CMSI High School Algebra I for Middle Grade Students:
What Does It Look Like and How Do Students Perform

End of Year External Evaluation Report

August 25, 2009
Revision October 14, 2009

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[1] Authors produced this report collaboratively and share responsibility for its contents. Conclusions drawn in this report reflect a systematic analysis of data by external evaluators. Our hope is that these findings facilitate improvement of this and related programs through open discussion and consideration of data-driven understandings. For further information, please contact Carol Fendt at crfendt@hotmail.com or (312) 413-9221.

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EXECUTIVE SUMMARY

This report focuses on the Chicago Public Schools and its offering of high school level Algebra I to middle grades students. The study draws on 2008-2009 teacher and algebra coach observations and interviews and student achievement data primarily from a representative sample of 34 of the 145 CPS schools approved to teach Algebra I to middle grades students.

Algebra I for middle grades students was offered with the following characteristics:

- Average class size is 21 students.
- Average class attendance is 94%.
- The average class meets 302 minutes per week.
- The background characteristics of students selected for the course vary from school to school.
- Not all students who start the course are retained for the full year.
- Not all students who start the course take the exit exam.
- Most schools (77%) only have students take Algebra I and not another math course in addition.
- Most schools (75%) have graphing calculators available for students.

Observations of the instruction in Algebra I classrooms for middle grades students found the following:

- Students were highly engaged in coursework in 94% of classrooms.
- Students worked together in small groups in 50% of classrooms.
- Students demonstrated understanding of math that goes beyond memorizing and procedural knowledge in 50% of classrooms.
- Content covered was on pace with or less than 2-weeks behind guidelines in 58% of classrooms.

Regarding District-provided supports to enhance Algebra I classrooms for middle grades students, the following were found:

Curricula

- Many schools (62%) used CMSI-supported curricula with the majority using CME.
- About half of schools (53%) used CMSI-supported curricula and full district ISO support that included algebra coaching for teachers and some materials for classrooms.

Professional development and cohort meetings

- About half of teachers (52%) attended curricula professional development or algebra coach-led cohort meetings but only 20% of the teachers attended more than 75% of these meetings.
- Almost all teachers who attended cohort meetings described them as being helpful.
- Teachers who took part in the algebra professional development found it to be helpful.
- Most schools (60%) had teachers who had attended Algebra Initiative university courses. The rest were either high school certified or received waivers from the courses.
- Many teachers who attended university courses said the courses influenced their practice.

Algebra coaches:

- As described by teachers, the work of coaches included: observing teachers as they presented lessons, helping teachers present lessons (co-teaching or interjecting ideas and explanations into lessons taught primarily by the algebra teacher), and modeling lessons.
- Teachers saw coaches' work as directly influencing their content knowledge or pedagogy and providing students with greater exposure to another set of teaching techniques and other ways of thinking algebraically.
- Coaches primarily supported teachers in their classrooms but were only able to hold pre- and post-conferences around lessons less than 50% of the time.

Students were successful in passing the district's end-of-year exit exam in algebra with a rate of 40%. The report examined possible influences on student success rates and found that:

- Students' prior math achievement was the most prominent predictor of success on the exit exam. Strong seventh grade ISAT scores were positively related to success on the exit exam with a correlation of 0.58.
- Characteristics of individual algebra courses mattered even when prior math achievement was taken into account.
    - Students who had both algebra and a general math class did better than students with only an algebra class.
    - In schools where students took both algebra and a general math class, algebra classes lasted longer and had fewer students.
- Some observed instructional practices had an effect on students' performance on the exit exam after controlling for previous achievement.
    - Evaluators observed more calculator use and group work in classrooms using district approved curricula with district supports (ISO) than in other classrooms (non-ISO).
    - Students in classrooms with high intellectual demand scored higher on exit exams (mean = 297) than did students in classroom with low observed demand (mean = 292).
- District supports affected student performance on the exit exam in the following ways: :
    - Students in schools using approved curricula performed better on the exam (mean = 294) than did other students (mean =290).
    - Students in ISO schools performed the best (mean = 296) relative to those in schools using approved curricula *without* ISO supports (mean = 288) and those using non-approved curricula (mean = 290).
    - Of students in ISO schools, those students whose teachers attended at least 75% of district-sponsored professional development (mean = 303) outperformed others (mean =288).

INTRODUCTION AND METHODS

Purpose of report. This is the final of two external evaluation reports for the 2008-09 school year by the PRAIRIE Group at UIC on CPS' Office of Math and Science (OMS) efforts to support elementary schools in offering Algebra I to their middle grades students. The purpose of this evaluation is to provide OMS and other stakeholders with an understanding of the processes and outcomes of the 8th grade algebra program. This work builds upon the PRAIRIE Group's external evaluation of this program in 2007-2008.

In the tradition of previous evaluations, the 2008-2009 study is based on rigorous data collection and analysis that are carried out in a manner so as to provide timely and meaningful feedback to appropriate audiences. The evaluation was designed in 2008 for the audiences of the Chief Educational Officer of CPS and leadership teams of the Office of Math and Science (OMS), the Office of High School Programs (OHSP), and the Department of Program Evaluation (DOPE). These findings are intended to be helpful in informing decisions about the planning and implementation of the program and the allocation of resources in ongoing efforts to increase and improve teaching and learning of high school Algebra I in middle grades.

Structure of report. The report first reviews the research methods used describing how the data sampled offer a representative view of the overall district. Then we report what CPS-approved High School Algebra I taught to middle grades students looks like in terms of types of schools offering the courses, credentials of teachers, characteristics of students, and other logistics associated with how the course was offered. Next, we describe what classroom instruction looks like. Then, we look at special supports that CPS has put in place to enhance the teaching of Algebra I for middle grades students. Specifically, we focus on curricula supported by the district, instructional coaches working with Algebra I teachers, and university courses taken by elementary school teachers in order to qualify them to teach these courses for high school placement. Finally, we examine how students performed on the end-of-year CPS Algebra Exit Exam in relationship to the varying ways that Algebra I was taught to them, as performance on the exam is the prevailing factor[2] in determining whether or not 8th grade algebra students will place into geometry as 9th grade students. Questions for reflection are presented throughout the sections. The report ends with a brief set of concluding remarks. All names have been replaced with pseudonyms in order to protect the identity of participants. Appendices hold comparisons showing the similarities between sampled classrooms and all classrooms approved to teach 8th grade, data collection tools used for this study, and other important documents.

Sample. This 2008-2009 final evaluation report for the High School Algebra I for Middle Grade Students program focused on case studies of a sample of 34 schools. These schools were selected as representative of all the schools in the district offering algebra to 8th grade students in terms of students' socioeconomic status, teacher credentials, and curricular materials used. Sample schools mirrored the overall district population of schools approved to offer Algebra I to middle grades students in terms of teacher certification and curriculum use. This sample also proved very similar to the larger district population of schools offering algebra when we examined student achievement on the end-of-year exit exam. Students passing the algebra exit exam for both the district (40% pass rate) and sample (39% pass rate) are comparable. There were also similarities in students' 7th grade ISAT performance levels for which ISAT scores were available in both the sample schools and the 8th grade algebra population of schools approved to offer the course. An examination of demographics related to student achievement also suggests that

[2] Students must also receive a grade of at least a C for both semesters in order to be placed into 9th grade geometry even if they pass the exit exam.

the sample is generally representative of all schools approved to teach Algebra I in 8th grade. Appendix A provides more detail on the sample selected.

Data collection. Between December 2008 and May 2009, evaluators conducted 39 classroom observations and debriefing interviews, four teacher focus groups consisting of 4-7 teachers each, five Algebra I coach interviews, and one Algebra I coach focus group. While there was some overlap between teachers observed (in classrooms and coach cohort meetings) and those who were in focus groups, we worked with a total of 63 individual teachers. Instruments used for observations, interviews, and focus groups can be found in Appendices B – E. Teachers who participated in focus groups also filled out a *Teacher Background* data sheet. This form can be found in Appendix F.

Data analysis. Data analysis was carried out by multi-person teams. One team consisted of three people and focused on characteristics of the overall program, instruction, and statistical analyses. Another team made up of three people concentrated on the work of coaches and their work with teachers.

Using the *8th Grade Observation Protocol*, the instructional and statistical analysis team studied all 39 classroom observations and debriefs. They coded and analyzed the observations based on the following variables:

- Student enrollment
- Minutes per week algebra was taught
- Time of day the class was taught
- Number of years the teacher had taught 8th grade algebra
- If 8th grade algebra was students' only 8th grade math course
- Student use of graphing calculators during the lesson
- Extent to which students worked in collaborative learning groups
- Level of student engagement
- Whether or not the teacher was on pace based on curriculum pacing guidelines
- Level of student intellectual demand
- Curriculum use
- Whether or not the school chose the Instructional Support Option (ISO) with its curriculum package
- Teacher participation in professional development
- Teacher certification status

This team double-coded 11 of the 39 observations and had a 93 percent agreement rate. The remaining observations were coded by individuals but the team talked together about various subtleties during the coding to increase the agreement across coders.

Analyses used for this report look to both school-level characteristics of algebra courses and individual student-level characteristics. The main database consisted of 34 cases representing 34 schools, 34 teachers and 39 observations.

Statistical analyses included correlation, regression analysis, and analysis of variance (ANOVA). All tests were conducted in order to explore the effects of classroom characteristics, instructional practices, and district supports on student performance on the algebra exit exam. In order to control for previous math achievement—a known predictor of subsequent math achievement—statistical tests were run on student level data. Given the nested nature of the data (students within classrooms within schools) future work could incorporate hierarchical linear modeling techniques. However, while the results of the analyses included in this report should be viewed with some caution due to the application of traditional linear techniques to nested data, they provide one snapshot of the 2008-2009 8th grade algebra classrooms and their effect on student exit exam scores.

FINDINGS

What High School Algebra I for Middle Grades Students Looks Like

Description of approved courses

Of the 483 CPS elementary schools, 145 schools (30%) were approved by the district to teach high school Algebra I. The schools with approved Algebra I programs differed somewhat from schools without approved algebra offerings. On average, schools with approved programs worked with students who were slightly less disadvantaged socio-economically, with 81% from low income families compared to 84% district-wide.

Teacher characteristics. The key requirement for offering Algebra I to middle grades students was that the course must be taught by either (a) a State of Illinois high school certified math teacher (a "Type 09") or (b) a State of Illinois elementary certified teacher with a middle grade math endorsement (a "Type 03") and a CPS Algebra I qualification. To earn the CPS Algebra I qualification, the teacher must have passed an algebra content exam administered by the district. To prepare to take this exam, most elementary teachers took a two-semester or three quarter university sequence of algebra courses for which the district subsidized tuition. If they had strong math college backgrounds, some elementary teachers got a waiver and took the exam without the special university preparation courses. Of the 145 approved middle grades Algebra offerings, most (69% or 100 teachers) were middle grades certified and algebra qualified and the rest (28% or 40 teachers) were high school math certified (see Appendix A).

In the study sample, 71% of the teachers were in their first or second year of offering algebra to middle grades students. Only 2 teachers had more than five years of experience teaching algebra to middle grades students. This characteristic is illustrated in Table 1.

Table 1
Number of Years Teachers Have Taught 8th Grade Algebra

	2 Years or Less	3 to 5 Years	More than 5 Years
Number (Percent) of Teachers	24 (71%)	8 (23%)	2 (6%)

Student selection. Eighth grade students taking Algebra I were selected for this course by teachers and administrators at their schools. The district recommended that they be selected through a process of meeting four criteria outlined in the *Student Selection for 8th Grade Algebra* document (see Appendix G). Two of these criteria are academic performance (ISAT scores, grades) and understanding of key mathematical concepts as outlined in the *Student Readiness Rubric* (Appendix H). OMS provided this rubric to all of the schools. The other two criteria were student attitude/motivation and teacher recommendations. The ultimate decision of allowing an 8^{th} grade student to take Algebra I was left up to each individual school.

Of the 34 schools in the sample, two were academic centers and two were gifted centers that students must qualify to attend. Algebra and/or geometry were the only 8^{th} grade math courses offered in these four schools, thus there was no selection process as recommended by OMS. In the other 30 schools, teachers used various combinations of the recommended selection process to admit students into the program.

All 30 of the schools that used the student selection process mentioned using either ISAT scores or 7^{th} grade math grades as a condition for students being admitted to the 8^{th} grade algebra program. Five teachers said they used the *Readiness Rubric*, nine said they considered students' attitude and motivation, and 19 indicated that teacher recommendations were part of the selection process. Most teachers relied on the combination of ISAT scores, 7^{th} grade math grades and teacher recommendations. This finding is noted in Table 2.

Table 2
Factors Teachers Considered in Admitting Students into 8^{th} Grade Algebra

Criteria	Number (Percent) of Schools Using These Criteria
ISAT Scores and 7^{th} Grade Math Grades	30 (100%)
Teacher Recommendation	19 (63%)
Student Attitude and Motivation	9 (30%)
Readiness Rubric	5 (17%)

Enrollment. Enrollment in the algebra courses sampled was about 21 and ranged between 6 and 35 students. On the days evaluators observed these courses, on average 94% of enrolled students were in attendance. Based on teacher interviews, it was clear that not all students who were initially selected for Algebra I were retained. Though it was not a set question on the teacher interview, 19 of 34 teachers interviewed raised the concern that course enrollment had changed since the beginning of the school year. These teachers cited a number of reasons for the changes such as schedule conflicts (e.g., other before- or after-school activities pulling students away from algebra), poor student performance and subsequent teacher withdrawal of students from the course, students transferring to another school, and teachers withdrawing students due to excessive absences or tardiness.

Course characteristics. Algebra classes were usually taught during the regular school day. Classes taught before or after school tended to require students to take regular 8^{th} grade mathematics as well; however, there were exceptions. For example, at one school, the program was offered after school at the beginning of the year and students also took regular 8^{th} grade math. When we visited late in the year, students were still taking 8^{th} grade math but the schedule for algebra had changed and was being taught during the regular school day.

Table 3 shows when algebra was taught across sampled schools.[3]

Table 3
Time of Day that Algebra I was Taught in Middle Grades

Schools Offering Algebra:	Number (Percent)
During School	28 (82%)
Before School	2 (6%)
After School	4 (12%)

In Table 4, we provide the numbers of schools in the sample in which students took only 8th grade algebra or took both 8th grade algebra and regular 8th grade math.

Table 4
Student Enrollment in Algebra or Both Algebra and Regular 8th Grade Math

Schools where Students Took:	Number (Percent)
Algebra Only	26 (77%)
Algebra and Regular 8th Grade Math	8 (24%)

The average number of minutes per week algebra was taught in the 34 school sample was 302. There were 14 schools that taught the course for less than 300 minutes per week and 20 schools had algebra for 300 or more minutes. The range of minutes per week algebra was taught was 200 to 660 minutes per week. Table 5 shows the number of schools in the sample that taught algebra for less than 300 minutes per week and the number of schools that taught algebra for 300 or more minutes per week.

Table 5
Number of Minutes Algebra per Week

	Less Than 300 Minutes	300 Minutes or More
Number (Percent) of Schools	14 (41%)	20 (59%)

[3] In the example from the previous paragraph, even though the configuration of when the class met changed during the school year, it was counted as meeting at the time of our visit (during the regular school day); not when it was originally scheduled to meet.

Most of the classrooms observed were typical elementary school settings with desks or tables, chalk or white boards, and students working with books and papers. However, in four of the observed classrooms, students were working primarily on computers in a lab or using laptops. Evaluators found evidence that about three-quarters of the Algebra I classrooms had graphing calculators available for student use. Not all of these rooms had enough graphing calculators for each student. A few classrooms had calculators that were not in working order due to two main reasons: 1) the calculators were broken or 2) the calculators were in need of batteries. Of the 34 teachers' classrooms observed, students were using graphing calculators in 20 (59%) of the observations.

Course characteristics related to student achievement

Given the variety of ways in which middle grades Algebra I was structured in our sample, we examined the independent effects of these characteristics on how students performed on their exit exams.[4]

Preliminary analyses revealed that Algebra exit exam scores and 7th grade math ISAT scores were correlated at 0.58. When these ISAT scores alone were put into a regression equation, they explained about 33% of the variance in exit exam scores. Given that students' prior achievement is predictive of performance on the Algebra exit exam, regression analyses examining the relationships between course characteristics and exit exam performance included 7th grade ISAT math scores in order to reveal the impact of each variable after controlling for this strong predictor. Table 7 displays the results of a regression analysis that includes 7th grade ISAT math scores, class enrollment, minutes per week that algebra was taught, the number of years the teacher had taught algebra, and if algebra was the only math course middle grades algebra students were taking[5].

[4] Due to the need to control for previous achievement at the student level, these analyses were conducted on disaggregated student level data. Thus, the predictor variables, aside from 7th grade ISAT math scores, are at the classroom and/or school levels. Hierarchical linear modeling will be considered for future work.

[5] Some course characteristic variables are continuous while others are dichotomous. In order to investigate the effects of the variables together while controlling for prior achievement all variables were included in a multiple regression analysis. Standardized beta coefficients are presented in order to compare and contrast the different types of variables in a meaningful way.

Table 7
Summary of Simultaneous Regression Analysis of Prior Achievement and Classroom Logistics Predicting Improved Student Performance on the Exit Exam

	B	*Sig*
Student 7th grade ISAT math score	.63	.00
Students Taking Algebra and Math	.22	.00
Years Teaching Algebra	-.07	.03
Minutes per Week in Algebra	.05	.11
Class Size	.01	.81

R^2 for this model is .402; $p < .05$
***All significance levels are two-tailed*
****Beta coefficients are standardized*

Table 7 shows the relative importance of each of the course characteristics discussed above controlling for previous math achievement (7th grade ISAT math scores), in a model that accounts for approximately 40% of the variance in Algebra I exit exam scores. The strongest contributor to the model after controlling for prior achievement is whether or not a student took another math class alongside his or her 8th grade Algebra I class. Because this variable is correlated with minutes per week spent in Algebra ($r = .32$; $p < .05$) and number of students enrolled ($r = -.40$; $p < .05$), a follow-up ANOVA analysis was run to explore the nature of this effect controlling for prior achievement, number of minutes per week spent in Algebra, and number of students enrolled (more on the nature of these correlations later). Table 8 displays these results. All N's refer to the number of students included in the analysis.

Table 8
Effect of Taking 8th Grade Algebra I and Another Math Class on Exit Exam Scores Controlling for Prior Math Achievement, Number of Minutes per Week in Algebra, and Number of Students Enrolled

	N	*Mean (SE)*	*Pass Rate*
Student Taking Algebra Only	590	290.4 (0.8)	32.8%
Students Taking Algebra and Math (from 8 schools)	102	304.5 (1.9)	58.3%

**Means differ significantly ($p < .05$)*
***Error variances do not differ significantly between groups ($p > .05$)*

These findings suggest that while only a portion of students in the sample were taking both 8th grade Algebra I and another 8th grade math class, those who did so scored significantly higher on the exit exam, and passed at higher rates than did other students.

The other statistically significant classroom characteristic predictor from Table 7 was that of the number of years a student's teacher had been teaching Algebra. The regression coefficient suggests that the fewer years a teacher had taught Algebra the better the teacher's students did on the exit exam. However, the bulk of teachers in the sample (72%) have taught for two years or less. To explore this effect further, we split the variable into three categories and analyzed it via analysis of variance. Table 9 displays these results.

Table 9
Summary of Effect of Number of Years a Teacher has Taught Algebra on Exit Exam Scores Controlling for Prior Math Achievement

	N	*Exit Exam Mean (SE)*	*Pass Rate*
1 or fewer years teaching	240	292.0 (1.2)	32.5%
2 years teaching	238	298.1 (1.2)	52.2%
More than 2 years teaching	214	286.8 (1.3)	23.7%

All means differ significantly ($p < .05$)

These findings suggest that students who were taught by teachers who had taught Algebra for two years or fewer scored higher on the exit exam and passed at higher rates than did students taught by teachers who had taught for three or more years. Further, it appears that the students taught by teachers who have taught for two years performed best on the exam. Analyses revealed no differences among the three groups of teachers on type of certification, university attended, or PD attendance. However, given this finding, it might be useful to further investigate the qualities of 8th grade Algebra I teachers who have taught the course for two years to determine if this group of teachers shares any unique qualities that may be contributing to their students outperforming other students in the sample.

Finally, the remaining variables from Table 7 are 1.) number of minutes a student spent in Algebra each week and 2.) number of students enrolled in the class. While neither of these were significant predictors of exit exam scores, there does appear to be a trend in the direction of better performance as a result of more time spent in Algebra (after controlling for the other factors).[6] In addition, as previously mentioned these two variables were significantly correlated with whether or not a student took another math class along with Algebra I. Table 10 compares the number of minutes spent in Algebra per week and class size for groups of students who either took Algebra I only or Algebra I and another 8th grade math class.

[6] This variable approaches statistical significance in a one-tailed test ($p = .06$)

Table 10
Mean Number of Minutes Spent in Algebra per Week and Class Enrollment for Students who Took Only Algebra or Algebra and Another Math Class

	Minutes per Week	*Students Enrolled*
Student taking Algebra only	277.2*	25.2**
Student taking Algebra and math	346.3*	17.1**

**Means differ significantly (p < .05)*
***Means differ significantly (p < .05)*

Table 10 shows that even though minutes per week in Algebra and number of students enrolled in class were not significant predictors of exit exam scores, they did relate in a meaningful way to a variable that predicts exit exam scores (i.e., whether or not a student took only Algebra I or Algebra I and another math class). That is, in schools in which students took both Algebra I and another math class, Algebra I classes on average had fewer students and lasted longer than classes in schools where students took only Algebra I. Future evaluation work could look more closely at schools with different configurations of Algebra I offering to further explore qualities of these classrooms and their effects of exit exam scores.

Reflection Questions:

- *Are these descriptions of classroom characteristics in keeping with program planners' expectations?*
- *What, if any, changes would program planners like to see and why?*
- *Given that students perform significantly better on the exit exam when enrolled in both regular 8th grade math and Algebra I, and that in schools where this was the case Algebra classes were longer and had fewer students, should the district suggest that all schools adopt this type of model?*
- *How can the district encourage greater compliance from schools for sticking to the recommended number of minutes of instruction in Algebra I?*
- *What characteristics of teachers who have been teaching Algebra for two or less years might be contributing to their students' higher performance? Could it be associated in some way with CMSI certification courses? How might future work explore this question?*

What Algebra I Classroom Instruction Looks Like

Description of instruction

Evaluators observed the grade 8 Algebra I classrooms of 34 teachers at 34 Chicago Public Schools. Here, we present some of the typically observed aspects of what students experienced and also describe some of the range of instruction in these classrooms. In almost all observed classrooms (94%) students were strongly engaged in learning algebra. There was very little off-task time during algebra classes and students' attention was on the math problems and what their teachers and classmates were explaining. Attendance rates (also at 94%) in the classes mirrored this strong level of engagement. (See appendixes for instruments used to observe for these classroom characteristics).

Small group work. In 17 classrooms (50%), evaluators observed instruction taking place through students working in small groups. As observed by evaluators, when not working in groups, classes reviewed the prior day's lesson, went over homework, and then the teacher introduced and taught the next lesson via whole class instruction or students engaged in individualized work.

When teachers used small group instruction, on average it comprised a little over one-third of the classroom time. Within these small groups, students were doing a variety of tasks showing different types of knowledge and skills. While some (35%) of the group work focused on students following procedures and solving equations, in more of the groups (65%) students demonstrated deeper understanding of math by explaining their findings and developing relationships between concepts.

The following example illustrates an instance of small group work serving the purpose of going beyond the procedural and focusing on the display of conceptual knowledge.

The 26 students in Mr. Jones' classroom were working on functions using input/output tables. Students were sitting at eight different tables. Mr. Jones assigned five problems out of the text book and instructed students to make their inputs go from -3 to +3. They were given the example of an input/output table and function like the following:

Input	Output
0	2
1	3
2	6
3	11
4	18

The rule or function is square the input and add 2.

He told them, "I'm going to come around and watch you and assist. You have 5 minutes to do this in your groups."

All groups were working. Students were writing down input/output tables and using graphing calculators. Some of the children were explaining the problem or process to their group. Others seemed to be holding non-math related conversation, but that was an isolated few.

Students were asking questions and the teacher was going around to the groups addressing them. Questions were about clarifying some of the ideas. For example, a girl tried to understand how a square root was not a function. She was able to clearly explain the rule of square roots but was confused as to why it was not a function. A student from a different group called Mr. Jones over for help on another problem. He went over, sat with them, and talked them through the problem asking if it was a function or not.

After that, Mr. Jones started working with another table. He started talking with them about absolute value, not giving them the answer, but telling them they had to think about the notation for absolute value. Then, Jones went to help another group that was struggling with remembering the notation for absolute value.

As class wound down, a student asked the teacher which problem he was collecting. The teacher said number 2, and students handed in the problem. Concluding, he said, "I'm going to collect this page. Could you respond in your journals and then I'm going to write your homework down." The period ended.

Some teachers shared their thoughts about students working in small groups. Mr. Jones, from the above example described the advantage of having students work in collaborative learning groups as follows:

> I've always thought that kids work better in groups…I went to this workshop once at UIC with [two speakers] and they were talking about why Latinos and African Americans don't do well in college is because they don't know how to work together in groups—don't know how to have study groups, want to do everything on their own and number 2, they are not organized. So I've told the team of teachers in the other subject areas that we have to teach the students the value of community, and there are things like working in groups, understand working together, solving problems together…the individual stuff…that's for sharks. The working in groups is how we become successful as a community. They know that from Day 1.

Other advantages teachers in the study sample saw in having students work in small groups were:

- It helps students understand the value of community.
- Students can understand how other students are working through problems through "kid" talk.
- Through sharing ideas, weaker students can learn the right answer.
- It helps students who are at different levels catch up.
- Teachers can assess student understanding by listening to their discussion.
- Students are able to talk things out and help each other like adults do.

Demonstrating understanding of mathematical ideas. Students were observed demonstrating understanding of mathematical ideas (moving beyond memorization or more straightforward performance of procedures) in 17 (50%) of the teachers' classrooms.

The following example illustrates a student demonstrating understanding of mathematical ideas.

Ms. Green passed out grid paper to the students as they entered the room. She told them to make a four quadrant graph with negative 8 and positive 8 as the minimum and maximum values for the x-axis, and negative 11 and positive 11 as the minimum and maximum values for the y-axis. She told students, "If you need a ruler you know where they are. The point of origin should be in the direct center, right?" As students got started on this, Ms. Green handed out strands of spaghetti to each student.

Students were instructed to take the piece of spaghetti and drop it on the graph, find two points on the line made by the strand of spaghetti, and then find the equation of the line. After they did it, Ms. Green told students that they were going to switch seats and see if the next person could find the equation of the line. Green checked students' equations before allowing them to switch and find the equations for their classmates' lines.

Looking at one student's equation, Ms. Green asked, "What are the x and y on that equation?" A student replied that they were points. Then the teacher asked, "Why do we like fractions for the slope?" No one answered so the teacher said, "Because it gives you direction. What's the direction?" At this point a student said that it was rise over run. Students began switching seats to see if they could find the equation for the line represented by a classmate's strand of spaghetti on the grid paper. The teacher was walking around the room helping students and asking questions such as what was the slope.

They continued working on this activity, with all or nearly all of the students engaged. The teacher instructed the students, "Drop it again. If you got a positive slope last time what do you want to do this time?" A student said, "negative." Variations of this activity went on as class continued. For example, she asked them what slope-intercept form was, put the equation -2x + y = -4 on the board, told them to put it in slope-intercept form and graph it with their spaghetti strand.

Pacing. In the August 2008 8th grade algebra evaluation report, *CMSI High School Algebra I for Middle Grade Students: Logistics, Students, Instruction, and Teachers and Their Preparation, 2007-2008* (See www.prairiegroup.org for access to this report), we found that students in classrooms that were on pace with curriculum pacing guidelines were more likely to pass the exit exam. For 2008-2009, content pacing calendars were provided to teachers who received district supports. District support, also referred to as the Instructional Supports Option (ISO), involved providing coaches for teachers, professional development for teachers, and other services. More will be said about ISO features later in this report.

Curricula that were supported by the district were Cognitive Tutor/Carnegie Learning, Agile Mind, and the Center for Mathematics Education (CME). Of the 21 schools in the 34 school sample using either of those materials, 18 had access to the pacing guides. That is because three of the sample schools chose not to be supported by the district even though they were using a recommended curriculum. Pacing guides were available to ISO schools only.

Starting September 2, 2008 and ending May 15, 2009, pacing guidelines were aligned with the school calendar, exactly 152 teaching days. Schools had the option of administering the exit exam any day during the week of May 18, 2009. Since the school year extended through June, teachers were expected to teach additional material after they had given the exit exam. Table 9 shows the pacing of the 21 schools for which pacing guidelines were available, keeping in mind that only 18 of those schools had access to the guidelines.

For six (29%) of the teachers, the material covered was on pace or ahead of the curriculum pacing guidelines. Our observations also show that six (29%) teachers were one day to two-weeks behind pace. Nine (43%) teachers were more than two-weeks behind. Reasons given for being behind in pacing included the following:

- Not enough time in the daily schedule
- Schedule interrupted by assemblies, field trips, make-up tests etc
- Need to cover ISAT topics not in the algebra curriculum
- Need to supplement – concepts/skills students missed because of not taking 8th grade math
- Need for time to "practice skills"
- Student motivation (8th-grade-itis, not doing out-of-class computer work)

When we developed Table 11 we looked at the lesson that was being taught on the day of our visit and when that lesson was supposed to be taught according to the pacing guide. We were unable to account for whether or not teachers were teaching lessons out of sequence according to the guide. Consequently, as indicated in Table 11, one teacher was 81 days behind, one was 72 days behind, and another was 70 days behind. In total we were able to map the pacing for 21 classrooms.

Table 11

Pacing Results Based on Curriculum Pacing Guidelines

Date of Observation	Curriculum	Topic Class was Covering	Date Topic Should be Covered per Pacing Schedule	Topic Class Should be Covering per Pacing Schedule	On Pace, Ahead of Pace, or Days Behind
12/9/08	Cognitive Tutor	Multi-step problem solving	12/9/08	Linear functions and inequalities; solving more complicated equations	On pace
1/22/09	Cognitive Tutor	Distribution and factoring	12/3/08	Lines of best fit; using lines of best fit	25 days behind
2/4/09	Cognitive Tutor	Graphing in the x-y plane; writing equations using point-slope; probability	1/8/09	Lines of best fit; scatter plots and non-linear data	17 days behind
4/21/09	Cognitive Tutor	Solving linear equations; functions and relations; graphing in the x-y plane	11/24/08	Properties of exponents; scientific notation	81 days behind
4/28/09	Cognitive Tutor	Quadratic equations and functions	4/20/09	Properties of exponents; scientific Notation	6 days behind
12/11/08	Agile Mind	Graphing in the x-y plane	11/5/08	Exploring rate of change in other situations	20 days behind
3/23/09	Agile Mind	Slope-intercept; solving linear equations	1/16/09	Graphs and quadratic functions	40 days behind
3/26/09	Agile Mind	Systems of equations and inequalities; writing equations using slope-intercept	2/20/09	Graphs and quadratic functions	23 days behind
4/22/09	Agile Mind	Inequalities	2/20/09	Operations on polynomials	35 days behind
12/8/08	CME	Writing equations using two points; graphing in the x-y plane; systems of equations	12/2/08	Rates of change; all about slope	4 days behind
12/9/08	CME	Writing equations using point-slope, slope-intercept, and two points	12/9/08	Co-linearity; all about slope	On pace
12/10/08	CME	Multi-step problem solving; connection between slope and rates	12/10/08	Linear equations and graphs; determine the slope of a line from its equation	On pace
1/6/09	CME	Graphing in the x-y plane	12/9/08	Systems of equations	10 days behind
1/15/09	CME	Solving linear equations; systems of equations and inequalities	1/15/09	Solve inequalities algebraically and by using graphs	On pace
2/6/09	CME	Functions and relations	2/6/09	Functions and Situations	On pace
2/11/09	CME	Functions and relations	2/6/09	Catch up day	3 days behind
4/2/09	CME	Polynomials and factoring	4/14/09	Factoring general quadratic polynomials	Ahead of pace
4/20/09	CME	Functions and relations; polynomials and factoring radicals	4/14/09	Quadratic formula	4 days behind

Table 11 (cont.)
Pacing Results Based on Curriculum Pacing Guidelines

Date of Observation	Curriculum	Topic Class was Covering	Date Topic Should be Covered per Pacing Schedule	Topic Class Should be Covering per Pacing Schedule	On Pace, Ahead of Pace, or Days Behind
4/21/09	CME	Polynomials and factoring	4/14/09	Quadratic formula	4 days behind
4/21/09	CME	Writing equations using point-slope, slope-intercept, and two points	12/9/08	Quadratic formula	70 days behind
5/13/09	CME	Systems of equations	1/14/09	Review for exit exam	72 days behind

We asked all teachers who were off pace why they were off pace and what supports they needed to help them with their pacing. The teachers who were more than two months behind said the following regarding the reasons for not being on pace:

> "Late start and interference from school activities."
>
> "They jumped from 6th grade math to high school algebra. And, that's too many steps that they missed. We usually have to go back and say, okay, this is why this works this way."
>
> "Because, I have to do a lot of re-teaching. These are 8th grade students. At this time of the year their mind is on graduation, graduation activities. And, it's almost like a fight to get them to do homework, get them to focus, and remember. So, I'm doing a lot of re-teaching. And, in the past I've done a lot of re-teaching. I don't know if it's the maturity level, or what. But, I've had to do a lot of re-teaching with this program."

These same teachers suggested that the district could support them in the following ways:

> "Give me a pacing guide."[7]
>
> "I would have liked to have been included in the support system that they were offering algebra teachers, which I wasn't.[8] . . . And next year, again, we're going to have the students . . . Next year's 8th grade students, they're going to have, already have, the basics for them to learn algebra. So, I don't think we'll have a hard time next year."
>
> "[The coach] has been wonderful. My coach, has been wonderful with helping me kind of group the lessons together and knock them out in maybe one or two class sessions."

Variations in how Algebra I was taught across the school year. Researchers examined how factors such as ISAT exam testing affected 8th grade Algebra instruction. Seventy-six percent of the 8th grade students in Algebra I did not have a regular math class in which to cover some of the topics tested on the March ISAT. To examine the impact of ISAT on Algebra I instruction in 8th grade, we looked for differences in observed classroom practices between the months of November through March (pre-ISAT period) and between the months of March and May (post-ISAT period). In the classrooms observed November through February (pre-ISAT) teachers expected students to demonstrate mathematical

[7] This is an ISO teacher.
[8] This is a non-ISO teacher but using a recommended curriculum.

understanding (beyond performing procedures) at the same rate as classrooms observed from late March through May (post-ISAT)—in about 50% of the lessons observed. Student attendance rates in the observed lessons were the same for these pre-ISAT and post-ISAT periods. Yet there were potential differences in how often evaluators observed teachers using small group work settings. Slightly more of the post-ISAT observed classrooms (64%) than pre-ISAT observed classrooms (40%) were organizing students for part of the lesson in small groups. A higher proportion of the pre-ISAT class observations were zero to two weeks behind pace (9 of 11) compared to those observed later where 4 of 10 were zero to two weeks behind (See Table 9).

Variation in instruction across different types of curriculum materials used. While curricular packages likely influence how teaching and learning took place in these classrooms, in broad categories the instruction was very similar. Regardless of whether a school was using a CPS-supported curricula (Cognitive Tutor, Agile Mind, CME) or the Glencoe materials, evaluators observed small group work by students in about half of the classrooms. The same pattern held across all curricula packages in terms of the levels of knowledge and skills students were expected to exhibit. In about half of the lessons observed students demonstrated mathematical understanding through explaining why they solved problems as they did. In relation to pacing, CME classrooms were more likely to be on pace than were classes using other approved CMSI Algebra I curricula (See Table 11).

Instruction related to student achievement

Here we examine how the classroom teaching and learning in the observed Algebra I classes may relate to student performance on the end-of-year exit exam. The following instructional characteristics were considered:

- Students' use of graphing calculators
- Whether or not they worked in collaborative learning groups
- The extent to which students were engaged
- Whether or not content was taught on pace as outlined in curriculum pacing guides
- The level of intellectual demand placed on students

Preliminary analyses revealed that instructional practices in courses in schools using approved curricula and receiving district supports (ISO) differed from courses in schools not using approved curriculum and/or district supports[9] (non-ISO) with respect to the above characteristics. Table 12 displays these differences.

Table 12
Differences in Distribution of Instructional Characteristics Between ISO and Non-ISO Classrooms

	ISO Classroom N = 18	Non-ISO Classroom N = 16
Used Graphing Calculators	72%	48%
Worked in Groups	65%	46%
High Engagement	96%	95%
High Intellectual Demand	56%	62%

[9] The non-ISO group includes schools using approved curricula but without district supports.

Table 12 shows that while we observed similar amounts of intellectual demand and levels of student engagement in both types of classrooms, we observed more calculator use and group work in ISO classrooms than in non-ISO classrooms (differences are statistically significant $p < .05$). These findings are important in that they provide evidence that classrooms using both CMSI curricula and CMSI supports are implementing classroom practices that align with the recommendations of the curricula.

Next we analyzed the impact of instructional variables on exit exam scores controlling for 7th grade ISAT math scores. We found no statistically significant effect of engagement or group work on exam scores. We did, however, find significant effects of intellectual demand and calculator use, as depicted in Table 13.

Table 13
Mean Exit Exam Scores as a Function of Level of Intellectual Demand and Calculator Use Controlling for Prior Math Achievement

	N	Mean (SE)
Intellectual Demand		
High	380	296.8* (2.1)
Low	291	292.3* (1.8)
Calculator Use		
Yes	270	289. 4** (1.7)
No	401	299.6** (2.2)

**Means differ significantly ($p < .05$)*
***Means differ significantly ($p < .05$)*

As shown, high levels of demand in classrooms positively impacts Algebra I exit exam scores. However, the analyses also show that calculator use was associated with lower scores on the exit exam. Given that we observed calculator use more often in ISO classrooms than in non-ISO classrooms this finding could be a function of a learning curve on the part of ISO instructors. Also, it is unclear whether or not calculators were meant to be used during each of these sessions. In addition, as will be shown in a forthcoming section, exam scores in ISO schools were on average higher than scores in non-ISO schools. Thus, the calculator finding should be viewed with these caveats in mind, but the finding does provide insight into the effects of different types of teaching practices.

As mentioned, pacing guides were used by 18 of 34 schools in the sample. We examined the effect of pacing on exit exam scores for students in these schools. Analyses revealed the following:

Table 14
Mean Exit Exam Scores as a Function of Whether or not a Classroom Was on Pace Controlling for Prior Math Achievement

	N	Mean (SE)
On Pace	241	293.4* (1.5)
Off Pace	156	289.5* (1.2)

**Means differ significantly ($p < .05$)*

As shown, in classrooms where instruction was on pace with the pacing guide, students scored higher on the exit exam than did those in off-pace classrooms. We then examined the effect of the degree to which a classroom was off pace (in weeks) on exit exams. These analyses revealed no statistically significant effects.

Reflection Questions:

- *If schools are using the district curricula, would it be useful, or even appropriate, for the district or IDS to provide all users of the curricula with the appropriate pacing guide so that all can gauge pace? Why did OMS or the Office of High School Programs not do this?*
- *How might coaches and school leaders keep teachers focused on keeping students engaged in learning, demonstrating their understanding, and on pace with covering materials?*
- *Given that calculator use was associated with somewhat lower performance on the exit exam, what might program planners do to ensure that teachers are helping students use calculators in the most beneficial ways?*

How Algebra I is Enhanced Beyond the Approved Program

The Chicago Public Schools middle grades "Algebra Initiative" included three major components aimed at enhancing the quality of teaching and learning in this important course. First, district leaders and teachers selected three sets of curriculum materials that, if used as intended by the district, would prepare students to perform above the State of Illinois math standards and to master district learning objectives for the Algebra I course most typically taught to high school students. Second, the district hired and trained instructional coaches to work with teachers of middle grades Algebra I. These coaches worked both one-on-one with teachers in their classrooms and also convened cohorts of algebra teachers to form supportive professional communities. Third, the district paid teachers' tuition so that elementary school teachers with middle grade math endorsements could also take specially designed university courses to qualify them to teach Algebra I to 8th grade students. In this section, we describe each of these enhancements and then consider evidence as to how these enhancements may have influenced how Algebra I was taught and how students performed after they took the course.

Schools were required to have a qualified teacher in order to get district approval to teach Algebra I to middle grades students. In order to teach 8th grade algebra the teacher must either have been certified to teach high school math (Type 09) or have had an endorsement in elementary school math (Type 03) and have completed the algebra qualification program at one of the participating universities. Beyond that, it was up to the school to decide which district enhancements, of the three outlined above, they wanted to partake in.

Curricula supported

Once an elementary school was approved to teach Algebra I, the school chose one of three curricula supported by the district or a non-district supported curricula Thus the options were teaching from a district-recommended curriculum with all of the district supports; teaching from a district-recommended curriculum with no supports; or, teaching from a non-district recommended curriculum with no supports. District-recommended curricula were Agile Mind (published by Agile Mind), the Center for Mathematics Education (CME) (published by Pearson), and Cognitive Tutor (published by Carnegie).

As noted in the section above on methods, the schools sampled for this evaluation mirrored all district schools in the proportion using CPS-supported curricula. This held true even at the level of specific curricular packages. Table 15 shows that across the district and in the sample studied, of schools approved to teach Algebra I to middle graders, most either used curricular materials not supported by the district (38%) or used the district supported CME materials (34%). The proportion of schools that used Cognitive Tutor or Agile Mind was approximately 18% and 10% respectively.

The district chose to support the Cognitive Tutor, Agile Mind, and CME curricula because those were the learning materials that high schools in the district's High School Transformation Teaching and Learning (HSTL) program used. CPS' Office of Math and Science and Office of High School Programs expressed the desire and need to align with the high school program for the purposes of coherence and sequencing. Middle grades that selected either of those programs were eligible for a number of district sponsored supports. OMS leaders explained the non-support of curricula that were once supported this way:

> And then, once HSTL came into being, we said, "Well, we will do whatever they're doing." So, this year, in 08-09, is the first year that we're using all of the ones that are HSTL. … So, we had Carnegie, and Agile Mind with Glencoe last year in 07-08. But we had to have a text book solution and that was Discovering Algebra … Then this year is the first year that we're using the HSTL programs, which are Carnegie, Agile Mind with Glencoe, and CME. And CME is new, it's the first year we're using it. Next year we're going to reduce it down to just CME and Carnegie. It's too hard for us to support 3 programs.

Table 15
Curriculum Used in Approved Algebra I for Middle Grade Students

Curriculum Option	Number (Percent) of Schools Using in the Sample (N = 34)	Number (Percent) of Schools Using in the Population (N = 146)[10]
Cognitive Tutor	5 (15%)	26 (18%)
Agile Mind	4 (12%)	15 (10%)
CME	12 (35%)	49 (34%)
Other	13 (38%)	56 (38%)

While the school was responsible for providing graphing calculators for the students, computer access for students for technology based programs, a laptop for the teacher, and the first $41 per student for the cost of any individual program, the district provided the following:

- LCD projector
- All costs over $41 per student based on the program the school chose. Cognitive Tutor, however, costs exactly $41 per student so schools working with that program did not receive a subsidy from the district for instructional materials. Additional costs were associated with the other curricula.
- Professional development and any related professional development costs (i.e., salary for summer sessions, sub coverage)
- Cohort related costs
- In-school instructional coaching
- Quarterly examinations for students for formative assessments

Generally, teachers who used the district-supported curricula described it as discovery-oriented. For example, one teacher explained it this way:

> Initially I viewed the curriculum, well it is standards-based, but I viewed it as being very student-centered, inquiry-based, and that is how you would teach it. But what I learned from the developers is that they created it specifically so that a teacher that [normally] would teach more teacher-directed could teach it and a teacher that normally taught more student-centered could teach it, and they didn't have to change very much about their teaching methods. But I am a student-centered, inquiry based type of teacher. That's how I've always taught so that's what I saw immediately in the curriculum so I was thinking, "Oh, this is great because it's inquiry-based," but it does do a very good job in giving the kids the opportunity to explore and learn things on their own; like come up with their own ideas and conjecture about things and then they are all solidified later.

[10] There were 145 unique schools in the population and 146 classrooms in this case because one school had multiple algebra classrooms and used both a recommended and non-recommended curriculum.

In our interviews, half the teachers using the Cognitive Tutor program explained that they liked the on-line feature that allowed students to work at their own speed. Most discussed this feature as helpful for keeping the advanced students engaged. For example, one teacher described the features of Cognitive Tutor as follows:

> First, the computer program lets students work at their own pace and helps with differentiated instruction, so the advanced students can keep moving forward. Without the computer lab, advanced students would be forced to stay slow. Second, the content is taught in real life context so the students can figure out what equations mean and use metacognition to find the answers.

Teachers we interviewed at schools not using the district-supported curricula described in most cases using curricula previously supported by the district. For example, half of these teachers are using Glencoe which was a district-supported curriculum last school year. A number of teachers (whether they used Glencoe, McDougal Littell, or Prentice Hall) did not know that the curriculum they were using was no longer supported by the district. A number of these were explicit in saying they chose the curriculum based on what looked to be best at the time, what was cost effective, or what was recommended by a University professor. Most of the teachers in these schools also explained that when selecting a curriculum they considered what curriculum was used by the high school most of their students attended or what style of teaching they preferred. Half of the teachers said it was cost prohibitive for them to change text books so soon after purchasing new texts within the last 4 years.

Coaches provided

About half (53%) of the schools approved to teach Algebra I to middle grade students used both district supported curricula and took advantage of supports that included algebra coaches. Eighteen schools receiving coaching support were part of the sample studied for the evaluation, and this report draws on the information from teachers at these schools and from information from the sample of six algebra coaches. This is represented in Table 16.

Table 16
Approved Schools Use of Algebra Initiative Supports That Include Coaching

Support Option	Sample (N = 34)	Population (N = 146)
Curriculum with Supports	18 (53%)	78 (53%)
Curriculum with No Supports	3 (9%)	12 (8%)

Six algebra coaches were hired by the district (one was hired on a part-time basis) in 2008 to work with high school teachers of Algebra I. Each of the full-time Algebra Coaches worked with approximately 12 to 14 teachers in as many schools.[11] For the most part, the coach worked with one teacher per school. A majority of algebra coaches had some experience coaching in the past, notably as Citywide Specialists for

[11] Coaches who travel between schools in this manner are sometimes called “roving” coaches within district circles.

OMS. One coach described being new to coaching. Coaches worked for the three district-recommended curriculum companies.

Preparation of Algebra Coaches. CME coaches (3) met weekly with a mentor to talk about their work and took turns planning weekly professional development for each other around issues they were experiencing in their coaching role. Cognitive Tutor coaches described training they received from the company prior to their in-servicing Algebra teachers. In addition, coaches described attending various other professional development opportunities provided by CPS such as attending training with high school coaches. Algebra coach training was separate from the district's In-School Instructional Coaching program (ISIC).

Algebra coach activities. Few teachers experienced pre- and post-conferences as their coach worked with them. This was corroborated by both evaluators' observations and coaches' interviews. For example, less than ten teachers described having had a pre-conference. For some this came in the form of an email or phone call to briefly describe their issues or concerns generally about the curriculum and how things were going or specifically about questions of how to teach specific parts of a given lesson. Others described this as not being particularly problematic as their coach was knowledgeable about the curriculum and was able to jump in no matter what the lesson was.

More teachers, but not quite half of those teachers evaluators spoke with, experienced some form of post-conference. Often this was described by teachers, evaluators, and coaches as taking place either as a side-bar conversation during the lesson, for a few minutes after the lesson as classes were changing, as a formal conversation after the lesson if the teacher had a prep period or if it was the end of the day, or as an electronic conversation via email. Often these quick conversations highlighted what went well or what could be improved in a lesson.

The role of the coach. Both teachers and coaches described the coaches' vision of Algebra instruction to be student-centered such that students are actively involved in discovery and allowed to struggle and learn from mistakes. One coach was less concerned with method or approach for the Algebra course and more focused on ensuring it provides a challenging course for high achieving students who are ready for it in order for them to take more advanced math in high school. This coach argued that conceptual understanding of algebra can be accomplished by any means (i.e., direct instruction or discovery).

Teacher perceptions of coaches. All but a few teachers described their coach in positive terms. One teacher described a personality conflict with his coach. Three others described not needing the services of a coach either 1) after the initial help received when starting the program or 2) as frequently as every other week. Teachers described the work of coaches as observing teachers as they presented lessons, helping teachers present lessons (co-teaching or interjecting ideas and explanations into lessons taught primarily by the algebra teacher), and modeling lessons. Teachers saw this work as directly influencing their content knowledge or pedagogy and providing students with greater exposure to another set of teaching techniques and other ways of thinking algebraically.

One teacher described it like this:

> The Coach comes in the class and when you're teaching the kids, at first, the coach will give you a few tips here and there as to what you need to hit on a little bit better. Maybe you skimmed over this and this is something that's really important in the next chapter so make sure you go back and hit that. The coach has really good tips after watching you teach. And the coach also is another set of eyes in the class. The coach will walk around and talk to groups—and that's a big relief to me on the days when the coach is there.

Another teacher in this focus group added as a way of explaining this further that, “The coach knows our students. Actually knows our students and can tell me I saw that this one didn’t really know how to do this, so we need to work on that.”

Three teachers described the work of coaches as instrumental in making school level changes. For example, one teacher explained how the coach came to talk to the principal who was admitting 7th grade students into the 8th grade algebra.

> [The coach] talked to the principal, and it took almost half a year…before we could finally get [the principal] off of doing this because it made no sense. And they [the 7th grade students] were failing it because they weren’t prepared for it. But [the coach] was very helpful in that because my principal isn’t always a rational thinker.

Another teacher explained how his “new to the school” principal tried to stop the program before it began. The teacher tried to explain that the school had already signed a contract, but instead of fighting with the principal about it, the teacher asked the coach to intercede. In time, the coach was able to get the program back on track. In another school, the coach was instrumental in getting the computer lab in operating order by reminding the principal of the needs of the program and the signed agreement.

One teacher explained that because her class was very early in the morning, she rarely saw her coach while she was actually teaching algebra. Instead, her coach came to check in on her during her prep period.

Teachers’ were thankful to have a coach who understood the curricula and could help answer their questions. Algebra coaches were able to do this, some more quickly than others. Many schools did not have in-school coaches and/or had in-school coaches who were less familiar with the curriculum. For these reasons, teachers preferred the Algebra coach over the in-school coach.

Coaches’ perceptions. Coaches described their work with teachers and students in classrooms in much the same ways as teachers. Most coaches explicitly said their focus was math content. For example, one coach explained

> We need to make sure that the teachers are comfortable with the math that they’re presenting. So, a lot of times during observations, I’m doing, like, real time coaching. I’m doing it like real time—just jumping in and trying to highlight certain things. Other times, I’m working with students and talking to them and seeing what their understanding is. And then, if they’re caught up on something, I can kind of pull that teacher aside and say, “Hey, I’ve visited a couple of groups and they’re struggling with this.” And that’s kind of it. That’s kind of my way of hinting to them –“This is what you should summarize with. This is what people are struggling with so you should have a whole class discussion.”

This coach went on to summarize his work saying:

> I am an extra set of eyes. So, I am almost like an extra instructor in the classroom for a teacher on that day. And then, I’m also an extra resource or if she’s struggling with something or if she wants me to lead a summary or if she wants me to lead a launch, I can do that.

Other coaches described a similar approach. Three described using the Classroom Observation Guide (COG) or a similar framework developed by the curricula to focus conversation about a lesson on teachers' areas of concern or student learning.

Coaches had one of two reactions to their role of being a roving coach (i.e., not being based at a single school, but rather roving among multiple schools). A few described the roving model as being difficult due to scheduling and traveling between schools. They described this as having less face time with teachers as opposed to an in-school coach who would work with teachers all of the day. Others saw benefits in the roving model. These coaches described having one focus—the one grade level of one curriculum. They explained that they work with both teachers who were selected to teach the course and who want to teach it and students who were selected to be in the course. A few also described using the travel time as a time to reflect on their practice.

Professional development and cohort meetings. Another aspect of coaches' work was scheduling and implementing cohort meetings. Evaluators observed five cohort meetings throughout the school year of five different coaches. Each observed cohort had three or four teachers total at a meeting. In only one of these meetings were all teachers present at the start of the meeting. In three of the meetings half of the teachers were present at the start of the meeting with the others arriving within 20 minutes of the start time. In one observation, no teachers were present on time, not even the teacher who taught in the building was present. That teacher showed up 30 minutes late and the other teacher over an hour after the start time. All of the cohorts ended on time except in the case of the cohort that started with all the teachers on time, that cohort meeting ended 20 minutes early.

Of all of the teachers we observed, 18 attended professional development and cohort meetings. Of those 18, eight attended 75% or more of the professional development opportunities available to them. Only one of these 18 attended 75% or more of the cohort meetings.

At the start of the year, OMS and coaches agreed on a structure for cohort meetings that included 10-15 minutes for sharing, 40-45 minutes for discussing a theme (suggestions were made for each month), 45 minutes for discussing student work, and 10-15 minutes for planning next steps. Not all aspects of this format were followed completely in the observations made by evaluators. First, time for each agenda item was off for nearly every observed cohort meeting; thus, in most cases, topics were not discussed for the length of time suggested by the cohort meeting structure. In addition, some changes were made to the process followed; some of these changes seemed to add to the process while others seemed less helpful.

For example, in one cohort meeting the algebra coach had the teachers begin and end with a written reflection. To start the meeting, teachers were asked to write down their plan for getting back on pace and then these plans were shared orally. At the end of the meeting, teachers were asked to write a response to an article they had discussed. These reflections were also shared. In another cohort meeting where a number of teachers came extremely late to the meeting, evaluators observed very little that reflected the agenda. While teachers shared some on pacing, the majority of the time teachers were all in attendance was spent talking about credit versus placement. When the coach tried to steer the conversation back to the agenda, teachers indicated they wanted to continue discussing credit versus placement and continued to do so.

Although the format of cohort meetings wasn't always followed, most cohort meetings observed by evaluators seemed to include the types of sharing and topic areas that OMS had intended. In one case, evaluators observed a cohort where teachers learned how to use the graphing calculator and received a packet of problems that they could use to work on with students. During another meeting, teachers graded each others' students' assessments and had opportunities to clarify concerns with each other and the coach. For yet another cohort meeting, teachers reviewed the exit exam with the coach and then did an overview of the chapter on quadratics. The coach asked them to anticipate what students might misconceive and how they would alter their teaching to correct the misconceptions. Coach and teachers went over a number of problems discussing them in this way.

Almost all teachers who attended cohort meetings described them as being helpful. At least five teachers described cohort meetings as helpful in the following ways:

- Planning and looking ahead at how to use materials or decide what instructional strategies to utilize in teaching lessons
- Learning from colleagues what does and does not work or how to overcome difficulties
- Looking at student work and understanding students' misconceptions or anticipating problems
- Monitoring one's pace or understanding how one's pace was in relation to others

Teachers described cohort meetings as helpful in other ways; however, these were mentioned by fewer than five teachers:

- Providing teachers with an opportunity to direct the conversation at meetings
- Provide opportunities for teachers to reflect on practice
- Provide assistance in how to use the graphing calculator
- Builds confidence in teachers
- Helps teachers select students
- Provides support for how to teach around ISAT preparation

A few teachers who attended cohort meetings had complaints about them. One found the two hours to be too long. Another found the sessions too focused on content that he already understood. Still another teacher wished for more help with how to teach lessons and how to assess students' progress.

Courses offered

Teachers are qualified to teach 8th grade Algebra if they have a Type 9 certification to teach math or a Type 3 certification to teach math and have passed the CPS qualifying exam to teach algebra. CPS provided tuition stipends for teachers to take university courses to gain middle grade math endorsement and to prepare them for the district qualifying exam. These courses were available at DePaul University, the University of Illinois at Chicago, and the University of Chicago.

Forty percent of teachers described attending university courses, and 73% of these teachers indicated these courses had a positive influence on their practice. For example, one teacher explained how it was helpful to her to see how other teachers taught a particular section. Another was thrilled to learn content above the level of what he teaches to students. One learned to incorporate visuals to help students understand concepts. Another learned how to see students' misconceptions and how to address them. Still, another explained that the course, "Definitely got us ready for the test."

A few teachers (14%) described university courses in negative terms. One explained the course was, "Over my head. [The instructor] taught us like we were math majors. I learned more through teaching the program." Another teacher described how the course was not practical, and one teacher noted that the course, "Filled in content, but was not worth the time." This teacher did not tell us what would be worth his time.

In addition to university courses taken prior to their teaching of algebra, most teachers also took part in district offered professional development workshops which they found helpful to their practice. More than five teachers described professional development as helpful in the following ways:

- Going over lessons and understanding the depth of the concepts within them

- Having time to talk to other teachers about practice
- Learning about the curriculum and depth of concepts from the professors and curriculum developers

A few teachers complained about the professional development noting that because they attended a Track E school,[12] summer professional development was offered during their school year and year long professional development was off pace with their pacing. Three teachers described that their own pacing of lessons was off pace due to their attendance at professional development. Two teachers declared no change in their practice attributable to their attendance at professional development.

Enhancements related to student achievement

The final area we examined with respect to student performance on the end-of-year exit exam was enhancements to the Algebra Initiative program. We looked at the effects of the following enhancements on student exit exam scores:

- Use of district-supported curriculum
- Teacher attendance of district-sponsored professional development
- Use of district-sponsored curriculum with full supports (materials, coaching support)
- If teacher was Type 3 certified and took university courses

Table 17 shows that teachers' use of district-supported curriculum, their use of the curriculum with all of the ISO supports, and teacher Type 3 certification status in addition to having taken the university courses are all positively and significantly related to how their students perform on the end-of-year algebra exit exam[13] after controlling for prior math achievement. Students seem to benefit from their teachers' involvement in these district-sponsored activities.

Table 17

Summary of Separate Regression Findings Predicting Student Performance on the End-of-Year 8th Grade Algebra Exit Exam Controlling for Prior Student Math ISAT Scores

	R^2	*B*
District-Supported Curriculum	.337	.09
District-Supported and ISO	.345	.12
Type 3 Certification and University Courses	.333	.07

All statistics are statistically significant ($p < .05$)
Reported Beta weights are standardized

[12] Track E schools follow a year round school year and thus have an earlier start day than most schools in CPS.
[13] The variables included in this regression analyses are dichotomous. Standardized beta weights are reported to show their relative importance.

We further explored some of these variables in terms of their effects on exit exam performance. An analysis of variance, controlling for previous math achievement (7th grade ISAT scores) revealed that in schools using district supported curricula, students scored higher on the exit exam than did students in schools not using supported curricula. This finding is illustrated in Table 18.

Table 18
Effect of Use of District Supported Curriculum on Exit Exam Scores Controlling for Prior Math Achievement

	N	*Mean (SE)*	*Pass Rate*
Using District Supported Curriculum	397	294.4* (1.0)	40.0%
Using Non-Supported Curriculum	295	290.0* (1.1)	32.0%

**Means differ significantly ($p < .05$)*

Further analyses showed that above and beyond the use of approved curricula, students benefitted from being in classrooms in schools that used approved curricula with ISO supports:

Table 19
Effect of Use of District Supported Curriculum and ISO Supports on Exit Exam Scores Controlling for Prior Math Achievement

	N	*Mean (SE)*	*Pass Rate*
Using District Supported Curriculum With ISO Supports (18 schools)	348	295.3*^ (1.0)	41%
Using District Supported Curriculum Without ISO Supports (3 schools)	49	287.5* (2.7)	33%
Using Non-Supported Curriculum (13 schools)	295	290.1^ (1.1)	32%

**Means differ significantly ($p < .05$)*
^Means differ significantly ($p < .05$)

As shown in Table 19, students in our sampled ISO schools scored significantly higher than did other students. In addition, the analyses revealed that there was no statistically significant difference between the scores of students in schools using non-approved Algebra curricula and those in schools using approved curricula but *without* ISO supports. These results should be viewed with caution due to the very small sample size of the curriculum without supports group. However, the finding suggests a positive effect of the district model for supporting teachers' use of approved curricula.

Next we analyzed the differences in exit exam scores for students in ISO schools whose teachers attended at least 75% of the offered professional development versus those whose teachers attended less than 75% of the offered professional development. Table 20 shows these results.

Table 20
Effect of Professional Development Attendance on Exit Exam Scores Controlling for Prior Math Achievement for Students in ISO Schools

	N	*Mean (SE)*	*Pass Rate*
Teacher Attended 75% or More Professional Development (7 teachers)	116	302.6* (1.6)	58.0%
Teacher Attended Less Than 75% of Professional Development (11 teachers)	232	288.0* (1.1)	26.6%

**Means differ significantly (p < .05)*

Table 20 shows that in ISO schools, students benefited from being taught by teachers who attended at least 75% of professional development. These students averaged higher scores and passed at higher rates than did students whose teachers attended less than 75% of professional development. This finding can be viewed in combination with Table 19, in which it is shown that students in ISO schools score higher overall on the exit exam than do other students. In Table 20 we see that it is possible that some of this higher performance is associated with teachers' professional development attendance. This finding should be viewed cautiously given the relatively small sample size and the nested nature of the data (students within classrooms within schools). However, teacher professional development attendance could be examined in future evaluation work to further explore its effect on exit exam performance.

Table 21 illustrates sampled students' success on the exit exam by district-approved curriculum. Pass rates for Cognitive Tutor and CME were about the same at 36 percent and 37 percent respectively. Students working with the Agile Mind program passed the exam at a 27 percent rate. None of those differences were statistically significant.

Table 21

Curricula and Student Pass Rates in the 34 School Sample

Curriculum (# of Classrooms)	Number of Students who Took Exit Exam	Number of Students who Passed Exit Exam (%)
	Classrooms (n = 21)	
Cognitive Tutor (5)	91	33 (36%)
Agile Mind (4)	77	21 (21%)
CME (12)	241	90 (37%)

Reflection Questions:

- *In what ways did program planners expect the Algebra I supports (curricula, coaching, cohort meetings, professional development) to influence teachers' instruction?*
- *How are messages about what Algebra I curricula OMS supports being communicated to schools and teachers?*
- *What steps are the OMS and district taking to help schools adopt district-supported curricula as this continues to change year-to-year?*
- *Are the descriptions of coaches' work with teachers aligned to OMS's vision of how coaches would assist teachers and schools? What expectations have been met or left unfulfilled?*
- *Although cohort meetings did not follow the agreed on agenda in a strict sense, it seems that most teachers who attended them found these meetings beneficial. Were these benefits to teachers what OMS intended? Are there possible ways to reconfigure these cohort groups based on teachers' various needs (i.e.: content knowledge emphasis versus a procedural or planning emphasis)?*
- *With less than half of the teachers attending 75% or more of professional development and knowing that students of teachers who do attend this amount of professional development do significantly better on the exit exam, would it benefit the district to determine what prevents teachers from attending 75% of professional development?*
- *Are IDS providers supporting schools in the ways program planners intended?*

CONCLUSION

Across the district, 40% of eighth grade students taking the Algebra I exit exam passed and gained credit to allow them to move into geometry for their first high school math course. Of the students taking eighth grade Algebra I, those who had stronger seventh grade ISAT scores were more likely to end up gaining credit for algebra by passing this exit exam.

Yet, students' backgrounds alone could not be used to predict how students did on the exit exam. The type of eighth grade algebra courses they took also influenced their success. Students were more likely to get higher scores on the algebra exit exam if they were taking both algebra and math, using district-supported curricular materials, and learning from teachers who had attended professional development or received support from algebra coaches. The district appears to be getting some return on their investment into their Algebra Initiative in terms of benefits accrued by students. The cost-benefit ratio is not examined in this study but could be examined in the future to better understand how to improve students' chances of success—even if the students come into the class meeting but not exceeding standards.

Below is a summary of some major findings and possible next steps for planners of the 8th grade Algebra I program:

Class Characteristics. Students who took both an algebra class and a regular math class scored higher on the exit exam than did other students. Closer inspection of the schools in which both algebra and regular math took place reveals that in such schools algebra classes last longer and have fewer students enrolled. Program planners could examine more closely the structures in place at schools that offer both algebra and regular math in order to determine if this type of model would be helpful district-wide.

Students taught by teachers in this sample who were in their second year teaching algebra at the time of the study scored higher than did other students. The district may want to examine the characteristics of this group of teachers and whether this finding could be related to the district credentialing process in some way.

District Supports. Students in schools that used district-approved curricula and district supports (ISO schools) had the highest exit exam scores in this sample relative to students in non-ISO schools, including those that used district approved curricula but without ISO. Further, students in ISO schools whose teachers attended at least 75% of the district professional development performed the highest of any subgroup in the sample, with an average score of 302.6 and a pass rate of 58%. Finally, teachers indicated positive perceptions of their algebra coaches and the work they did together. Given that ISO supports appear to be an important contributor to the effectiveness of 8th grade algebra courses in this sample, program planners may want to continue to provide these supports and to urge schools to use them more widely and faithfully.

Instructional Practices. The majority of students in the classrooms observed were engaged in their Algebra lessons. In addition, teachers using district-approved curricula were observed using calculators and group work more often than were other teachers. Finally, students in classrooms in which researchers observed high intellectual demand performed better on the exit exam than did students in classrooms with low observed demand. However, students who used calculators during our observations of their classrooms scored lower on the exit exam than did others. The district may want to further investigate the nature of this finding (i.e., whether it is a function of a learning curve among teachers, if calculators were not functioning properly, if calculators are being used at inappropriate times, etc.)

In conclusion, 40% of the students taking the exit exam show proficiency in algebra at a level allowing them to take higher level courses in ninth grade. Further, the strongest predictor of success on the exam is their previous math achievement—namely the grade 7 math ISAT. However, when teachers use the resources supported by the district, they tend to help more of their students pass the exam. There appears to be an observable benefit to going to professional development, working with a coach and using district-supported curricula. There is also an observable benefit in asking students to demonstrate understanding rather than memorizing and doing procedures on worksheets. Future work can add to this evaluation by including hierarchical linear modeling, data on cost of district supports and alternatives, and data on how 8th grade algebra students then do in high school math classes.

Appendix A. Sample Selection

Appendix A provides detail on the sample selected, data collected and analyses carried out. Sample schools mirrored the overall district population of schools approved to offer Algebra I to middle grades students in terms of teacher certification and curriculum use. This sample also proved very similar to the larger district population of schools offering algebra when we examined student achievement on the end-of-year exit exam. During the week of May 18, 2009, 8th grade students who were enrolled in algebra across the district took the end-of-year exit exam; a total of 3,137 students took the exam. Students could obtain a rating of either "pass," "high pass," or "fail." A "pass" score means that students showed a generally consistent command of algebra and were able to apply it in a variety of settings. "High pass" indicates that students had a comprehensive, flexible, and consistent command of algebra and were able to apply it to any setting. In our analysis, we did not differentiate between pass and high pass – a student either did or did not pass.

Table A1 shows the schools in terms of teacher certification and curriculum use.

Table A1
Characteristics of the 34 Sample Schools Offering Approved Algebra I for Middle Grades Students

Characteristic	Sample N = 34	Population N = 145
Average Percent Low Income Students	74%	81%
Number (Percent) of Elementary Certified Teachers	24 (71%)	100 (69%)
Number (Percent) of High School Certified Teachers	10 (29%)	40 (28%)[14]
Number (Percent) of Classrooms Using District-Supported Curriculum	21 (62%)	92 (63%)
Number (Percent) of Classrooms Using Non-District-Supported Curriculum	13 (38%)	54 (37%)[15]

[14] The total number of teachers in the denominator for this category totals 140 rather than 145 because 5 (3%) of the teachers' certification status was unknown.
[15] Total schools in the curriculum category total 146 rather than 145 because one school had multiple algebra classrooms that used both district-supported and non-district-supported curricula.

In Table A2 we show that the rate at which students passed the exam for both the district (40% pass rate) and sample (39% pass rate) are comparable. We examined exit exam performance a little more closely to further determine the extent to which the sample is representative of the population. The Illinois Standards Achievement Test (ISAT) is given to all Illinois public school students in grades 3-8. Student performance on this test is measured in terms of whether or not students are at one of the following performance levels:

- Academic warning
- Below standards
- Meets standards
- Exceeds standards

Table A2
Student Pass Rate on the End-of-Year Algebra Exit Exam May 2009

Student Group Rate	Number of Students who Took the Exam	Number of Students who Passed the Exam	Percent Pass
District	3,137	1,267	40%
Sample	748	289	39%

Table A3 points out the similarities in students' 7th grade ISAT performance levels for which ISAT scores were available in both the sample schools and the 8th grade algebra population of schools approved to offer the course.

Table A3
ISAT Performance Levels for Students in 8th Grade Algebra

Performance Students Level Level	Number (Percent) of Students from Sample at Level	Number (Percent) of from Population at
	Students (n = 692)	Students (n = 2,874)
Academic Warning	0 (0%)	3 (0%)
Below Standards	11 (2%)	38 (1%)
Meets Standards	345 (50%)	1,324 (46%)
Exceeds Standards	336 (49%)	1,509 (53%)

In Tables A4 and A5 we provide correlation matrices illustrating the relationships between students' ISAT raw scores in mathematics, and performance on the exit exam. Population relationships are shown in Table A4 and relationships within the sample are shown in Table A5. Again, both groups are similar.

Table A4
Intercorrelations Among Students' ISAT Performance and Exit Exam Performance in the Population of 8th Grade Algebra Schools

	Algebra Exit Exam
ISAT Raw Scores	.530** (n = 2,874)

**Correlation is significant at the 0.01 level (2-tailed)

Table A5
Intercorrelations Among Students' ISAT Performance and Exit Exam Performance in the 8th Grade Algebra Sample

	Algebra Exit Exam
ISAT Raw Scores	.426** (n = 692)

**Correlation is significant at the 0.01 level (2-tailed)

An examination of demographics related to student achievement also suggests that the sample is generally representative of all schools approved to teach Algebra I in 8th grade. There was no difference in pass rates on the exit exam between students who were limited English proficient and special education students in both the population and sample. However, there was a difference between sample and population pass rates related to student socioeconomic status. Pass rates were different in the population between low income students and non-low income students (see Table A6).[16] There was no difference in pass rates between low income students and non-low income students in the sample.

[16] A school's percentage of low income students is based on the percentage of students in a school that qualify for free or reduced price lunch.

Table A6

Low Income Students and Pass Rates on the Exit Exam in the 8th Grade Algebra Population

(Percent) of Passed	Total Number of Students	Number Students who
	Students (n = 2,875)[17]	
Low Income (33%)* Students	1,992	664
Non-Low Income (48%)* Students	883	427

t = 7.735
df = 2,873
*p = .001

[17] Data on students' free or reduced price lunch status was missing for 262 students.

Appendix B

8th Grade Algebra Observation Protocol
2008-2009

Teacher name:
Algebra curriculum using:
School and ID number:
Grade/Room Number:
Date of Observation:
Time Observation Started:
Time Observation Ended:
Individuals present: Number of students __________ Number of adults __________
Observer recording notes:
Story of Initial Contact:

- Who were the other adults in addition to teacher:

- What was their role (i.e., teaching a lesson, assisting students with work, observing the lesson, other)

- Comments on other adults in the classroom

- How were students arranged within class:

1a	1b	1c	1d	1e	1f	1g	1h	1i	1j
2a	2b	2c	2d	2e	2f	2g	2h	2i	2j
3a	3b	3c	3d	3e	3f	3g	3h	3i	3j
4a	4b	4c	4d	4e	4f	4g	4h	4i	4j
5a	5b	5c	5d	5e	5f	5g	5h	5i	5j
6a	6b	6c	6d	6e	6f	6g	6h	6i	6j
7a	7b	7c	7d	7e	7f	7g	7h	7i	7j
8a	8b	8c	8d	8e	8f	8g	8h	8i	8j
9a	9b	9c	9d	9e	9f	9g	9h	9i	9j
10a	10b	10c	10d	10e	10f	10g	10h	10i	10j

Description of site:

List of materials collected:

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*

I. Observation of 8th Grade Algebra Lesson (Insert observational notes here. Note time throughout and how students are organized throughout, in addition to trying to capture as much dialogue as possible.)

When lesson shifts, for example, from review of homework to today's lesson to activity for today's lesson note engagement in each segment. For example:

Review of homework:
Total number of students taking notes (if it's a note taking moment)
Total number of students following the teacher/paying attention/not taking notes
Total number of students who appear distracted, head down, sleeping, talking to others

Today's lesson:
Total number of students taking notes (if it's a note taking moment)
Total number of students following the teacher/paying attention/not taking notes
Total number of students who appear distracted, head down, sleeping, talking to others

Today's activity:
Total number of students taking notes (if it's a note taking moment)
Total number of students following the teacher/paying attention/not taking notes
Total number of students who appear distracted, head down, sleeping, talking to others

****
*

Analytic Questions

1. What was the percentage of class time/number of minutes students spent working in groups?
    a. Did the teacher assist? If so, how?
    b. What was the approximate group size?
    c. What was the assignment?

2. What was the percentage/number of students who seemed to be on task for most of the class period?

3. What was the percentage of class time/number of minutes students spent working on algorithmic, low demand, skills practice types of activities? Explain.

4. What was the percentage of class time/number of minutes students spent working on deep understanding, intellectually challenging types of activities? Explain.

5. Was the class on pace (refer to interview item addressing this)? If the class was off pace, how far off pace was it?

6. Were manipulatives used? Explain.

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Post-Observation Debrief

PART A: Group Work:

1. **How often do you have your students work in collaborative learning groups?**

2. **What kind of projects do you usually have your students work on in groups?**

3. **What are the benefits of your students working in groups?**

4. **What are the disadvantages of your students working in groups?**

5. **Are you satisfied with the amount of time you devote to having your students work in collaborative learning groups?**

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Part B: Pacing

1. **Where does the lesson fall within the unit? (ex: second of a five day unit?)**

2. **Given where the lesson falls within the unit, how does it focus on specific content or problem solving strategies differently than lessons before or after it within this unit?**

3. **Where is the class with this lesson relative to the pacing guide? If the teacher is teaching the lesson out of order, what is their rationale is for making that change in the pacing?**

4. **Are you on or off pace?**

5. **If off pace, how far behind are you?**

6. **If off pace, to what do you attribute that?**

7. **If off pace, what can the district do to help you with your pacing?**

8. **If off pace, what other supports do you need to help you with your pacing?**

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PART C: Pedagogy and Learning

1. **Are you teaching this class at what you feel is a regular 9th grade/high school level?**

2. **What are you doing differently in your 8th grade algebra class than you are in your other 8th grade math classes?**

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PART D: Teacher Background

1. **How long have you been teaching grade 8 algebra?**

2. **What type of certification do you have (type 09, type 03)?**

    - **If Type 03, did you take the Algebra Initiative university courses and then pass the exam to obtain the 03?**

    - **When did you pass the exam?**

    - **Where did you take the Algebra Initiative courses (DePaul, University of Chicago, UIC)?**

    - **How many courses did you have to take?**

    - **What were the courses?**

    - **How long did it take you to finish the program?**

    - **How would you assess the courses, instruction, and overall program?**

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*

PART E: Class Schedule and Logistics

1. **What is the schedule for this class? (# of days it meets, length of class, what time of day)**

2. **How many students are enrolled in this class?**

3. **How are students selected for the course?**

4. **What are their ISAT scores?**

5. **What kind of grades do they get?**

6. **When are they selected?**

7. **Do students in 8th grade algebra still have to take regular 8th grade math?**

8. **How do the students get appropriate credit for regular 8th grade math, 8th grade algebra, and 9th grade algebra?**

9. **How well do you think this schedule and logistics work? Are there ways to improve upon this system?**

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PART F: Supports and Challenges

1. **What supports do you need in order to be successful in teaching 8th grade algebra?**

2. **What are some of the barriers you've found to successfully implementing 8th grade algebra?**

3. **If ISO approved, have you found the district-provided 8th grade algebra professional development workshops to be helpful? If so, how?**

    - **If you have not found the district-provided 8th grade algebra professional development workshops to be helpful, please explain why.**

4. **If ISO approved, has the district provided you with materials such as LCD projector, laptops, calculators, or other manipulatives.**

5. **8th Grade Algebra Coaches (if ISO approved):**

- **Who is your algebra coach?**
- **What is the coach's role in your school?**
- **How often does the coach visit?**
- **What does the coach do while visiting?**
- **How well does the "roving" coach model work compared to the in-school coach?**
- **Do you have any interaction with the coach away from your school? If so, in what way?**
- **What do you find to be the most beneficial aspect of your work with the coach?**
- **What do you find to be the least beneficial aspect of your work with the coach?**
- **Would you change your work/relationship with the coach? If so, how?**

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PART G: Curriculum Use

1. **Which curriculum are using?**
2. **If using non-CPS recommended curriculum:**
    - **Why did you choose the curriculum you're using rather than one of the ones supported by CPS?**
    - **Why did you think algebra was appropriate with the curriculum you're using?**
3. **If using CPS recommended curriculum:**
    - **What are the distinguishing characteristics of the curriculum you are using?**

Appendix C

Algebra Teacher Focus Groups

1. This year the district chose to support AI in a number of ways. What value do you see in:
   a. District-provided professional development
      i. How have these influenced your practice (i.e., what's different from last year to this year?)
   b. Coach cohort meetings
      i. How have these influenced your practice (i.e., what's different from last year to this year?)
   c. The actual algebra coach
      i. How have these influenced your practice (i.e., what's different from last year to this year?)
2. What happens during the cohort meetings?
3. What do you get out of the meetings?
4. How does the whole cohort model work? What's the process?
5. Do you find the cohort model/process to be effective? If so, how?
6. Do you feel that student performance as measured by the exit exam will be affected by your participation in these 3 district supports? In what ways? Why?
7. How often does your AI coach interact with you (number and in what ways? Pre, post conferences?
8. How would you describe your coach's vision of Alg instruction? How does your coach support, promote, and/or model that vision?

Appendix D

Algebra Coaches Focus Groups

1. What vision do you have of high quality algebra instruction?
    a. Prompts
        i. Examples
        ii. Influence on teachers, students, etc.

2. How do you support, promote, and/or model that vision using the model of pre-conference, classroom visit and post-conference?
    a. Prompts
        i. Examples
        ii. Coaching cycle

3. What kind of professional development do you receive? By whom?

4. How well does the "roving" coach model work compared to the in-school coach?

Appendix E

Algebra Coaches' Interview Protocol

1. What vision do you have of high quality algebra instruction?
    a. Describe specifically the kind of teaching and learning you want to see in 8^{th} grade algebra.
        i. Provide some concrete examples.
        ii. How does this vision promote students developing algebraic habits of mind, particularly as described by the CME curriculum?
    b. How do you influence the characteristics of:
        i. Teachers (i.e., certification type, credentials)
        ii. Students (i.e., ISAT scores, grades)
        iii. Curricula (i.e., CPS recommended or not)
        iv. Classroom instruction (i.e., use of group work, on pace)
        v. School context (i.e., school demographic characteristics, logistics)

2. How do you support, promote, and/or model that vision using the model of pre-conference, classroom visit and post-conference?
    a. Provide concrete examples of what you do in each part of your work with teacher:
        i. Pre-conference
        ii. Classroom visit
            1. What's the structure of the visit?
            2. Do you go in with a specific plan? If so, how is it developed?
        iii. Post-conference
            1. What's the structure of the post-conference?
            2. What role does data from the classroom visit play in this meeting?
    b. Do you engage in all facets of the model (pre-conference, meeting, post-conference) with all teachers?

        i. If not, what are the barriers?

3. What kind of professional development do you receive? By whom?
    a. How do IDS leads support you in that role
    b. How do IDS leads support your work with the cohorts
    c. What about your professional development do you find to be most beneficial?
    d. What about your professional development do you find to be least beneficial?
    e. How would you change the type of professional development you receive?

4. How well does the "roving" coach model work compared to the in-school coach?
    a. Are the challenges different?
    b. Are they similar?
    c. What are the advantages of the roving coach model?
    d. What are the disadvantages?

Appendix F

Background Information Sheet
8^{th} grade Algebra
Teacher Focus Groups

Name:__________________________ School: _________________________

Years Teaching:________________ Years Teaching 8^{th} Grade Algebra: ________

Type of teaching certificate: Type 3 ___ Type 9___

Endorsements (Please list): ____

Are your 6-8 grades departmentalized for math? Yes _____ No _____

When does your 8^{th} grade algebra class meet?
Before School ___ After School ____ During School Day _____

Do 8^{th} grade Algebra students also attend Regular 8^{th} grade math class?
Yes _____ No _____

How many students are enrolled in your 8^{th} grade Algebra class? ___________

How are students selected for 8^{th} grade algebra? (list order of importance)
______ ISAT scores
______ Grades
______ Algebra Readiness (as rated on the Algebra Readiness Rubric)
______ Attitude and Motivation
______ Adult Recommendation
_______ other: ____

Which curriculum do you use for 8^{th} grade algebra?

Appendix G

Student Selection for 8th Grade Algebra

Schools should consider the following criteria when deciding which students to enroll in 8th- grade algebra.

Academic Performance

- Did the student earn a scale score of 245 or greater on the spring 2006 6th-grade ISAT mathematics exam?
- Did the student earn a scale score of 255 or greater on the spring 2007 7th-grade ISAT mathematics exam?
- Did students have an "A" or "B" grade average in 7th-grade mathematics?

Understanding of Key Concepts

The Algebra Readiness Rubric, available at http://cmsi.cps.k12.il.us/, is a tool that will enable teachers and schools to make informed decisions about student understanding of key pre-algebra concepts.

- Do students demonstrate understanding of the key mathematics concepts?

Attitude and Motivation

- Does student have attendance at or above the citywide average for seventh grade?
- Does the student complete homework on a regular basis?
- Does the student complete in-classroom assignments?
- Does the student seek out academic challenges?

Adult Recommendations

- Does the student's 7th-grade mathematics teacher support enrollment in 8th-grade algebra?
- Does the student's parent support enrollment in 8th-grade algebra, and understand the additional commitment and work that it will entail?

Appendix H

Student Readiness Rubric

Student Name: ____________________________________ Student ID: ________ 7th Grade *ISAT* Score: _________

School: ___________________________________ **7th Grade Math Teacher: _______________________________**

Instructions for 7th Grade Mathematics Teacher:

Please complete this rubric for <u>students who met or exceeded standards on the ISAT</u> mathematics score, and who you believe are well prepared for 8th Grade Algebra. This rubric should be considered when deciding to place students into 8th Grade Algebra the following year. Assess the student's level in each area using the scale below. Total all scores and use the scale provided below to recommend course placement. Additional comments may be added on the reverse side.

In addition to the student's ISAT score and the results of the readiness rubric, the student's attendance should be at or above the citywide average for the current school year.

1 = No evidence: Student demonstrates no understanding of these mathematical concepts.
2 = Little evidence: Student demonstrates a limited and/or very inconsistent understanding of these mathematical concepts.
3 = Emerging evidence: Student demonstrates understanding of mathematical concepts in many, but not all, contexts.
4 = Strong evidence: Student demonstrates a deep understanding of mathematical concepts in most or all contexts.

MULTI-STEP PROBLEM-SOLVING				
Student can solve computational problems involving the four basic operations in various settings that require more than one step.	1	2	3	4
FRACTIONS, DECIMALS, PERCENTS AND PROPORTIONAL REASONING				
Student is able to: • Understand ratio and proportion both conceptually and procedurally *(e.g., "If 30 pairs of gym shoes cost $2050, how much would five pairs of gym shoes cost? Explain how you know this;" or, "If a 75-foot tall building casts a shadow that is 15 feet long, how long of a shadow will a 25-foot tall building cast at the same time of day?");* • Translate between fractions, decimals, and percentages *(e.g., "Out of a class with 14 boys and 12 girls, what fraction/decimal/percentage of the class is girls?").*	1	2	3	4
POSITIVE AND NEGATIVE NUMBERS				
Student is able to: • Compare and order positive and negative integers, fractions, and decimals *(e.g., "Place these numbers in order from least to greatest: -1/2, 1200, -17.89, 0.5, 34/39, 0.75, -8, -17½, etc.");* • Add, subtract, multiply, and divide positive and negative integers, fractions, and decimals using the proper order of operations.	1	2	3	4
VARIABLES AND PATTERNS				
Student is able to: • Understand the meaning of a variable in an algebraic expression; • Evaluate simple algebraic functions for a specific value of a variable *(e.g., "Evaluate -12x + 9, for x = -2")*; • Solve linear equations with whole number coefficients *(e.g., "Solve for x if -5x + 2 = x – 7")*; • Identify and describe patterns in sequences of numbers.	1	2	3	4
GRAPHING				
Student is able to: • Identify and graph numbers (integers and fractions) on a number line; • Identify and graph ordered pairs of numbers in the x-y (horizontal and vertical) coordinate plane; • Represent relationships in both tabular and graphical form *(e.g., "Given an x-y graph showing how many jumping jacks a student completed in three minutes, make a table of the data and describe how the number of jumping jacks changes for each 10-second interval.").*	1	2	3	4
EXPONENTS				
Student can: • Understand and interpret repeated multiplication in exponential form; • Simplify and evaluate expressions involving exponents and scientific notation.	1	2	3	4

TOTAL SCORE: __________________

Placement Recommendation: *(Please check one.)*

☐ 6 to 17: I recommend this student in a regular 8th grade mathematics class.

☐ 18 to 24: I recommend this student be placed into 8th Grade *Algebra.*

Teacher Signature: ____ Date: ____