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Alignment of Algebra Curriculum, Assessment, and Instructional Practices in District B: A Case Study of Fall 2004

Jeannette R. Olson
Iowa State University, olsonj@iastate.edu

Anne Foegen
Iowa State University, afoegen@iastate.edu

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Abstract

Project AAIMS (Algebra Assessment and Instruction: Meeting Standards) is a federally funded project that has two objectives. The first is to examine the alignment of algebra 1 curriculum, instruction, and assessment in general and special education. The second is to develop and validate algebra assessment tools for use in general and special education classes. This case study focuses on the first objective – it examines the alignment of algebra curriculum, instruction, and assessment for students with and without disabilities in one of the three districts participating in Project AAIMS.

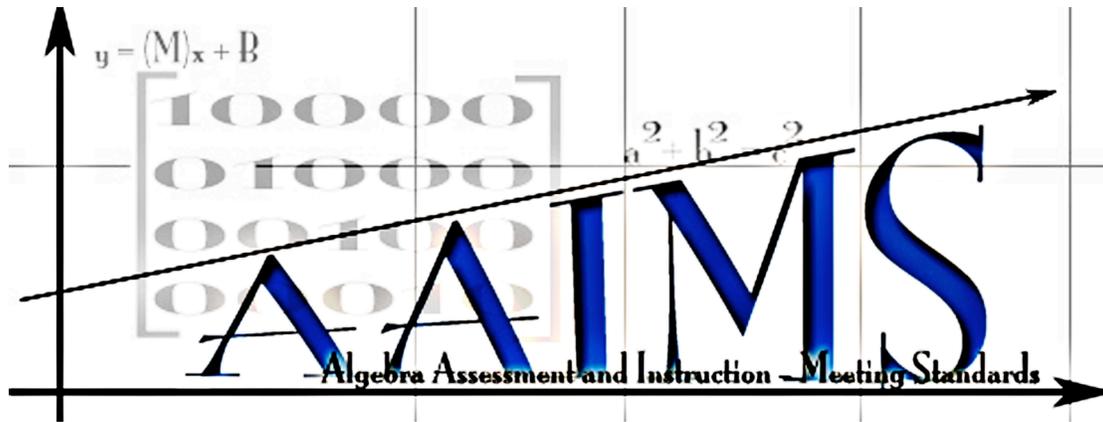
Disciplines

Curriculum and Instruction | Education | Elementary and Middle and Secondary Education Administration | Higher Education | Science and Mathematics Education

Comments

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**PROJECT AAIMS: ALGEBRA ASSESSMENT AND
INSTRUCTION – MEETING STANDARDS**



Alignment of Algebra Curriculum, Assessment, and Instructional
Practices in District B: A Case Study of Fall 2004

Jeannette Olson, M.S.

Anne Foegen, Ph.D.

Iowa State University

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Project AAIMS is funded by the U.S. Department of Education,
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Project AAIMS (Algebra Assessment and Instruction: Meeting Standards) is a federally funded project that has two objectives. The first is to examine the alignment of algebra¹ curriculum, instruction, and assessment in general and special education. The second is to develop and validate algebra assessment tools for use in general and special education classes. This case study focuses on the first objective – it examines the alignment of algebra curriculum, instruction, and assessment for students with and without disabilities in one of the three districts participating in Project AAIMS.

We begin this case study by describing our data sources. This description is followed by background information about District B, a brief description of the teachers and students who participated in this project, and a summary of the algebra curriculum in this district. Next, we take a closer look at algebra instruction in District B, as well as discuss the district's assessment results. We conclude the case study by addressing our findings related to the alignment of curriculum, instruction, and assessment for students with and without disabilities in this school district.

Sources of Data

In an attempt to explore the similarities and differences in curriculum, instruction, and assessment for general education and special education students enrolled in District B's algebra classes, the research team gathered information for this case study during the fall of 2004 using a variety of methods. We reviewed documents, conducted eighteen observations of algebra classes, and interviewed teachers and administrators.

Document Review

Members of the research team analyzed the district's annual progress reports, standards and benchmarks, website, and algebra textbook. We also examined the Iowa School Profile for this district on the Iowa Department of Education website, as well as student algebra grades and standardized test math scores for students from whom we had student and parent consent for additional information about algebra achievement. Our goal in conducting this review was to identify District B's established curriculum, instruction, and assessment guidelines, as well as its achievement results.

Observations

Two types of classroom observations were conducted concurrently. The first type used a systematic, momentary time sampling observation system, while the second type used an anecdotal observation form to document aspects of instruction that may not have been captured with the former system.

Whereas the momentary time sampling observations used predetermined codes and

¹ Throughout this case study any time we refer to algebra, we mean beginning algebra courses such as Algebra I, Algebra IA or Algebra IB.

required observers to record only the most prevalent student behavior, teacher behavior, instructional organization, and task format, the codes for the expected tasks, teacher actions, and student actions during the anecdotal observations were derived after all the data had been collected. (See Olson and Foegen, 2006 for a thorough description of the momentary time sampling observation results and Olson and Foegen, 2007 for a comprehensive examination of the anecdotal observation data.) We believe that by using these two observation methods we were able to develop a more complete depiction of the algebra curriculum and instruction approaches used in District B's algebra classes.

Interviews

Three group interviews were conducted with the participating teachers. During one of the interviews questions were asked of all the teachers. Later, the general education teachers and then the special education teachers were interviewed as separate groups. Two district administrators were also interviewed. All of the interviews were tape recorded and transcribed for later review and analysis. (See Appendix A for a copy of the interview protocols.)

Having the opportunity to analyze data from multiple sources allowed us to develop a more complete description of the algebra curriculum, instructional practices, and assessment approaches for students with and without disabilities in District B. This description begins with some background information about the district.

The School District

District B serves a town of slightly more than 25,000 people. The senior high school, which was built in 1958, has an enrollment of approximately 1,230 students; about fifteen percent of these students receive special education services. Approximately 32 percent of the district's students are eligible for free and reduced lunch, and twelve percent are of diverse backgrounds in terms of race, culture, and ethnicity. The district has a mobility rate of 24%, which means that almost one quarter of the students either move into or move out of the district over the course of an academic year. Approximately 79% of District B's graduates plan to pursue post-secondary education or training, with 51% planning to attend a 2-year school, 25% planning to attend a 4-year school, and 2.7% joining the military. About 10% of the students enrolled at the senior high school take the ACT exam with an average composite score of 21.6. The dropout rate for the 2004-2005 school year was 4.1% of the student population (77 students) in grades 7-12. Students with IEPs have the highest dropout rate (6.1%) of all the subgroups reported in the 2004-2005 Annual Progress Report to the Community.

The Teachers

Two general education teachers' classes were observed. One teacher held an initial Iowa teacher's license, and the other held a standard Iowa teacher's license. Both of these teachers held 7-12 mathematics endorsements and had earned Bachelor's degrees. One teacher was a first-year teacher, while the other had 15 years of teaching experience. The experienced general education teacher had taught algebra for seven years. The first year teacher taught three sections of Algebra IA during the fall of 2004, and the

experienced teacher taught one section of Algebra IA and two sections of Algebra IB. Another general education teacher was included in the group interview because he taught an algebra class during the following spring term. This additional algebra teacher was also a first year teacher with an initial Iowa teacher's license with a 7-12 mathematics endorsement.

Two special education teachers had some co-teaching responsibilities in beginning algebra classes. Both of the special education teachers had Master's degrees and special education endorsements. One of these teachers had six years of teaching experience, while the other had thirteen years of experience.

The Students

Student participants included youth in the ninth through twelfth grade who were currently enrolled in a beginning algebra course. Ninety-nine students were enrolled in Algebra IA and 36 students were enrolled in Algebra IB. Of the 135 students taking algebra, about ten percent were special education students. All of the special education students received algebra instruction in general education classes.

The Curriculum

Six units of mathematics credits were required for graduation from District B for freshmen and sophomores during the Fall of 2004; this is equivalent to three years of mathematics courses. (Juniors and seniors only needed four units or the equivalent of two years of mathematics to graduate.) An algebra class was not required for graduation; nevertheless, approximately 70% of District B's students took at least one algebra class before they graduated. While the majority of general education students take Algebra I or IA in ninth grade, there were some 10th, 11th, and 12th grade students enrolled in the algebra classes we observed.

At the time of this study, District B's high school offered two alternatives for initial algebra instruction. Students could choose between Algebra I or Algebra IA and Algebra IB. District B uses block scheduling²; therefore, students in Algebra I take one-half of an academic year to complete the course, and students in the IA/IB option spread their algebra instruction over a full year. This slower pace is intended to allow students additional time to master the concepts of algebra. The students in these classes use the same textbook as the students in the traditional Algebra I class. Students are not required to take Algebra IA and Algebra IB in consecutive terms, and some students never take Algebra IB after completing Algebra IA.

Algebra I is addressed in five of the nine mathematics goals in District B. Table I lists these goals and the 9-12 Standards and Benchmarks that are to be addressed in this beginning algebra class.

² Students usually take four classes each semester that meet for 90 minutes each day.

Table 1: District B’s Algebra I Standards and Benchmarks
 (compiled from the 11/03 revision of the Mathematics 9-12 Standards and Benchmarks)

Goal	Standards and Benchmarks
Effectively uses a variety of strategies in the problem-solving process	Constructs and describes simple algorithms for solving problems that take several steps Writes an equation to represent a problem situation
Understands and applies basic and advanced properties of the concept of numbers	Demonstrates a basic understanding of inequalities
Uses basic and advanced procedures while performing the process of computation	Performs computations involving radicals and exponents Performs computations in algebraic expressions
Understands and applies basic and advanced concepts of data analysis and distributions	Understands basic generalizations about the nature of graphs: the position of any point on a surface can be described by two numbers; a graph represents all the values that satisfy an equation; and the point at which two graphs intersect represents the values that will satisfy the two equations represented by the graphs Analyzes graphs
Understands and applies basic and advanced properties of functions and algebra	Demonstrates a basic understanding of polynomial equations Solves systems of equations and inequalities graphically and algebraically Uses appropriate terminology and notation to define functions and their properties, including domain and range Understands that symbolic statements can be combined to solve systems of two equations Understands that when a relationship between variables is represented in symbols, numbers can be substituted for all but one of the symbols and possible value of the remaining symbol computed Constructs linear mathematical models Solves single variable sentences

Generally, students who earn As and Bs in their eighth grade mathematics course are eligible to take Algebra I; however, teacher recommendations, scores on an algebra aptitude test, and the other mathematics courses that a student has taken are also considered. Even with these guidelines, the decision about which class to take rests with the students and their parents. According to the general education algebra teachers, many students start in Algebra I and then transfer to Algebra IA, but very few students move from Algebra IA to Algebra I.

The district adopted new mathematics textbooks in 2002, after some teachers pilot tested the book during a complete course. The beginning algebra classes in District B used *Algebra 1* published by Mc Dougal Little (Larson, Boswell, Kanold, & Stiff, 2001). This textbook was chosen because it was a good match with the district's standards and benchmarks and teachers were more comfortable with it than some other more constructivist books that were considered.

All of the students with disabilities were enrolled in the same beginning algebra classes as their general education peers. (There were fourteen students with disabilities in Algebra IA and nine students with disabilities in Algebra IB.) Consequently, the curriculum was the same for both groups of students. Occasionally, a special education teacher would work with a small group of students with disabilities in a different classroom to reinforce their algebra skills, but this did not change the required course content for Algebra IA or Algebra IB.

Algebra Instruction in District B

This section of the case study will focus on instruction in each of the beginning algebra classes that we observed during the fall of 2004. None of the participating teachers taught an Algebra I course during this semester; therefore, we will only describe what happened in four Algebra IA classes and two Algebra IB classes. What follows is a glimpse at the algebra instruction in each course based on three observations of each class at the end of the first term and beginning of the second term (October and November). The following descriptions provide an overview of each type of beginning algebra class, drawing from the observation and interview data.

Algebra IA

There were four Algebra IA classes included in this study. One general education teacher (Teacher 1) taught one section during first block (8:20 – 9:50 AM) and a second general education teacher (Teacher 2) taught three sections during second block (9:57 – 11:27 AM), third block (11:34 AM – 1:34 PM, with 30 minutes for lunch included), and fourth block (1:41 – 3:11 PM). A total of 99 students were enrolled in the Algebra IA classes we observed. Class sizes ranged from 23 to 27 students. There were fourteen students with disabilities enrolled in the Algebra IA classes we observed in the fall of 2004.

Both teachers' classrooms were very similar. The student desks were arranged in rows facing the front of the classroom. There were white boards at the front and right

side of both classrooms. Teacher 1 had her desk at the left side of the classroom and the overhead projector set up to project on a screen in the right front corner of the room, while Teacher 2 positioned her desk at the left back corner of the room and the overhead projector was at the center front of the room.

Both of the participating teachers from District B structured their beginning algebra class periods in their own way. Teacher 1 used a variety of activities in her Algebra IA class, while Teacher 2 used the same basic pattern of activities each day. During our first observation the first fifteen minutes in Teacher 1's class was spent working on and checking daily review problems. This activity was followed by fifteen minutes devoted to checking homework, then twenty minutes of a review with guided practice, and then fifteen minutes for a quiz. During the guided practice activity students used white dry erase boards that they held up when they had solved a problem so the teacher could check their work. On our second visit the class began with twenty minutes devoted to checking homework, which was followed by an hour for completing an in-class assignment that was designed as a review activity. When we made our final observation of this Algebra IA class, the first task was going over a test that the students had taken earlier. This activity took twenty-five minutes. The next forty minutes were spent learning new content with opportunities for students to participate in additional guided practice activities. Students worked on their homework assignment for the last fifteen minutes of class on this day.

The activities for the three Algebra IA classes that were taught by Teacher 2 were basically the same when we looked across the different sections with only slightly different amounts of time spent doing each of the activities. During all but one of the observations the class began with a warm up activity. This was followed by five to ten minutes of checking homework during two of the observations. A twenty to forty minute lesson was the typical third activity in the 90 minute blocks. This was followed by time for students to work on assignments for fifteen to twenty five minutes. On the second day that our observations were conducted the lesson and homework time were replaced by a review activity and returning a test to the students.

Teacher 1 spent the most time checking homework, and nearly as much time reviewing, and engaging in teacher-led instruction in her Algebra IA class. Teacher 2 spent more than one quarter of the observation time engaged in teacher-led instruction, which was followed by leading a warm up activity, and checking homework in her Algebra IA classes.

Algebra IB

Two sections of Algebra IB were observed for this case study. These classes were scheduled during block three (11:34 AM – 1:34 PM, with 30 minutes for lunch included) and block four (1:41 – 3:11 PM). A total of 36 students were enrolled in Algebra IB. The size of these classes ranged from 10 to 26 students. Nine students with disabilities were enrolled in this course. Teacher 1 taught both of these classes in the same room where she taught Algebra IA.

The way each of the Algebra IB class periods was structured varied by observation as they had in this teacher's Algebra IA class. Nevertheless, when both classes were observed on the same day, the students were expected to do the same activities for similar amounts of time. Class periods began with a warm up, a review problem, or housekeeping activities such as returning homework or passing out progress reports. These activities were following by time to check homework, play a review game using small groups, or do an individual review activity using white boards and dry erase markers. During three of the six observations (once in third block and twice in fourth block) the last half of the class period was used to teach a lesson. During three other observations the last ten to forty minutes of the class periods were devoted to working on individual assignments. During one observation a quiz was given.

Teaching a lesson was by far the most common teacher action in Algebra IB classes with modeling procedures for solving algebra problems as the predominant "teaching a lesson" behavior. The second most prevalent teacher action was task management. Task management includes activities such as taking attendance or returning papers.

Instruction Across Beginning Algebra Classes in District B

When we considered our data on the instructional organization of the two beginning algebra classes, we found that whole class activities were observed most often in the Algebra IA and Algebra IB classes. The whole class activities were usually lectures or discussions with the teachers engaged in academic talk or listening. Paper and pencil tasks during independent work time were observed next most often. In Algebra IA, the teachers usually provided individual assistance during this independent work time, while the Algebra IB teacher was engaged in task management activities (e.g, grading student work or entering students scores into the computer) while the students worked at their desks. During small group work, the Algebra IA teachers spent most of their time monitoring the groups to be sure they were on task, while the Algebra IB teacher provided individual and group assistance during the time her students worked in small groups. (Readers interested in a more detailed treatment of the quantitative data from the momentary time sampling observations are referred to Olson and Foegen, 2006. Those interested in the narrative data from the anecdotal observations are referred to Olson and Foegen, 2007.)

With block scheduling the teachers need to progress through the beginning algebra curriculum at a fairly brisk pace, when compared to teachers who work in schools with a traditional school schedule. Even though the students Algebra IA and Algebra IB move through the required algebra curriculum at a slower pace than their Algebra I peers, these courses only last for one half of the school year.

Assessment

The participating algebra teachers from District B reported using a wide variety of formal and informal assessment tools and strategies in their classes. These ranged from reading students' body language during a lesson to grading and interpreting chapter tests. In addition to tests designed by individual teachers for their classes, this district used

common Algebra Semester Tests for all beginning algebra students. The first test was given half way through Algebra I and addressed skills and concepts from chapters 1-6 of the text. The second test was given at the end of Algebra I and addressed the content from chapters 7-12 of the text. Students in Algebra IA take the first exam at the end of their course, and students in Algebra IB take the second exam when they finish this course. The district used the Iowa Tests of Educational Development (ITED) as part of its mandatory assessment process to comply with the requirements of the No Child Left Behind Act.

Both teachers used the time they spent checking homework to informally judge whether students were learning the concepts and skills related to the content for a particular chapter. If students had many questions, then some reteaching or additional examples were given before the class proceeded to new content. If there were only a few questions, then the teachers moved on to the next topic. Both teachers used quizzes, tests, class assignments, and homework completion as a part of their grading procedures.

For this case study, the researchers chose to use grades and ITED test scores as measures of algebra achievement. Although both of these measures are not perfect indicators of a student's mastery of algebra, they are important yardsticks when it comes to decisions about a student's future coursework and a district's standing with regard to the adequate yearly progress goals set by the state of Iowa.

As far as grades are concerned, 60% of the students earned a C or better in Algebra IA. On the whole, students in Teacher 1's section of this course earned lower grades than their peers in Teacher 2's classes with 48% of Teacher 1's students earning a C or better as compared to 65% of the students in Teacher 2's classes. Less than half of the Algebra IB students (45%) earned a C or better, and 27% of these students failed the course. (See Appendix B for information about grade distributions for the beginning algebra classes in District B.)

In Algebra IA, the most prevalent grades were Bs and Cs. One fifth of the students in Teacher 2's classes earned a B. In Teacher 1's class the most common grades were Cs and Fs (16% each). In Algebra IB, the most typical grade was an F, followed by a C, and then a B. The students in District B earned very few As in beginning algebra classes.

We wanted to use an algebra achievement test as our second measure of algebra achievement; however, we were unable to find a test that met our requirements. Therefore, we decided to use the ITED tests because these are the measures used for determining mathematics proficiency in Iowa. We begin with a discussion of district proficiency rates. Next, we will address proficiency rates for the beginning algebra students from whom we obtained student and parent consent. During the 2004-2005 academic year, 99.7% of the 11th grade students in District B were tested. Seventy-three percent of these students were deemed proficient in Mathematics. (This means they scored at or above the 41st percentile.) This was slightly higher than the two previous academic years (71.1% and 72.2%, respectively.) Although the scores have been improving, the proficiency rate is less than state average of 78.68 for 11th graders in

Iowa during the 2004-2006 biennium (Iowa Department of Education School Profiles, 2007). When we examined the proficiency percentages for the 11th grade students with disabilities we found that the rate for the 2004-2005 school year was 28.2%. This was down from previous year, (31.3%), but a significant improvement when compared to the 2002-2003 percentage, which was 3.4%. The current proficiency rate for students with disabilities is lower than the state average of 36.53%.

When we examined the mathematics proficiency of the students enrolled in the two algebra classes we observed for this case study for whom we had consent, we found that 70% of these Algebra IA students (n=53) were deemed proficient. Of the six students in Algebra IA with IEPs and consent, 2 of these students (33%) met the Iowa proficiency standard. Fifty-four percent of the Algebra IB students (n=24) were considered proficient, while 40% of the students with disabilities in this course (n=5) met this standard. Comparing the district and algebra class data, we found that students who were enrolled in the slower paced Algebra IA and Algebra IB classes had lower proficiency rates than typical 11th graders in this district.

Examining Alignment between General and Special Education

After analyzing the data collected through document review, observations and interviews, the research team has come to some conclusions about the alignment of curriculum, instruction, and assessment in algebra classes for students with and without disabilities.

To address the question of *curriculum alignment*, we looked at the data from the observations and the document reviews. Students with disabilities were enrolled in the same beginning algebra classes as their general education peers in District B. These students were expected to learn the same content as everyone else enrolled in Algebra IA or Algebra IB; therefore, the curriculum in District B is aligned for students with and without disabilities.

The research team used data from the observations to determine the *alignment of instruction* for students with and without disabilities. The students with disabilities in District B were dispersed across the sections of Algebra IA and Algebra IB. The same teacher taught both sections of Algebra IB and used basically the same lesson plan for both classes, which means the instructional approaches were very similar for students enrolled in this course. Two different teachers taught Algebra IA; consequently, the students in these classes were exposed to different instructional strategies. However, these strategies were not designed to provide different forms of instruction for students with or without disabilities. The one difference in instruction for students with disabilities was that they sometimes worked with the special education teacher who was coteaching the class in small groups to reinforce some of the skills they were learning.

As far as the *alignment of assessment* is concerned, we will comment on district level assessment and classroom level assessment. The district used the Iowa Tests of Education Development (Grades 9-12) to meet the reporting requirements set forth by the

Iowa Department of Education, as well as the United States Department of Education. It is important to point out that all of the algebra students took these tests, which means that there was complete alignment between general education and special education when it came to the assessments that yield proficiency percentages that are reported to the public.

In addition all students took the District B Algebra Semester tests. The only variability when it came to assessment was that two teachers taught Algebra IA and designed their own quizzes and chapter tests and had their own grading criteria. This variability was not related to whether or not students with disabilities were enrolled in a class, and would be evident in most schools where there is more than one teacher teaching a course.

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APPENDIX A

Interview Questions for District B Teachers and Administrators: Project AAIMS

All Teachers/General Issues: (45 minutes)

1. Describe how the math curriculum is currently organized at the high school level; what is the general sequence by grade level?
2. When was the text adopted for Algebra? How did this process work? How satisfied are you with the text? Are different texts used for different algebra courses?
3. How do you decide which students enroll in which algebra options?
4. What is the level of satisfaction with student achievement in algebra in District B? In math more generally?
5. Has math been an area of focus in the district in the past few years? Professional development activities? School improvement plans? Strategies?
6. What challenges do students experience in algebra? Are there specific aspects of algebra that present the most difficulty for students?

General Education Teachers: (45 minutes)

1. What do you enjoy most about teaching algebra? What frustrations do you experience?
2. What is your typical teaching routine? Structure for presenting a unit? A lesson?
3. How do you assess student learning in algebra?
4. What are the similarities and differences between students with and without disabilities in general education algebra classes? Are there particular strengths the students with disabilities bring? Particular difficulties they experience?
5. To what extent, if at all, does having students with disabilities in your class impact your teaching?
6. What kinds of information about students with disabilities do you receive from the students' special education teachers?
7. To what extent do you collaborate with special education teachers to meet students' needs? Describe the form this collaboration takes. What barriers do you encounter in your efforts to collaborate?
8. What kinds of teaching strategies/activities do you find are most effective for teaching algebra? Do these differ for students with disabilities? Students in general? Students in different algebra courses (1 vs. 1A/1B)?
9. What types of support would you like to see provided regarding students with disabilities in your classes? (to you or to the students)
10. Is there any additional information you'd like to have in order to support your instructional decisions? Needs that this project might address?

Special Education Teachers: (30 minutes)

1. What kinds of information about the students with disabilities on your caseload do you provide to the students' general education (algebra) teachers?
2. To what extent do you collaborate with general education teachers to meet students' needs? Describe the form this collaboration takes. What barriers do you encounter?
3. What types of support would you like to see provided regarding students with disabilities in general education algebra classes? (to the teacher or to the students)
4. What are your thoughts regarding the available math course options for students with disabilities?
5. Are there particular difficulties that your students experience when they are enrolled in algebra courses?

Administrators:

1. How does the textbook adoption process work in District B? When was the algebra textbook adopted?
2. What is the level of satisfaction within the district on the level of student achievement in algebra? In math more generally?
3. What is your general sense of the ITEDs data in math? Which grade levels complete ITEDs and ITBS?
4. Has math been an area of focus in the district in the past few years? Professional development activities? School improvement plans? Strategies?
5. What is the process for accessing student cum file data? Demographic information? ITED scores?
6. Are there any questions or concerns that you would like to see the project address during the next few academic years?

APPENDIX B

Distribution of Student Grades by Class Type in District B – Fall 2004

	Algebra IA Total n = 86	Algebra IA Teacher 1 n = 25	Algebra IA Teacher 2 n = 61	Algebra 1B Total n = 33
A	8%	8%	8%	3%
A-	2%	4%	2%	3%
B+	6%	0%	8%	3%
B	19%	12%	21%	12%
B-	3%	4%	3%	6%
C+	5%	4%	5%	3%
C	17%	16%	18%	15%
C-	7%	12%	5%	3%
D+	6%	4%	7%	6%
D	10%	12%	10%	9%
D-	3%	4%	3%	3%
F	12%	16%	10%	27%
Incomplete	1%	4%	0%	3%

NOTE: Percentages do not add up to 100% due to rounding