid-Michigan, and the curricular shift is from a reform to traditional mathematics curriculum. This paper presents our preliminary results and analyses from our first year of data collection (1999-2000) at this site.

Prescott[2] High School (PHS) provided nearly ideal conditions for examining mathematical transitions. The only junior high in the district had been a "lead" pilot development site for the Connected Mathematics Project (Lappan, Fey, Fitzgerald, Friel, & Phillips, 1997), and the teachers were highly knowledgeable and very comfortable with that curriculum. It also became the one site where we had detailed understanding of our future participants' classroom experiences (e.g., the dissertation work of the second author (Herbel-Eisenmann, 2000).). Moreover, this was the only junior high in the district, and so it "fed" directly into PHS. Most important, Prescott's mathematics staff had considered and rejected a Standards-based program (Core Plus Mathematics Project (Hirsch, Coxford, Fey, & Schoen, 1998)) and retained a set of courses (Algebra I, Geometry, Advanced Algebra, Functions, Statistics, and Probability, and Pre-Calculus) using a range of more traditional textbooks from Glencoe, Prentice-Hall, and University of Chicago School Mathematics Project (UCSMP)[3] (McConnell et al., 1993).

One of the major tasks of our research group is to develop our conceptualization of "mathematical transition" from studying a context in which students are experiencing a curricular shift, such as the one mentioned above. We utilized the following four factors for assessing whether or not a student had, indeed, experienced a mathematical transition: (1) achievement in mathematics relative to overall achievement; (2) disposition toward mathematics; (3) approach to learning mathematics; (4) whether students notice differences between their junior high and high school mathematics experiences. In particular, these differences students notice as a part of their mathematics learning experience are what we call their mathematical discontinuities (Smith & Berk, 2001). (For a more thorough introduction to this project, see Smith & Berk (2001).)

Research Questions: In this paper, we will address the following research questions:

- What is current classroom instruction like? That is, what is the intended (text materials) and enacted (teaching practice) mathematics curriculum for participating students?
- Which students experience mathematical transitions and which do not? What are the nature of these mathematical transitions?

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[1] For more about our conceptualization of mathematical transitions, our characterization of reform vs. traditional curricula, and the various curricular transitions represented in our study as a whole, please read our introductory paper for this symposium (Smith & Berk, 2001). (Our characterizations of reform-oriented mathematics curricula, in contrast to more traditional curricula, have been described in previous papers (Smith et al., 2000; Star, Herbel-Eisenmann, & Smith, 2000).)

[2] Pseudonym

[3] UCSMP has been considered a reform-oriented text due to increased emphasis on real-world uses of mathematics and multi-step problem solving (Hirschhorn, 1996; Thompson & Senk, 2001), but the implementation of this curriculum at PHS was not necessarily reform-oriented due to the teachers' lack of expectations for the students to communicate about the mathematics.

- Do students' grades in mathematics courses change significantly over time with respect to their grades in other school courses?
- Do students' approaches to learning mathematics change over time?
- What do high school students in a traditional mathematics program notice as different from a reform-oriented junior high mathematics program? How important are these differences? (Who notices a mathematical discontinuity and what is the character of that discontinuity?)
- Do students experience changes in their motivation and engagement in their mathematics classes over time?

We will begin by first discussing the local context, including the curricula, teachers, participants and teaching, in order to describe our site and address our first research question.

The Local Context: The Town and District

Prescott is a Midwestern rural town located near a large university. The population of the town is approximately 4200 people. The majority of the population is middle class (but not affluent) and white.

The school district consists of three elementary schools that feed into one junior high in Prescott. The students at the junior high all attend the same high school, Prescott High School. The district enrollment is 2,516 students, 600 of which attend this school. The ethnic composition of the school district includes 97.79% White, 1.63% Hispanic, 0.17 % each Black, Asian/Pacific Islander, and Other, and 0.07% American Indian/Eskimo/Aleutian**.** The district is also listed at 9.91% students in poverty.

The Curricular Context

The Junior high: The Connected Mathematics Project

In an attempt to make the *Standards* (NCTM, 1989) more concrete, the National Science Foundation (NSF) announced funding for the development of reform-oriented curriculum. NSF wanted curriculum to be developed that embodied the ideas explicated in the *Standards* document. The Connected Mathematics Project (CMP) (Lappan et al., 1997) was one such curriculum to receive funding and was the one used in the 8th grade classrooms.

Broadly speaking, the CMP curriculum is a junior high problem-centered curriculum where almost every problem occurs in a "real life[4]" context. The mathematical goals of CMP can be summarized in the following statement:

> All students should be able to reason and communicate proficiently in mathematics. This includes knowledge and skill in the use of vocabulary, forms of representation, materials, tools, techniques, and intellectual methods of the discipline of mathematics including the ability to define and solve problems with reason, insight, inventiveness and technical proficiency (philosophy statement, CMP, revised 1997).

CMP is organized into units centering on big mathematical ideas. Students develop understanding and reasoning by exploring a set of problems that embody these ideas. Extensive problem sets are included throughout each unit that help students practice, apply, and extend their understanding and reasoning. Periodic reflections help students make connections among a set of "big" mathematical ideas and applications, contained within a given unit.

[4] "Real life" is being used for problems based on real experiences that may not be directly related to the students every day experiences. See Boaler (1997) for a discussion of some of the difficulties with this notion (Boaler, 1997).

In the spirit of the reform (and in addition to the multi-representational approach), a characteristic feature of this curriculum is that it takes a functions approach to the teaching and learning of algebra instead of a more traditional symbolic-manipulation approach. Students are asked to define, observe, model, analyze, etc. variables and make predictions about the data in terms of input/output and in relationship to how one variable depends on another.

The High School: A Mix of Relatively Traditional Curricula

The high school began the school year using the University of Chicago School Mathematics Project (UCSMP) (McConnell et al., 1993) materials in both their algebra and geometry classes. After approximately the first month of school, however, the algebra classes switched to the Glencoe series, while the geometry classes switched to Prentice Hall. In these courses, routine procedural skills were emphasized stronger than they had been as a part of the students' junior high mathematics courses and had a decreased number of real-life mathematics problems. As of Year 2 in our study, the other math courses still were using the UCSMP texts, but were planning on switching to a Prentice Hall Advanced Algebra text for Year 3. The main reason for switching texts was primarily that the books were worn and needed to be replaced, rather than changing the texts to be aligned with a different approach to teaching mathematics.

While the textbooks and their authors vary, the approach to teaching is quite similar (see Results). The traditional aspects of learning math at PHS are related more to the teaching than to the texts.

Inside the Schools: Teachers and Classes

The Junior high

In 1991 the junior high in Prescott was chosen as one of the first sites out of 55 districts/schools) to pilot the CMP materials as they were being authored. Throughout the process of editing the materials, the teachers used the units in the classroom and offered feedback to the authors about changes they suggested. Because of this involvement, the teachers who teach in the junior high building are not only very experienced with the curriculum, but they are also very supportive of it and the approach to learning mathematics it embodies.

Josh and Karla were two of the teachers chosen to pilot the curriculum. Josh was part of piloting the 8^{th} grade units and taught them for the past six years, and Karla also taught 8^{th} grade mathematics with these units for the past two years. Between the two teachers, they encompassed the entire 8^{th} grade student population, one for which there was no tracked mathematics classes. In addition, each teacher had a partial teaching assignment at the 7^{th} grade level—in math for Josh and in science for Karla.

While piloting this curriculum, the county school district received an Eisenhower grant to offer summer professional development activity related to the NCTM *Standards* and implementation of reform-oriented mathematics teaching. These workshops took place for one week during each of the summers from 1991 through 1995 and both Karla and Josh participated in all of them. Some of the presenters and organizers of these workshops were colleagues from Josh and Karla's school. The activities that they engaged in ranged from observing teaching of CMP lessons by model teachers to discussing the meaning of "discourse" as it was presented in the *Standards*.

Josh and Karla are strong proponents of the CMP curriculum. They have shown their enthusiasm and support for the curriculum in at least two ways. The first was how they represent themselves as teachers of CMP at broader levels than just within their building, as they became very enthusiastic about CMP and showed this enthusiasm by becoming involved in the professional development activities CMP offered for its teachers. In the second way, they have shown their support at local and regional levels in defending the curriculum when it has come under fire at the school, as well as beyond the school's four walls (e.g. at the district and regional level).

Since the CMP units are quite different from traditional mathematics textbooks, they also carry with them the controversy and adjoining criticism that often accompanies any reform-oriented curriculum (Askey, 1992; Dillon, 1993; Jackson, 1997a; Jackson, 1997b). In order to prepare for such backlash, Josh and Karla spent one summer (with other teachers in their building) mapping the CMP curriculum onto the state standards. That way, if they (the teachers and textbooks) were ever accused of not preparing their students sufficiently, they could point to all of the connections between CMP and the state standards[5].

The High School

Some of the criticism to which we referred above came from the high school mathematics teachers. According to both the high school and junior high teachers, the philosophies about teaching and learning mathematics vary quite a bit between the two buildings. While the junior high teachers focused more on problem solving skills and "big ideas," the high school teachers expressed concern related to students' ability to manipulate symbols. This difference of focus and opinion was sometimes a point of tension between the two buildings, not unlike the case written by Dillon (1993).

The teachers

The math department at Prescott H.S. consists of five teachers: Roger Graves (department head), Jake Brown, Jeanne Davis, Deanna Cooley (Year Two) / Shawna Brackle (Year One), and Joseph Nee. (Ms. Brackle was on staff at PHS for Year One of the study, then transferred schools and Mrs. Cooley was hired for Year Two). Deanna Cooley, Shawna Brackle and Jean Davis are female teachers, while Jake Brown, Roger Graves, and Joseph Nee are male teachers. During Year One of our study, we met Jeanne Davis, Shawn Brackle, and Jake Brown. Jake Brown and Shawna Brackle taught Geometry, and Jake Brown and Jean Davis taught Algebra. For Year Two of our study, we met Deanna Cooley and worked with Jake Brown again in Geometry, while we met Roger Graves and worked again with Jean Davis, but this time in Advanced Algebra.

Tracking.

Students moving into the high school were placed into either an Algebra I or Geometry class. In the past, Josh and Karla had made recommendations based on student performance in their 8th grade mathematics classes. For our participants' cohort (entering 9th graders, 1999-2000), however, students were asked to choose which class they would like to take. Students have mentioned choosing tracks for a variety of reasons, varying from the extent to which they wanted to be challenged to the extent to which they felt academically prepared for high school mathematics.

There are two primary tracks for students at Prescott H.S. for their first two years of study:

- Upper: Geometry (Year 1) → Advanced Algebra (Year 2)
- Lower: Algebra (Year 1) → Geometry (Year 2)

{Insert Figure 1}

[5] The principal at Prescott Junior High mentioned this in a casual conversation with the second author during one of her visits to the school.

The primary difference between the upper and lower tracks is that the upper track students skip Algebra I as 9th graders and go directly into Geometry.

During students' junior year of h.s., students may take either Advanced Algebra or A.I.M. (a math class designed to prepare students for standardized tests, such as the ACT or the SAT), or Functions, Statistics, and Trigonometry (if the prerequisite of Advanced Algebra has been satisfied). Students are only required three years of math at PHS, but if they choose to take math their senior year, students either take FST, if they have not already done so, or pre-calculus. Calculus is not offered at PHS.

For the first quarter of the high school Geometry curriculum, the department head, Roger Graves, designed a mini-Algebra I review curriculum. This algebra review has lasted at least an entire grading period, and as long as 12 weeks, depending on the teacher and whether the geometry class was observed during Year 1 or Year 2 of this study.[6]

Method

Participants

28 9th grade students (1999-2000) volunteered to participate in the Navigating Mathematical Transitions project at Prescott High (14 males, 14 females). Students were compensated $250 per academic year for their participation in this study. To recruit a range of students, we presented the study to the to the students as 8th graders and elicited initial volunteers. We then visited their high school the following year and presented the project to the 9th grade student body and asked for volunteers during their math classes. In addition, we took recommendations from both the 8th grade teachers and from one of the authors who had spent time on a weekly basis with the students in their 8th grade classrooms. We wanted a similar distribution of genders and of students who were going into Algebra and into Geometry. We also tried to include students who had done well in 8th grade mathematics as well as students who had struggled with the mathematical content. Lastly, we looked for students who had been outgoing as well as students who had been fairly quiet in their 8th grade mathematics classrooms.

The population of students involved in the first year of this study is included in Table 1 below.

{Insert Table 1}

This paper's preliminary analysis includes data from the first year of our study (1999-2000) only[7]. Our participants were enrolled in either Algebra I or Geometry during Year One of this project. They took Algebra I from either Jeanne Davis or Jake Brown or Geometry from either Jake Brown or Shawna Brackle.

We selected target students as part of our beginning analysis with a goal of looking at a mix of male and female students, a mix of upper and lower track students, and a mix of students who had varying attitudes towards participating and engaging in mathematics learning. Students who are represented with a first-name pseudonym are analyzed as a part of this paper, while students who are represented with initials are a part of our overall sample, but are not a part of our preliminary analysis thus far.

Participation in the Mathematical Transitions Project at the high school level involves working with members of our research group at the site. Research group members observe the

[6] Graves mentioned to the first author during a school visit that this Algebra I review was designed to help the students coming from the junior high in order to improve their symbol manipulation skills as well as helping the students from Algebra I retain what they learned in the previous year.

[7] In the second year of data collection (2000-2001), ten of the Algebra students (5 female, 5 male) chose to continue their participation in the study as they moved into their geometry classes. In Geometry, 11 students continued their participation (6 females and 5 males) as they moved into advanced algebra for year two.

teaching in participants' mathematics classrooms one to two times a week every semester, and interact with the participants (and other students in the class) informally during the class period, at times serving as a classroom aide and answering questions about the lesson's mathematics problems. Participants participate in interviews about their experiences in the classroom and about their problem solving process, thinking aloud as they solve math problems. Also, participants write weekly journal entries about their mathematics experience, complete surveys twice a year about their conceptions of mathematics and perspectives about themselves as learners, and give the research group access to their grades and test scores.

The first author was the primary data collector at Prescott High School, with support from the project's primary investigator during both years of the project thus far and from the second author during Year 1.

Results / Analysis: Teaching at Prescott High School

Our assessment of the teaching at the schools in the Mathematical Transitions Project is in light of what we consider the "standard model" of mathematics teaching (Smith, 2001). Essentially, the standard model would be: (1) Going over the previous nights' homework; (2) Teacher presents new material; (3) Students practice the new material by working on an assignment.

There are few exceptions to examples of mathematics teaching at Prescott H.S. that vary from this standard model. One exception would be Jeanne Davis; she uses Warm Up problems at the beginning of class. These problems are more like logic puzzles and are unrelated to the mathematical concepts in the particular unit of study (e.g., Rearrange the letters of MARCH to form a common English word (class observation, 3/27/01).) Another exception would be special activities; Roger Graves, Jake Brown, Deanna Cooley, and Jeanne Davis have conducted activities related to the current math unit once or twice a semester (e.g., Jake Brown and Deanna Cooley had their students create their own tessellations in Geometry).

The elements of our standard model of mathematics teaching also vary between teachers. For example, teachers go over the homework in different ways. Both Deanna Cooley and Shawna Brackle put answers to the homework on the overhead for the students to grade their own work. Jake Brown selects 3-5 problems from the homework from the night before, puts the numbers on the board, and as students come into class, they can volunteer to work on one of those problems at the board at the beginning of class for extra credit points. Roger Graves and Jeanne Davis call on students for answers or read the answers out of the textbook while students grade their own work. Teachers also vary in their implementation of group work, and when it is used teachers typically have students in small groups during homework / practice time.

Also, the organization of the class differs among the teachers. Deanna Cooley, Shawna Brackle and Jeanne Davis require their students to keep an organized notebook for a grade. (JD did not start this until Year 2 of the project.) Roger Graves and Jake Brown, on the other hand, do not require their students to take notes. In all classes, seats are assigned and students often have input in the design of the seating charts. The frequency with which seats change during the semester varies across classes.

Overall, the teaching at Prescott H.S. is aligned with what we consider a standard model of mathematics teaching. This model is based on an idea of "traditional" teaching of mathematics. In contrast, the teaching at the junior high affords more opportunities for discussion of the mathematics (see the second author's dissertation study (Herbel-Eisenmann, 2000)) as well as a pace determined more by level of students' understanding than accomplishing a set schedule of a textbook section per day[8].

[8] This comparison between the teaching approaches at the two buildings can be found in participants' interview data.

Next we will move into examining our research questions regarding the nature of mathematical transitions at this site, which include addressing issues of mathematics achievement, mathematics learning approach, motivation and engagement in mathematics class, and the differences students notice between their high school and junior high mathematics experiences.

Results / Analysis: The Nature of Mathematical Transitions at P.H.S.

As mentioned earlier, we use four criteria to determine whether or not a student is experiencing a mathematical transition: (1) change in mathematics performance, (2) change in approach to learning mathematics, (3) change in mathematics disposition, which we classify as a change in motivation or engagement in their math class, and (4) whether students notice salient differences between their junior high and high school mathematics experience. If a student meets two out of the four factors, we classify this student as experiencing a mathematical transition.

We have observed three types of mathematical transitions among our participants at Prescott High: *An academic transition, an adaptive transition, and an affective transition*. We observed some students whose grades in mathematics changed and their learning approach changed, but they did not notice salient differences or change their motivation and engagement in mathematics classes; these students experienced an academic transition. Our student who experienced an adaptive transition maintained consistent mathematics grades and did not change his motivation or engagement in math class, but changed his learning approach and noticed salient differences. Affective transitions occur when students have minimal to no changes in mathematics achievement or mathematics learning approach, but they notice salient differences between their junior high and high school mathematics experiences, and their motivation and engagement with respect to their experiences in math class changes.

Academic Transitions: Changes in mathematics performance and learning approach

One type of transition, an academic transition, occurred with mathematics students whose grades in mathematics changed along with their approach to learning mathematics. These students may have observed differences between junior high and high school, but students did not express any of the particular differences with emphasis, nor did these differences affect their disposition towards learning mathematics.

In order to discuss which students experienced academic transitions, we will present our results and analysis of students' mathematics achievement and their changes in learning approach.

Relative Changes in Achievement. In this section, we look at students' performance in mathematics (course grades) from the end of 8^{th} grade to their first semester in 10^{th} grade. We are paying attention to whether their mathematics course grades change dramatically, particularly in comparison to the way their grades are changing in their other classes.

We determined if the change in math grade was significant by defining a relative grade change between the change in math grades and change in semester grade point averages. In determining the change between two semesters, we first found the difference between the student's math grades and the semester G.P.A.'s.

$$\_{\text{MathGrade}} = \text{Math grade}_{\text{Sem2}} - \text{Math grade}_{\text{Sem1}}$$

$$\_{\text{G.P.A.}} = \text{G.P.A.}_{\text{Sem2}} - \text{G.P.A.}_{\text{Sem1}}$$

Then, we found the difference between these differences, which is what we call the relative change in achievement.

$$\_\_{\text{MathGrade}} - \_\_{\text{G.P.A.}} = \text{Relative Change}$$

If the relative change in achievement was more than 0.5 or less than 0.5, we said that the relative change in math grades with respect to the semester G.P.A. was important enough to note (see table: ↑ or ↓), but not enough to consider significant[9].

We considered a student with a relative achievement change of 0.75 to have experienced a significant change (see table: ↑↑ or ↓↓) in their mathematics grade with respect to the rest of their course work.

{Insert Table 2}

Mathematics Performance Alone. If we looked at students' performance in mathematics alone, most students' math grades went down the first set of semester changes (8th spring to 9th fall), a mix of trends occurred in the second set of changes (9th fall to 9th spring), and most students' math grades went down again in the third set of semester changes (9th spring to 10th fall). These changes in grades alone did not thoroughly inform us about patterns in their achievement performance.

For example, in the first set of semester changes, we saw a variety of changes in students' math grades, but *we observed decreases in math grades more often than increases*. Four students' math grades decreased by 0.5 of a grade or more in math (Katherine, John, Sam, and Jeffrey). Two students' math grades decreased by less than 0.5 of a grade (Kevin and Sophia). Two students' grades in math were consistent as they moved from 8th grade to early 9th grade (Stacy and Larry). Two students grades increased in math; Bethany's math grade increased by less than 0.5 of a grade while Kara's math grade increased by more than 0.5.

If we looked at these math grade changes alone, we would consider any grades that changed more than 0.5 of a grade in math to be important enough to note. In this first set of grade changes, five students would have a notable change in math grades: Kara, Katherine, John, Sam, and Jeffrey. However, we wouldn't know how these changes related to the way their grades changed in their other classes. In other words, we wouldn't know if the change was a math change or an overall trend in their grades that semester.

Semester Grade Point Average. Looking at the students' semester grade point averages with respect to their math grades told us more about a change in math grades relative to a change in the rest of their courses that semester, which provided different results in terms of significant performance changes.

Looking at the first set of relative changes, five students had significant changes in math grade in relationship to G.P.A. changes, but it is a slightly different set of five students: Katherine, Sam, Sophia, Kara, and Jeffrey. Bethany and Kara's math grades went up significantly more (relative change of more than 0.75) than their G.P.A.'s changed from 8th grade spring semester to 9th grade fall semester. Sophia and Jeffrey's math grades went down significantly more than their G.P.A.'s went up, and Katherine's math grade went down more than her G.P.A. went down.

Trends in achievement data. *Notable changes between math grades and GPA are more likely to occur initially rather than later.* More notable changes (more than 0.5) were found at the first set of relative changes (between spring of 8th grade and fall of 9th grade) than at the second. 5 out of 10 students had notable relative achievement changes in the first set with 3 out of 10 students in the second set. However, 4 out of 10 students had notable relative achievement changes in the 3rd set, 3 of whom also had a significant change in the first set of achievement changes. If a relative achievement change occurs in both the 1st and 3rd set of changes, does this mean the student struggles in during a semester when the teacher and

[9] A student's math grade could increase by 0.25 and their G.P.A. could decrease by 0.25 and still get flagged by this rule. We were not certain that this change felt "significant."

textbook change? (Is the impact in achievement a result of change in teacher rather than a move into the high school?)

However, if we move to look at the significant grade changes, we see that out of the five students whose grades changed significantly (more than 0.75), four experienced this change at the initial move from junior high to high school (the first semester). Only one experienced this change later on (third semester)[10].

More students in the lower track (Algebra I (9th grade) to Geometry (10th grade)) experienced a significant math grade change than students in the upper track (Geometry (9th grade) to Advanced Algebra (10th grade)). Three out of five students who experienced a significant math grade change were in the lower track (Jeffrey, Sophia, and Kara). Two out of three students who experienced a significant math grade change were in the upper track (Katherine and Sam).

Students chose their own placement into these tracks, which affects how we think about students' mathematical performance. One of the females who has mismatches for both sets of relative changes and who is in the lower track told me that she choose this track not because she struggled in math and thought she needed to learn more content, but because she didn't want to take advanced mathematics courses in high school. There were motivational reasons behind her placement in the track rather than academic performance reasons.

If significant changes in mathematics grades occur, and they are not frequently observed, they will usually be decreases. Out of our five students who experienced a significant change in their math grades, four of them experienced significant decreases (Katherine, Sam, Sophia, and Jeffrey). One of the students, Kara, did experience an increase in math grade.

Overall, when looking for students' changes in mathematics achievement, these changes don't appear often. Out of ten students, and three opportunities for their grades to change, we only observed five students' mathematics grades changing significantly one time each. We observed three out of five of these students in the lower mathematics track of courses. Also, we observed four out of these five significant changes occurring as decreases rather than increases in mathematics grades.

We have talked about the five students who experienced significant changes in their mathematics grades, but satisfying this criterion alone is not enough to have experienced an academic transition; students also had to have experienced a change in learning approach.

<u>Changes in Learning Approach.</u> We determined a change in approach to learning math if a student specifically mentioned a change in how they studied for math class, either in preparation for a test or when completing assignments. Our research group concerned ourselves with considering autonomous changes, not changes that students mentioned occurring as a result of another change, such as the change in teaching styles. For example, we might consider students who change their patterns of participation to have expressed a change in approach to learning mathematics, but these students would give the reason for changing their participation patterns as attributed to their teachers' different approaches to running the classroom. Also, when students generally express having to "pay attention more" or "work harder," we did not consider this to be an autonomous change in approach to learning math, but more a change in response to changing classroom demands.

Our data for changes in students' learning approach comes interviews with students. Students shared whether they changed their approaches to learning when they talked about whether they made efforts to cope with differences between middle school and high school mathematics classes.

Types of (autonomous) changes in learning approach toward math class include the following:

- Student expresses a change in approach to completing assignments; student uses the textbook more as a resource, such as reading the examples provided in the textbook to determine the steps for solving the problem, rather than getting this information

[10] This particular student also experienced a number of major family changes at home that semester.

primarily from class discussions or teacher's lecture, and using answers that are now in the back of the book to work backwards and solve problems (Kara, Sophia, and Jeffrey).

- Student notices the problems are not written as story problems, and instead will construct a context or story of his own to fit to the problem so he can understand it (Larry).

To illustrate these points, here are some sample interview responses:

> *Like, in the beginning, for every problem, in the beginning of the chapter, it will have one for two or three [story] problems, and after that, I guess you've got to kind of relate the question with what if Bobby was x instead, in the problem. You have to bring the question you're being asked, and substitute it, instead. Bring the characters from the problem that had the character and move them into this one.*
>
> - *Larry*

In Larry's case, he doesn't "have" to bring a story context to a problem because he is required to do so. He chooses to do this, and his use of "have to" may imply that he personally wants to in order to get a better sense of the problem itself. However, since Larry didn't meet the previous requirement of significant grade change, he is not one of the students we are speaking about in the case of academic transition.

Another sample interview response is as follows:

> *It's a lot of the same stuff, like the equations and stuff like that. I like this year's stuff better, though. The book helps more... Last year, it was all pretty much given in real life form, and that was just a little bit confusing, but here, they give you the actual equation, and then a real life problem, so you can always go back to the equation and check. It just got a little confusing last year. You couldn't get anything straight out of it.*
>
> - *Jeffrey*

Jeffrey preferred the textbooks in high school because he can use the textbook as a resource. Responses about using the text as a resource also included discussion about the answers now being in the back of the book, allowing students to work backwards if they wanted to do so.

One upper track student's lack of change in learning strategy was significant in that his classroom environment did not seem to support his attempt to maintain this learning strategy. Kevin spoke of how it was easier to participate in class in 8th grade, because the teacher invited more opportunities to talk about ideas.

> *Everybody got involved last year. Kind of hard to remember everything, but... everybody really, everybody talked. I remember a couple of times last year, the teacher {8th grade} would go around the room, and everybody had to say something about what they thought about it. He'd start at one end of the room, and he'd ask them what they thought about it, and what they understood, and what they didn't understand, and they'd just talk, then he went around the whole entire room. If it was a topic that was kind of shaky, he didn't know who understood it and who didn't, so he just went around the room and asked everybody.*
>
> - *Kevin*

Then, he said his 9th grade math class wasn't really a class discussion "because not too many people got involved. Maybe one or two. We just go over an example that's in the book. We just go over it. She'd {Ms. Brackle} write the exact same thing on the board and tell you how they went over it and everything, and..." Kevin was usually among the one or two students who still got involved in class. His lack of change, in this case, is important to note, because he is one of the few students who noticed it was harder to participate in class, but then still tried to participate.

Trends. *Only students in the lower track expressed a change in learning approach.* Four students out of ten experienced a change in learning approach, and they are all in the lower track of students. There are a variety of possible explanations for this trend. One might be that the upper track students are typically the more successful mathematics students, and these students may be more adaptable, making changes in their learning approach so automatically that they don't think to mention them. However, many students in the upper track did mention changes in learning approach, but they were not mentioned here because these changes were determined to be not autonomous, but more a direct response to change in teaching. In most cases, students in the upper track were still doing well academically in their math class (Katherine seemed to be struggling the most in the upper track.), so they might just be naturally adaptable and not think to talk about these adaptations in interviews, or their learning techniques still seem to work well for them.

While four out of the five lower track students did express a change in learning approach, one student in the lower track did not express an autonomous change in learning. This student, Stacy, was another "naturally adaptable" student like those mentioned in the upper track; she had earned straight A's in math since 8th grade and doesn't mention an autonomous change in learning approach; she prefers the way she learns math in high school due to the decrease in story problems.

In general, *it is challenging to isolate students' changes in learning approach at the high school level as "autonomous" changes*. For example, using the text as a resource and bringing a story context into problems without stories may be considered closely tied to changes in their learning environment. Students who use their text more as a resource may do so because the chapter explicitly explains procedural steps; their middle school text did not do this.

Four students have met the criterion of change in learning approach: Larry, Kara, Sophia, and Jeffrey. They are all in the lower track of students.

Who had an academic transition? Now we have talked about the two criteria necessary for an *academic transition*: change in mathematics grade and change in learning approach. Three students satisfied both of these criteria: Kara, Sophia, and Jeffrey. Their grades changed (Kara's went up, while Sophia and Jeffrey's went down.) and their learning approach changed (all used the textbook more as a resource in high school). These three students also did not notice salient differences between junior high and high school mathematics and did not experience a change in motivation or engagement in math class.

Adaptive Transitions: Change in Learning Approach and Noticing Salient Differences

Another type of transition is a category for the student whose learning approach changed and also noticed salient differences between high school and junior high mathematics classes: an *adaptive transition*.

Larry was another student who experienced a change in learning approach, but he also expressed noticing salient differences between junior high and high school mathematics classes. He is the only student in our sample thus far who is experiencing an adaptive transition.

We have already discussed the sorts of changes in learning approaches we found with the students in our study. Next we will present our results of the types of differences students notices between junior high and high school mathematics classes.

Commonly noted differences. Because one main objective of this research is to understand how students view two types of curricula that look quite different to mathematics educators, we directly asked students where they see differences between their current math course experience and their previous mathematics program. Our questions are posed in general, (e.g., "what is different...?") and more specific terms (e.g., "how does a typical day in math class this semester/year differ from last year?").

We cannot count any "difference" response as significant, particularly because we sometimes asked the students directly about specific differences. Instead, we define the differences reported by a student in our analysis to date to be *significant* if the student repeatedly mentions it more than three times (over two interview sessions). The main principle here was to designate some indication of importance for and/or impact on the student. Our analysis to date includes coding of two interviews with students about the differences in their mathematics experiences, one from the beginning of 9th grade and another at the end of 9th grade.

At the group level, students observed 10 significant differences between their junior high and high school mathematics experiences. We also included an 11th difference in the table that no one mentioned at a level of significance, but that every student did mention once (see below).

{Insert Table 3}

Differences according to Curriculum and Teaching Scheme. Our analytic scheme for the origins of differences students note includes the curriculum, teaching / teachers, site policy, and individual difference, including interactions between all four, but the students at Prescott observed differences that they attributed to changes in the Curriculum, Teaching / Teachers, and interactions between the two, not observing differences between the school's site policy's or not mentioning as salient differences within themselves.

Students attributed differences to the following origins:

Curriculum

- Typical problems: less story problems, different topics.
- More direction provided (in the textbook) for solving problems.
- Typical problems: less understanding of content required.
- Content is presented in greater detail or "complexity."

Teaching / Teachers

- Teacher's typical lesson: organization, direction, or shaping of activity (e.g., nature of class discussions.)
- Teacher-student relationship.
- Classroom management: challenging to participate, different norms.
- Instructional Pace.
- Teacher's expectations for student participation: less discussion of alternative solutions.

Curriculum and Teaching / Teachers

- Typical problems: ease of understanding content.
- Typical homework assignments: number of problems.

Trends in types of differences. While students at PHS do not particularly attribute differences to site policies or themselves, they *noted differences slightly more often with respect to the teacher and teaching rather than the curriculum*. We would expect students who were not experiencing a curricular shift, such as from reform to traditional math texts, to also observe some of these differences in teacher and teaching as a result from changing teachers in any context, and perhaps in particular during the move from junior high to high school. In particular, we might not be surprised that students moving out of junior high into high school would speak of differences in teacher-student relationship (teacher is less interested in students' lives outside of class), changes in typical lesson (less variation in the organization of day-to-day activity), or instructional pace (spending less time focusing on particular topics).

However, students also notice differences in teaching that they attributed specifically to their experiences in math class, particularly related to different expectations and norms for participation, including the decreased opportunities for discussion of alternative solutions for solving problems.

> *Like, last year, I had [8th grade teacher]... And she taught us different ways, and she, like, kind of left it up to us to find a way that was easiest to us. In that we understood. [...] But, like now, the teacher I have right now, she's kind of, like, kind of focusing on just like one method. And, like, I really don't, I really don't like that, because it's like I don't really like that method, and I have a way that I feel more comfortable with, so I tend to do that, like self consciously. I'll just start doing it, you know, I really don't think about it. And, like, I'll have to go back, oh, I can't do that, because I have to do it this other way.*
> - *Bethany*

Students would speak of differences in ways they were expected to participate in class, sometimes talking about these differences with respect to the specific case of a lack of discussion of alternative solutions for solving problems.

Ease of understanding the content, depth of understanding required, and content presented in greater detail or "complexity" are three differences that were expressed in relationship to the other. Students spoke about the greater amount of complexity and detail in their high school math classes. Sometimes they said they expected this to happen, because as you move into a more advanced math class, math should be more complex, more detailed, and more challenging. However, they were sometimes noticing that with more complexity sometimes seems less expectation for depth of understanding, and that more complexity sometimes makes the problems easier or more difficult to understand what was expected for solving the problem.

> *This year we have to do much more math and longer equations, we have to plug them into such a long equation to help solve x it takes so long because you're plugging in so many numbers and multiplying all these numbers together and I guess you punch in a lot of numbers. This year is more about multiplying the numbers and last year was more about inserting them into the equation and getting them to where they like bond between two ways of dong it. We'd learn more of putting together instead of actually figuring it out. [...] Different in the complexity of math, but not really different because you're doing the same type of work.*
> - *Kevin*

This is one example of a student who would talk about the math being more complex in the amount of detail ("such a long equation... so many numbers..."), but also would refer to the different types of understanding ("This year is more about multiplying the numbers... last year... we'd learn more of putting together instead of actually figuring it out...").

<u>Trends in Tracks of Students.</u> *Students in the upper track (those who took Geometry in 9th grade, skipped Algebra I after 8th grade) noticed significant differences than the students in the lower track.* Every upper track student noticed multiple significant differences, while only two lower track students (Larry and Stacy) noted more than one significant difference. Three out of the five lower track students noted only one significant difference, while one lower track student (Kara) did not note any significant differences, and when she did note a difference at all, it was when she was responding to specific prompts, such as "Are there any differences between your math textbooks in high school and junior high?"

The lower track students are those who did not skip Algebra I upon entering high school, considered the lower track of mathematics students. There are a variety of reasons why a student might be in this track, including a lower self-perceived ability in mathematics (students self-selected their placement into tracks upon entering high school) or a lack of interest in mathematics.

For example, Kara, who does well in math class, is a lower track student who didn't mention any significant differences due a lack of interest in mathematics. I asked her why she choose Algebra I for 9th grade, and she talked about not wanted to take FST.

> *It's hard. My sister's in it, and it stresses her out. I don't want to take it. So, I'm just going to take advanced algebra.*
> - *Kara*

She wanted to get her three math credits out of the way without having to take Functions, Statistics, and Trigonometry (FST). Instead, Kara wanted to take Algebra I, Geometry, and Advanced Algebra, and not have to take FST, which follows Advanced Algebra. So, it would make sense that certain differences were not significant to her, because she's not particularly passionate about mathematics; she just wants to get through it.

Other lower track students, who were not doing as well in math class, may have been confronting the struggle with the content rather than attending to the differences between junior high and high school mathematics.

Overall, more students in the upper track noticed more than one salient difference (five out of five: Bethany, Katherine, Kevin, John, and Sam) than students in the lower track (Stacy and Larry). The differences that were noticed were usually attributed to the teacher rather than the curriculum.

Back to the nature of transitions: Adaptive. As mentioned earlier, one student who noticed salient differences, Larry, also experienced a change in his learning approach. He is the only student who was flagged for both of these factors, and the combination of these factors, along with maintaining consistent grades in mathematics and not experiencing a motivation or engagement change, placed him in the category of experiencing an *adaptive transition*.

Affective Transitions: Change in motivation / engagement and noticing differences

Many other students noticed salient differences, but did not experience a change in learning approach. However, many of the students who did notice the salient difference also experienced a change in motivation and engagement (mathematics disposition) in their mathematics courses. We say that these students experienced an *affective transition*.

Changes in mathematics motivation and engagement were determined in our analysis by first looking for when students noted significant differences, and then coding these portions of the interviews for whether the students expressed an opinion about how this significant difference affected their opinions about school mathematics.

Types of changes in mathematics motivation / engagement:

- Student expressed annoyance at not being able to do math "her way" in high school like she could in junior high (Bethany).
- Student expressed a dislike for not being expected to figure out more of the mathematics on his own, would have preferred for the teacher to be less directive about how to solve the problems (John).
- Student expressed decreased motivation to work hard at math in high school, which included a decreasing preference for the school subject due to lack of involvement and hands-on activities structured by teachers (Katherine).
- Student expressed a decreased preference for math teachers who do not get students involved in class, because it is "more boring" (Kevin).
- Student expressed a preference for high school math, because of the decrease in the amount of story problems and the more "direct" approach to mathematics (Stacy).

Trends. It follows that *more students in the upper track expressed changes in their motivation and engagement in mathematics* (four out of five: Bethany, Katherine, John, and Kevin), since more students in the upper track also noted significant differences. Also, one student out of our five in the lower track (Stacy) expressed changes in her motivation and engagement in mathematics.

Some students expressed preferences for aspects of their junior high or high school mathematics experiences only when specifically prompted, and then these preferences were mentioned with a qualifier (e.g., "If I had to choose…") or a proceeding remark (e.g., "Big deal, get over it."). These students would often say they based their opinions toward their math classes on whether they were doing well in math at that point in time. Students in this group include Sam (upper track) and the rest of the lower track students (Sophia, Kara, Larry, and Jeffrey). For example, Larry has always liked math, and continues considering it among his favorite school subjects, because he feels like he understands it, and Sam does not have a strong opinion about math as long as he's doing well. However, Sophia, Kara, and Jeffrey do not consider math to be an important school subject in their lives, so differences may affect them to a lesser degree.

Revisiting Affective Transitions. The five students who experienced a change in motivation and engagement in mathematics and also noticed significant differences between their junior high and high school mathematics classes experienced an *affective transition*. These students are Bethany, Katherine, John, Kevin, and Stacy. All of these students are from the upper track, except Stacy. However, Stacy could have been in the upper track, as she is a straight A student in mathematics, but she said she chose the lower track because she thought it would be easier.

Three types of Transitions: Affective, Adaptive, and Academic

Again, our criteria for a student to have experienced a mathematical transition involves satisfying any two of the following four factors: (1) a significantly different grade change in mathematics class with respect to his or her grades in his or her other classes that semester; (2) prefer studying mathematics more or less than he or she has expressed in the past, or notating a strong preference or dislike for the differences he or she noted; (3) express an autonomous change in strategy for studying for their mathematics class (such as a strategy for completing homework or preparing for a test); (4) mention particular differences between junior high and high school mathematics classes frequently (more than three times) throughout multiple interviews.

We observed three types of transitions at Prescott High. An *affective transition* occurred among students who had a change in motivation and engagement in mathematics and who also noticed salient differences between junior high and high school mathematics. Bethany, Katherine, John, Kevin, and Stacy experienced this transition. An *adaptive transition* occurred with Larry, because he noticed salient differences and changed his approach to learning mathematics. An *academic transition* occurred among the students whose mathematics grade changed and also changed their learning approach (Kara, Sophia, and Jeffrey).

Almost all of our students, nine of our ten, have experienced a mathematical transition: Bethany, Katherine, Kevin, John, Stacy, Kara, Larry, Sophia, and Jeffrey. We are not certain that Sam (upper track) has experienced a mathematical transition, since the factors he has met include noting differences and a change in math grade that did not occur until fall of tenth grade. Also, we are not completely certain about Katherine's transition because she also experienced a change in her mathematics grade along with changes in her motivation and noticing salient differences. How is Katherine's transition similar or different from the other students who experienced an affective transition?

Trends in types of transitions. *Upper track students have different mathematical transitions than those in the lower track.* When we found students experiencing a mathematical transition in the upper track, it was due to noting significant differences and experiencing a change in disposition (Bethany, Katherine, Kevin, and John). However, most of the students experiencing a mathematical transition in the lower track had a significant relative change in achievement and a change in learning approach (Kara, Larry, and Jeffrey). The exception in the lower track was Stacy, who experienced an affective transition due to noting significant differences and experiencing a change in disposition, but Stacy is also unusual because she is the only student in our entire sample to have earned straight A's in mathematics class since 8^{th} grade.

In summary, three types of transitions appear to characterize students' experiences as they move from reform mathematics in junior high to traditional mathematics in high school: affective, adaptive, and academic transitions.

Discussion / Conclusions

Tracks 1 and 2 - experiences differ

Overall, it seems that students in the upper track have a different mathematics experience than those in the lower track. This is particularly interesting since the students place themselves in the tracks. A recent conversation between the first author and the Prescott High principal revealed the strong possibility of the high school beginning to implement guidelines for placement into Algebra I or Geometry upon entering 9^{th} grade, including a placement test, due to the high number of students in Algebra I who struggle.

Will these results still hold at schools like PHS when students do not self-select their placement into the Tracks? Is it surprising that the students in the upper track mentioned more criticisms and expressed stronger emotions about their math experiences, while the students in the lower track expressed more concern over achievement and how they dealt with it? This self-selection into tracks is certainly only one of multiple reasons for this difference between tracks, however.

Challenge: Isolating issues to be specifically related to mathematics experience.

As our analysis progresses, we continue to refine our analytical framework in order to capture differences that are significant for the students in terms of their experiences in math class. Although we have developed a way to look at changes in mathematics achievement relative to changes in the rest of the students' course grades, we have struggled with how to consider their responses about other issues (significant differences, changes in learning approach, or changes in disposition) relative to any changes the students might be experiencing along these lines with respect to their other course work or high school in general. How do we know that their responses are about *math* in particular?

Autonomy. A salient issue for our students was the issue of autonomy; it appeared as a theme throughout many of our interviews. Issues relating to autonomy included general issues of transition into high school as well as issues relating to the students' experiences specifically in math. In terms of general transition into high school, most of the students spoke of the teachers expecting more from them, having to be more mature and take responsibility for themselves. Sometimes students spoke about their math classes in the same way, a specific case of teachers expecting students to think for themselves and take responsibility for their own learning.

Also, in a few cases, the students mentioned that their math class was contrary to this overall expectation of increasing student responsibility in high school (John and Sam). John said that in high school math class, the teachers expect them to think for themselves less than they were expected to in junior high. ("This year, it's just like, here's this, memorize it, learn it, and I think I know stuff better when I get to learn it by myself." – John) Sam said that his high school math teacher was more controlling than his 8^{th} grade math teacher was, and the rest of his high school teachers were a lot less controlling than his junior high teachers. Bethany continually spoke about the value she placed on being able to develop her own solution methods for doing the mathematics, and this development was not supported in 9^{th} grade math class like it was in 8^{th}.

When the differences students note about their math classes are contrary to what they say about their general high school experiences, these differences are more clearly specifically about their mathematics experiences. However, when the differences the students notice in math class are similar to the differences they have noticed about high school in general, it's difficult to say if the differences are significant to students' mathematical experience, or just a part of high school.

Benefits to site.

Teachers' meetings. We cannot attribute this development to our presence at this site, but the teachers at the junior high and the high school have been concerned about the issue of this curricular shift. The high school and junior high mathematics departments have held several meetings over the past two years to discuss the issue, and have agreed to disagree for the time being. Members of our research team have been invited to sit in on these meetings, and the first author has been in attendance of some of them. If we can be a neutral party that helps open discussion to occur, we would consider this a way to support the math teachers at both the junior high and the high school in Prescott.

A sounding board for students. Students have freely offered feedback to members of our research group about their experiences as a participant in this project, presumably because we have been in their lives for such a long time now – longer than some of their high school teachers have been.

Bethany has been extremely open about participating in the Mathematical Transitions Project, writing several different entries in her math journal to us about her feelings on this issue. In one of her entries at the end of her 9th grade year, she wrote:

> *Also, writing and looking back and having the talks with you, helped me to get my ideas out. That way if I can give you my ideas I won't be so afraid to tell the teacher [Brackle]. (Last year I wasn't, but I was this year!)*

We consider it a benefit to students if they learn how to express their thoughts about their mathematics experiences by talking or writing to our research group. Bethany was forthright about her opinions about how her participation in our project helped her. In a situation with multiple transitions, such as those at Prescott High School, not only are we, as researchers, benefiting from this learning opportunity, but students are also benefiting from our presence there.

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Figure 1

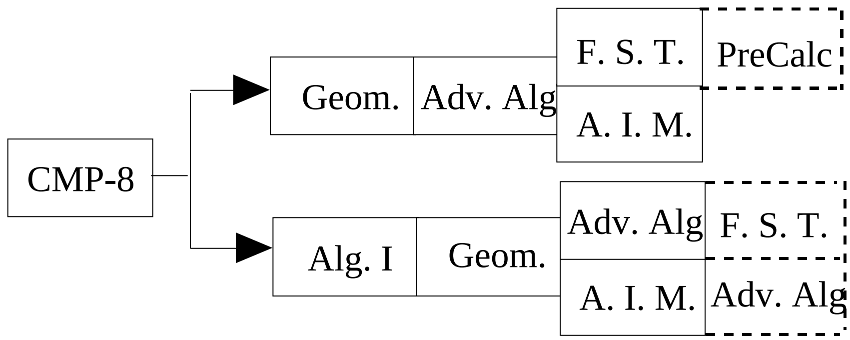
CMP-8
Geom.
Adv. Alg
F. S. T.
PreCalc
A. I. M.
Alg. I
Geom.
Adv. Alg
F. S. T.
A. I. M.
Adv. Alg

Table 1

Student Sample

	Female Students	**Male Students**	**Total**
“Lower” Track (8th grade CMP to Algebra I to Geometry)	**6** (Kara, Stacy, Sophia, AW, CS, JS)	**8** (Larry, Jeffrey, MF, BB, AG, MT, MM, PC)	**14**
“Upper” Track (8th grade CMP to Geometry to Advanced Algebra)	**6** (Bethany, Katherine, SL, BB, KD, LP)	**8** (Kevin, Sam, John, DT, TG, WN, MF, TC)	**14**
Total	**12**	**16**	**28**

Table 2
Prescott High Students' Academic Performance

		8th / spring	9th / fall	9th/ spring	10th / fall	RC1	RC2	RC3
"Upper" Track Students								
Bethany	Math grade	3.7	4	4.3	3.7	0.54	0.24	-0.67
	Semester G.P.A.	3.96	3.72	3.78	3.85	↑		↓
Katherine*	Math grade	3	2	2.7	2.3	-0.9	0.66	0.21
	Semester G.P.A.	3.333	3.23	3.27	2.66	↓↓	↑	
Kevin	Math grade	4	3.7	4.3	3.7	0.04	0.22	-0.29
	Semester G.P.A.	3.79	3.45	3.83	3.52			
John	Math grade	3.7	3.3	3.3	3	-0.13	-0.1	0.12
	Semester G.P.A.	3.75	3.48	3.62	3.2			
Sam*	Math grade	3.7	3.3	4	2.7	-0.07	0.23	-0.85
	Semester G.P.A.	3.71	3.38	3.85	3.4			↓↓
"Lower" Track Students								
Stacy	Math grade	4	4	4	4	0.05	0.2	0.03
	Semester G.P.A.	3.88	3.83	3.63	3.6			
Sophia*	Math grade	2	1.7	1.7	3	-0.78	0.45	0.57
	Semester G.P.A.	2.52	3	2.55	3.28	↓↓		↑
Kara*	Math grade	3	3.7	3	3.7	0.89	-0.5	0.47
	Semester G.P.A.	3.92	3.73	3.57	3.8	↑↑	↓	
Larry	Math grade	3	3	3	3	-0.23	-0.6	0.25
	Semester G.P.A.	2.54	2.77	3.38	3.13		↑	
Jeffrey*	Math grade	2.3	1.3	1	0.7	-1.21	0.42	0.53
	Semester G.P.A.	2.79	3	2.28	1.45	↓↓		↓

Table 3
Differences between junior high and high school mathematics

	Number who *SIGNIFICANTLY* mentioned the difference.	Number who mentioned the difference.	Illustrative Quote
Teacher's typical lesson: organization, direction, or shaping of activity (e.g., nature of class discussions.).	7	10	"We actually did things {in 8^{th} grade math}. Yeah, we're getting older, and the games aren't as fun, but he {9^{th} grade teacher} didn't mix things up enough... We don't have to have homework everyday." - Kara
Typical problems: less story problems, different topics.	6	10	"Now it's just solve this and solve that. And last year it was Jimmy has to ride his bicycle at this pace... Pictures and words and sounds and stuff like that stick in your head longer than statistics." - Larry
Typical problems: ease of understanding content.	4	8	"This year it's more direct, and it's not as confusing... It's just easier then to remember stuff... as an example and then put it into another problem." - Stacy
Teacher-student relationship.	2	9	"...in middle school, the teacher, like she almost like all knew us... and, like now we don't really know her, and she's like new to this school, so she doesn't know a lot about this school and us, so it makes it kind of hard to be able to talk to her." – Bethany.
More direction provided (in the textbook) for solving problems.	2	8	"...they {9^{th} grade books} try to do in steps rather than the whole thing at once, as last year they didn't do that as much. They kind of tried to show us everything at one time, and we'd try to figure out what that was." - Sam
Classroom management: challenging to participate, different norms.	2	6	"He {8^{th} teacher} was just more personable, almost. That kind of helped people want to listen in class instead of goofing off {in 9^{th} grade}. They were actually listening to what he said." - Katherine
Instructional Pace.	2	5	"Like in 8^{th} grade, we'd, uh, he'd {8^{th} teacher} teach us a concept, and then a formula, or a problem of some sort, and he'd let it sink in for a day, and then assign us homework, and then review it the next, and assign homework for it, and then go on. He'd let it sink in. Here {9^{th} grade}, we supposedly learn it... If we don't understand it, it's a little hard to do the homework..." - Kevin
Typical problems: less understanding of content required.	2	5	"The books aren't harder. It's just that we don't have to think as much... The other books, we had to think and we understood it and stuff. We had to make up the formula on our own. And now they just give it and make us do it over and over." - John
Content is presented in greater detail or "complexity."	1	6	"The work itself is a little more complex. In 8^{th} grade it seemed like there was always like one simple rule for everything and that's the one you followed, but here {9^{th} grade} there's a lot of different things you have to look at and think about." - Jeffrey
Teacher's expectations for student participation: less discussion of alternative solutions.	1	4	"I wanted to speak up and say, well, this is better for me to solve it this way, but the more I kind of watched other people try to do it, to me, it seemed like she {9^{th} teacher} didn't really want us to say that, and she kind of wanted us to do it all the same way, so I kind of just kept my mouth shut..." - Bethany
Typical homework assignments: increased number of problems.	0	10	"We didn't have homework every night [in 8^{th} grade}. We have homework every single night in this class {9^{th} grade}. I hate that." - Sophia