

**CMSI High School Algebra I for Middle Grade Students:
Data Brief**

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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) 413-3367.

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Algebra I in Grade 8: Evaluation Data Brief, March 27, 2009

EXECUTIVE SUMMARY

This report is the first for the 2008-2009 school year in a series of external evaluation studies (2002-present) completed by the PRAIRIE Group at UIC on the Chicago Math and Science Initiative (CMSI) and its implementation of Algebra I for Middle Grade Students. The report draws on observations of 8th grade algebra classrooms at 17 different elementary schools, debrief interviews with the teachers, cohort meetings, and teacher focus groups about coach support.

Findings related to professional development:

- Six of the nine sample teachers who chose not to receive district supports explicitly asked for professional development support.
- Several teachers objected to having to attend professional development during the regular school day because of disruption in their pacing to not only algebra but their other math classes. One teacher refused to attend professional development for that very reason. A few argued they would be more willing to leave their classroom if they knew a qualified substitute was in their place.
- Most of the teachers found professional development beneficial for a variety of reasons.

Findings related to algebra coach cohort meetings:

- Program planners and coaches developed criteria for how cohort meetings should be structured, including time for sharing amongst teachers and analysis of student work. Neither of the two observations contained analysis of student work.
- Teachers who attended cohort meetings generally found them to be helpful because they offer an opportunity for teachers to look ahead at the curriculum with “other eyes,” to read and reflect on algebra, and to see and discuss how others are teaching.
- Some teachers valued the intimate setting of the cohort meetings in getting to know each other and building connections and relationships.
- A small minority of teachers described not attending any cohort meetings as they conflicted with after-school activities such as teaching after-school programs and taking care of family.

Findings related to the role of the algebra coach working with individual teachers:

- The coach usually visits teachers’ classrooms once every two weeks.

Findings related to instruction:

- Teachers using a district-supported curriculum seem to be more likely to have students work with manipulatives.
- Teachers using a district-supported curriculum and receiving district supports seem to be more likely to:
 - Have students work in collaborative learning groups
 - Have students engage in activities that promote deeper understanding of mathematics (i.e., giving students opportunities to express how and why they solved problems as they did)
 - Be within two weeks of their pacing guidelines from the district

CMSI High School Algebra I for Middle Grade Students: Data Brief

March 27, 2009

INTRODUCTION AND METHODS

This data brief is the first of two external evaluation reports for the 2008-09 school year by the PRAIRIE Group at UIC on CPS Office of Math and Science 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. Those audiences include the Chief Educational Officer of CPS and leadership teams of the Office of Math and Science (OMS), the Office of High School (OHSP), and the Department of Program Evaluation (DOPE). These preliminary 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.

This external evaluation for 2008-2009 will focus on the following four sets of questions²:

1. How do characteristics of teachers (e.g. credentials), students (e.g. entrance scores, grades), curricula (e.g. CPS recommended or not), classroom instruction (e.g. use of collaborative group work, whether content taught on pace) and school demographic characteristics and logistical factors relate to student performance?
2. What are the mechanisms (curriculum, certification, etc.) that foster student achievement in algebra? How do teachers create classes that support strong student success on the exit exam? What are the supports and barriers to practices supportive of student success?
3. What value is added by the major supports provided by OMS for Algebra Initiative (AI) schools—professional development, coach cohort meetings, Algebra coach? What happens during the cohort meetings? How does the cohort model work? Do teachers find it effective? If so, in what ways? What do they get out of the meetings? How do rigor of instruction and student performance/outcomes differ in schools that choose the full package of supports versus in schools that choose only the curriculum (with no supports)? How do these groups differ from schools that are “approved” but have not adopted the curriculum?
4. What are the enacted roles of CPS algebra coaches working with middle grades? How do these coaches influence the characteristics of teachers, students, curricula, classroom instruction and school context that relate to student performance? What vision do coaches have of high quality algebra instruction? How do coaches support, promote, and/or model that vision? Do coaches engage in all facets of the model (pre-conference, meeting, post-conference)? How well does the “roving” coach model work compared to the in-school coach? Are the challenges different? Are they similar?

² These are the evaluation questions taken from the 2008-2009 CMSI workscope.

In this first report, based on data collected during the first half of the 2008-2009 school year, we address evaluation questions 3 and 4 above. We describe the district supports for middle grades teachers who offer Algebra I. Then we describe our initial impressions of classroom instruction at three different types of these schools: (1) those with full district supports, (2) those using district-supported curricula but not using other types of supports, and (3) those not using district-supported curricula or other district supports. The second and final report will come out in summer 2009 and will relate schools' uses of supports with the exit exam that students take in the spring to determine if they learned the material taught in Algebra I.

Sample

For the 2008-2009 evaluation of middle grades Algebra, we selected a stratified random sample of schools that mirror the CPS population of schools according to what type of curricular materials schools used. Table 1 below describes the population and sample by algebra curricula used. It also describes the sub-sample of schools that we report on in this report at the mid-point of our 2008-2009 evaluation.

Table 1:

Population and samples of schools teaching Algebra I in 8th grade

Curriculum used to teach Algebra I in grade 8	Number of schools in 2008-2009 in CPS using this curriculum for 8 th grade algebra (%)	Number of schools in full 2008-2009 Evaluation Sample using this curriculum for 8 th grade algebra (%)	Number of schools in Data Brief Sample (a subset of full 2008-2009 evaluation sample) using this curriculum for 8 th grade algebra (%)
District-supported			
Center for Mathematics Education (CME)	52 (33%)	12 (33%)	6 (35%)
Cognitive Tutor	26 (17%)	6 (17%)	3 (18%)
Agile Mind	18 (12%)	5 (14%)	1 (6%)
Sub-Total	96 (62%)	23 (64%)	10 (59%)
	Number of schools with district supported curricula AND other full supports		
	82 (53%)	19 (53%)	8 (47%)
	Number of schools with district supported curricula with NO other district supports		
	14 (9%)	4 (11%)	2 (12%)
Not district-supported			
Glencoe	32 (21%)	8 (22%)	5 (29%)
McDougal Littell	11 (7%)	3 (8%)	1 (6%)
Others	17 (11%)	2 (6%)	1 (6%)
Sub-Total	60 (39%)	13 (36%)	7 (41%)
TOTAL	156	36	17

Our 17 observed schools studied for this report mirror the CPS population of 156 schools teaching grade 8 algebra. They are distributed across the curricula in nearly the same proportion as the population regarding the district-supported and non district-supported curricula. Our report sample has a higher percentage of schools using Glencoe and only two schools with district-supported curricula but no other district supports.

Data collection and analysis

The data used to write this report come from teachers teaching grade 8 algebra and the district algebra coaches working to support these teachers. Focusing on the 17 schools sampled, we contacted one teacher at the school teaching algebra (in all but 1 school this was the only teacher at this school teaching algebra). Between December 2008 and February 2009 we observed a full algebra lesson taught by each of these teachers and then conducted a debriefing interview with each teacher. In addition we studied the cohort meetings that algebra coaches facilitate by observing two 2-hour observations of cohort meetings with a total of seven teachers and by conducting a focus group with seven other teachers.

In all, a total of 28 unique CPS teachers from 28 schools are included in the data used for this report. We used the PRAIRIE instrument *8th Grade Algebra Classroom Observation Protocol*³ (Appendix A) to focus the data we collected during the classroom observations and debriefing interviews. Focus groups and cohort observations also were recorded using instruments PRAIRIE created (Appendix B and Appendix C, respectively). Guidelines for some of the analytic distinctions for this study are embedded within some of the data collection tools.

The quality of analysis for this study relies on the richness of the descriptive field notes taken during observations and the semi-structured interviews and focus groups that are audio-recorded and transcribed. Report authors collaborated on the data collection and analysis, thus fostering discussion and clarification around the themes emerging and meaning made of the data. An important distinction is made in the analysis by considering similarities and differences among schools: (1) with full district supports, (2) using district-supported curricula but not using other types of supports, and (3) not using district-supported curricula or other district supports.

FINDINGS

First, we first describe the supports that the CPS Algebra Initiative provides to elementary schools teaching algebra to middle grades students. We share an initial sense of the value these supports add to the algebra classes that students experience. Then, we examine the characteristics of instruction within these classes. For this initial report on 2008-2009 algebra, we focus on these descriptions and will wait until the full data are available before commenting on the relationships among the supports, the instruction, and ultimately student achievement.

Key supports

The key supports that the CPS Algebra Initiative provides to elementary schools teaching algebra to middle grades students are:

- A. **Qualified teachers.** CPS pays tuition for teachers to take university courses to gain middle grade math endorsements and to prepare them for a district qualifying exam. With a middle grades or high school math endorsement and a passing score on the exam, teachers are considered qualified by CPS and allowed to offer Algebra I to middle grades students.
- B. **District-supported curricula.** CPS has evaluated and selected three algebra curricula around which its support services are designed. For the 2008-2009 school year these curricula are CME, Cognitive Tutor, and Agile Mind.

³ This protocol is very comprehensive. Some data gathered with this instrument are not included in this report. In addition, this protocol has gone through a number of iterations as we have collected and analyzed data. Appendix A includes our latest version of this instrument.

- C. **Professional development workshops.** CPS offers a week-long workshop in August, two day-long workshops during the first semester, and three day-long workshops during the second semester for each of the district-supported curricula. These are free of charge to teachers who wish to learn more about the effective use of district-supported algebra curricula and any algebra content issues that may arise.
- D. **Coach cohort meetings.** Starting in 2008-2009, CPS employs five full-time algebra coaches to work with elementary schools. Each coach has been assigned to work with approximately 15 teachers. The cohorts are small subgroups of the 15 teachers (4-6 teachers each) who meet for two hours once a month. Cohorts are organized by coaches according to the logistics of geographic proximity and schedules.
- E. **Algebra coach visits to schools.** Teachers who use district-supported curricula and whose schools are registered with CPS to receive a full package of supports also receive coaching support. Coaches visit these teachers in their classrooms about once every two weeks.
- F. **Materials to support algebra classes.** Schools that register with CPS for a full package of supports receive a number of supplies.⁴

A. Qualified teachers. Across the district, there are 156 elementary schools approved by OHSP to offer Algebra I with teachers qualified to teach the course. Eight of these school have more than one qualified teacher teaching Algebra I in 8th grade. Three of these schools utilize two different curricula within their 8th grade algebra program. According to district records, most (66%) of these teachers are qualified to teach Algebra I to middle grade students because they have the Type 03 certification to teach math and passed the CPS qualifying exam for algebra teaching. The other 28 percent of the qualified teachers have the Type 9 certification in high school math teaching.⁵

Table 2:

Characteristics of teachers implementing Algebra I in 8th grade

Curricula	Type 03 Cert. in CPS	Type 09 Cert. in CPS	Type 03 Cert. in full 2008-2009 Evaluation Sample	Type 09 Cert. in full 2008-2009 Evaluation Sample
District-supported				
CME	39	9	8	5
Cognitive Tutor	16	10	4	2
Agile Mind	14	1	5	0
Sub-Total	69 (71%)	20 (21%)	17 (73%)	7 (27%)
Not district-supported				
Glencoe	18	13	5	3
McDougal Littell	6	5	3	0
Others	10	6	0	1
Sub-Total	34 (57%)	24 (40%)	8 (62%)	4 (38%)
TOTAL	103 (66%)	44 (28%)	25 (69%)	11 (31%)

⁴ We will provide more data on the materials support provided by the Algebra Initiative in the final evaluation report.

⁵ CPS data on teachers of Algebra I to 8th graders is incomplete for 9 qualified teachers. Their certification status is either not listed or listed as *unknown*.

The full 2008-2009 evaluation sample described in Table 2 mirrors this proportion of how teachers are qualified. However, our sample of 17 teachers for this report has a greater percentage of Type 03 teachers than are in the overall population. The sample for this report has 12 Type 03 certified teachers (71%) and five Type 09 certified teachers (29%). This compares to 66 percent of teachers in the overall population with Type 03 certification and 28 percent with Type 09 certification (with the certification status of some teachers in the population not known).

The 12 teachers with a Type 03 certification were evenly split between having taken coursework at the University of Chicago or at UIC (two of the 12 were Algebra certified via other means). (The full evaluation sample to be reported on in summer 2009 includes teachers whose coursework was at DePaul University—this interim sample did not happen to include any DePaul trained teachers.)

Of the five teachers who took courses at the University of Chicago, four had taken the Algebra series over a year's time. Teachers described the University of Chicago classes as "good" or "fantastic" in that they were well-taught, challenging, and helpful to teachers, especially those struggling with a limited background in mathematics. One teacher described it as follows: "And now, teaching it my first year, I feel like I'm well-prepared to teach it." Another teacher, who did not need to take courses because of his background in math, took one course at the University of Chicago and is glad he did because "the waiver basically just says that you've had enough math background, but don't need to take classes. But that doesn't say you've actually had background in teaching algebra or things like that."

Of the five teachers who took coursework at UIC, two took 2 Algebra classes as part of a Master's degree. Four teachers described taking these courses over a year's time. Teachers enrolled at UIC had mixed views of their instructors and the instruction they received. About half thought the classes were wonderful and the professor knowledgeable while the other half disliked the instructor's approach (e.g. lecturing style) or found the content less than compelling. One explained the content as follows: it "filled in a couple of gaps but wasn't worth my time."

B. District-supported curricula. Since the district began piloting Algebra I in 8th grade, some of the "approved" curricula for this course have changed. In the transition from 2007-2008 to 2008-2009 the district discontinued its support of Glencoe and Discovering Algebra, supporting instead the CME and Agile Mind curricula. A primary reason for this change of curricular support by the district was to facilitate greater alignment and coherence between the 8th grade programs and Algebra I as it is taught in high schools.

Of the seven teachers studied for this report who were not using a district-supported curriculum, all described the curricular materials that they were using as new (less than 4 years old). Six noted that these were one of the recommended curricula at the time of purchase. Some explained that this was the best curriculum at the time of purchase because at that time the school did not have the capability to do computer-based curricula -- the other options at that time had a computer component. Six teachers explicitly asked for professional development support. Two of the seven teachers using non-recommended curricula argued that their curriculum was still recommended by the district. Two explained that they were using the same curriculum as is used at the high school where the majority of their students attend. Most teachers seemed to feel a bit unhappy with the district for no longer providing support or suggesting that they need to change their curriculum⁶.

⁶ Program planners made a strategic choice to only provide support to the "approved" curricula. The curricula designated as "approved" have changed several times thus far as the program has developed.

The six teachers who asked for support wanted help with the following:

- Scaffolding
- Appropriate uses of materials
- Conversation with others about practice
- Content knowledge
- How to enrich the curriculum
- How to get back on pace
- How to balance teaching within the lessons.

Eight of the teachers observed were using one of the recommended curricula *and* receiving full supports (professional development, coach, cohort meetings). Five were using CME, two were using Cognitive Tutor, and one was using Agile Mind. Their views of supports they received were combined with those of the teachers in the focus group and PRAIRIE’s observations of these supports and described in the following sections on professional development, cohort meetings, and coaches’ work.

C. Professional development workshops. Professional development was organized for each of the three district-support algebra curricula. For each curriculum, OHSP provided a week long training session in the summer and 4-5 days of workshops during the school year. Through February, of the 82 teachers who receive professional support (refer to Table 1), 49 or 60 percent of the teachers were in attendance for at least 75 percent of the time and 30 (37%) teachers were in attendance at least 90 percent of the time. Table 3 shows this attendance rate by curriculum.

Table 3
Teacher Professional Development Attendance Rate by Curriculum

Curriculum	Number of Teachers Using this Curriculum	Number of Teachers who Attended at Least 75% of the Time (%)	Number of Teachers who Attended at Least 90% of the Time (%)
CME	42	30 (71%)	21 (50%)
Cognitive Tutor	22	10 (46%)	6 (27%)
Agile Mind	18	9 (50%)	3 (17%)

Of the 14 teachers we spoke with about professional development in schools with full supports, all spoke positively of what they gained by going to professional development. However, at least five spoke explicitly about how they disapproved of leaving their classrooms for the day because it disrupted their pace, not only of algebra lessons, but also in all of their math classes. One even explained that she refused to attend any professional development during the day for that very reason. A few ($n \approx 2$) spoke of wishing that within the professional development offerings there was less time on the use of curriculum and more on algebra content. However, other teachers described the need for professional development to cover the curriculum and how to use the materials.

Teachers described the following as benefits of attending the professional development sessions:

- University professors teaching about algebra content
- New users described the focus on how to use the curriculum as essential
- Previewing lessons
- Learning how to use the graphing calculator
- Sharing with colleagues (ideas, struggles, accomplishments)

D. Coach cohort meetings. Each district algebra coach coordinates several cohorts of teachers. In our two observations thus far, there were 4-6 teachers at these cohort meetings. These cohorts meet monthly for a 2-hour session after school. Attendance rates for the cohort meetings through February are illustrated by curriculum in Table 4.

Table 4
Cohort Meeting Attendance Rates by Curriculum

Curriculum	October	November	December	January	February
CME	75%	62%	62%	45%	42%
Cognitive Tutor	27%	18%	27%	36%	37%
Agile Mind	47%	35%	18%	18%	35%
Overall	56%	44%	44%	37%	39%

Program planners and coaches collaboratively developed an agenda for how cohort meetings should be run. This plan included the following order and time structure:

1. Sharing (10-15 minutes)
2. Common Theme (40-45 minutes)
3. Student Work Analysis (40-45 minutes)
4. Looking Ahead (10-15 minutes)

In addition, they developed a set of themes for most months and a pool of themes that could be drawn from for non-designated months. According to CPS documents, designations were as follows:

- October: Questioning students and select topics for February, March, and June
- November: Quarterly assessments
- December: Fostering and listening to student discourse
- January: ISAT (extended response/multiple representation)
- February: Topic 1 (see pool of themes in next paragraph)
- March: Continuation of Topic 1
- April: Quadratics
- May: Planning for next year
- June: Topic 2

For the months of February, March, and June, cohorts were to select from the following pool of themes: questioning students (this theme could be repeated if cohorts chose to do so), differentiating instruction, fostering collaborative group work, concepts beyond Algebra I, multiple representations of math, calculator work. PRAIRIE staff observed two cohort meetings (November and December). We share below short descriptions of the two cohorts from our observation field notes, and then share how teachers in our sample described cohort meetings to us.

Sampled November Meeting: There were four teachers in attendance for the majority of the meeting time. The cohort meeting started 10 minutes late and two teachers showed up within 10 minutes of the time the meeting started (up to 20 minutes after the official start time). It appeared as if quarterly assessments was the designated topic. Time was included for teachers to reflect in writing and orally about how they intended to catch up with their pacing (20 minutes). The teachers and coach also discussed the formative assessments talking through the solutions to these

and how their students did on them and whether or not these were fair questions in the context of the curriculum. If teachers felt the questions were fair they were to point out where the content showed up in the text (25 minutes).

Teachers then devised their own multiple choice questions and included distractors with the correct answer (20 minutes). After a five minute break, the teachers and coach then took a few minutes to set the next cohort meeting. Afterwards the coach gave them a problem to use with their students that they all worked on and solved, paying attention to what their students might do in trying to solve the problem (15 minutes). They spent about 10 minutes reading part of an article related to algebraic thinking and briefly talked about it. The session ended with teachers taking a few minutes to reflect on what was clarified in the session, what concerns or questions remained, and what topics they would like to address in the next meeting.

Sampled December Meeting: Three teachers were in attendance. The meeting started a half hour late as the host teacher was teaching her algebra class. With just the host teacher in attendance, the teacher and coach began talking about how things were going, what was working, and what the teacher needed help with. The biggest problem students were having was making the transition from the computer lessons to paper. Both teacher and coach strategized on how to address student abilities and needs and agreed that, in some cases, in making instructional decisions, it was necessary to break away from the curriculum because trying to incorporate standardized test preparation into the curriculum, for example, was not feasible.

Thirty minutes into this conversation, another teacher arrived (60 minutes after the official start time). The coach invited the new teacher to explain how things were going for her, asking her if it would be necessary for students to work on the same skill for three to four weeks or if she might combine some units to move on to new skills—in order to get back on pace. This was in response to the teacher’s comment about how lengthy the units were (about 40 pages) and the difficulty she was having getting through them in a timely manner. About five minutes into this sharing another teacher arrived. The coach explained that they were talking about pacing and combining units and how it might be necessary to stray from the curriculum in order to prepare students for standardized testing. For about 20 minutes teachers talked about placement versus credit. Teachers spent about five minutes talking about generating tests and the last ten minutes making a plan for their next meeting.

Based on interviews and focus group data, teachers who attended cohort meetings generally found them to be helpful as they provided opportunities for teachers to look ahead at the curriculum with “other eyes,” to read and reflect on algebra, and to see how others are teaching. Some valued the intimate setting of getting to know each other and building connections and relationships. Three of the 14 teachers in our observation and focus group sample described not attending any cohort meetings as they conflicted with after school activities like teaching after school and taking care of family.

E. Algebra coach visits to schools. Most teachers described seeing their coach once every two weeks; a few noted that they saw their coach a little less frequently--once every three weeks. Most talked about their coach as observing and providing feedback, modeling especially in areas where the teacher lacked comfort, and providing assistance in pacing and planning. One teacher explained how the coach was going to take over her class for four days while she was away from the building in order to keep the class on pace in her absence.

A few teachers described being disappointed that they did not have time to meet with their coach to talk about observations as they were interested in their insights. For example, one teacher indicated that:

We don't have a time to meet because I have class right after it . . . He comes for the class and then he leaves and, generally, we don't like debrief or anything afterwards. If they're looking at the coaching model for next year, it would probably be more helpful if they scheduled it at a time where we could have more discussion. We discuss because I tell the kids to do something, and I go ask him a question.

One teacher described his experience of having the coach help at the beginning of the year to get materials and logistics of curriculum use set up but noted that since that time the interaction has not been as useful or important as this initial orientation to the curriculum was for him. Another teacher said she did not have a chance to set up her expectations of the coach with the coach at the beginning and finds the comments from the coach as being “more directive and from the top down, and more just picking on things I didn't do right...I just think it's not her. Her coaching style doesn't match my teaching style.”

F. Materials and equipment. Twelve of the 17 teachers observed had materials available in their classrooms that included computers hooked to projectors, smartboards, and/or graphing calculators for all students. The five who did not were all at schools that were neither using district-supported curricula nor getting supports. In one school all students had laptop computers. The laptops, however, were the result of a school grant and unrelated to the Algebra Initiative. We will provide further analysis of this aspect of the Algebra Initiative in the final report.

Impressions of instruction

For this report, we analyzed field notes from observations of classroom instruction and the corresponding debriefing interviews of 17 teachers from 17 schools. We focused on several facets of instruction that previous studies in Chicago's algebra classrooms and in national research suggest are critical in relationship to student success in learning. These facets of the classroom lessons observed include if and how:

- teachers and/or students used manipulatives
- teachers organized students to work on collaborative small group projects
- teachers shaped classroom tasks so that the level of intellectual demand is higher than memorizing or performing procedures
- classes were “on pace” in terms of covering content

For this study we looked to see if there were similarities and differences in instruction across three types of schools: (1) those with full district supports, (2) those using district-supported curricula but not using other types of supports, and (3) those not using district-supported curricula or other district supports. When there were differences across the three types of schools, we highlight these. However, we note that this is an early report and does not yet include the full sample of classes we will observe by the end of 2008-2009.

Using manipulatives. In Table 5 we summarize students' use of manipulatives by type of classroom. Teachers working with district-supported curricula appear to be using manipulatives more regularly than teachers not working with district-supported curricula. Of the twelve teachers whom we knew had materials available, eight were utilizing manipulatives for their algebra lesson on the days we observed.

Table 5
Student Use of Manipulatives

Type of Classroom	No. of Classrooms Using Manipulatives (%)	No. of Classrooms not Using Manipulatives (%)
CPS recommended curriculum with supports (n = 8)	4 (50%)	4 (50%)
CPS recommended curriculum with no supports (n = 2)	1 (50%)	1 (50%)
Non-CPS recommended curriculum with no supports (n = 7)	3 (43%)	4 (57%)

The types of ways students used manipulatives varied from class to class. Student use of manipulatives mainly involved the use of graphing calculators, although we did observe students using individual white boards and in one classroom they effectively used graph paper and spaghetti to understand linear equations. Some teachers allowed students to use calculators as an option during the classroom period. In other classes, there were specific activities requiring calculators. For example, in one class after students drew a parabola on graph paper, the teacher led them through graphing using the calculator. In a few of the classes the teacher walked students through step-by-step in using the graphing calculator.

Typically, students would graph a problem by hand, for example, $y = 2x^2 - 4x - 5$. Then the teacher would tell them how to graph the equation on their calculators. For this particular equation, the teacher told his students to enter the equation they just graphed. If they were having trouble they could either raise their hand or ask one of their classmates. Then he told them to press the *graph* button and asked, "What do you see there?" A student replied that it was what they had just graphed. The teacher told the students to press the *trace* button and asked them again what they saw. No students responded so the teacher answered, saying it was all of the x and y values for the graph.

One teacher who did not use manipulatives explained why:

When you try to come out with manipulatives or things to work with, they're very standoffish. They feel that they're treated like babies. They get frustrated because they feel like, why do we go through this whole thing when you could have just said that in the beginning, and we would have known what you were talking about... We do some things just based on discovery... but it has to be very brief and they have to be able to just kind of get the point immediately.

The teacher later added that he would welcome some ideas from professional development to enrich his ideas of how to teach because "a lot in algebra is pretty direct and straight forward. It's a little difficult sometimes to come up with some type of manipulative based lesson."

Collaborative group projects. When asked by interviewers if they had students work in groups, most of the 17 teachers in the sample said that they often encouraged students to talk together

about solving problems. However, we observed many of them doing this in an informal fashion and not organizing specific group tasks for collaboration. We define a collaborative learning group as comprised of two to seven students working together as a subset of the whole class on a learning activity. This group of students would be talking together and working to solve a common problem together, not just sitting near each other and working on individual academic tasks. Seven of the 17 teachers had students work in collaborative groups during our observations. Most of these (n=5) were from the group of 8 teachers using district-supported curricula. Teachers working with district-supported curricula and receiving district support appear to be using collaborative groups more regularly than other teachers.

In the observed lessons, the use of collaborative groups varied in terms on how much of class time they required. Some used short five-minute group exercises and others did group work for 75% of the class period. The average amount of group work during the lesson did not differ in statistically significant ways across the three types of schools studied.

Intellectual demand. The pedagogical processes teachers use with their students (such as collaborative groups and use of manipulatives) and the content topics they cover (pacing) only make sense in the context of the level of intellectual challenge in the tasks that students are expected to complete. We coded observations of tasks in which students engaged during classroom lessons according to a framework of Expectations of Students in Mathematics and Levels of Cognitive Demand developed by researchers at the University of Wisconsin and the Council of Chief State School Officers (Blank, 2009). This frame delineates that students during class may be asked to engage with knowledge across a variety of domains in mathematics:

	<u>Knowledge domains</u>
<ul style="list-style-type: none"> • Memorize / definitions/ formulas • Perform procedures 	Lower demand
<ul style="list-style-type: none"> • Demonstrate understanding of mathematical ideas • Conjecture/generalize/prove • Solve non-routine problems/ make connections. 	Higher demand

In an initial analysis of 17 teachers, about half (n=8) facilitated lessons in which students were engaged in lower demand knowledge domains--memorizing information and performing procedures—and did not engage in the other types of actions. The other half (n=9) of the teachers, while also typically including some memorization and recall and some procedural problem solving in their lessons, pushed their students to demonstrate a deeper understanding of math through higher demand knowledge domains. These teachers set up lessons so that students had opportunities to express how and why they solved problems as they did. Their students also were given activities requiring them to explain relationships between concepts and utilize multiple representations of mathematical ideas.

As a result, we determined how lessons across the different types of schools engaged students in the different levels of knowledge domains. In Table 6 we summarize findings comparing those lessons as they cover lower demands or also cover higher demands of mathematical knowledge. It shows that while the sample sizes are small and we can only look at these data as suggestive, classrooms with CPS curriculum and supports were more likely to engage students in higher levels of knowledge in math.

Table 6
Students Engagement in Demanding Math Knowledge Domains

Type of Classroom	No. of Classrooms at Lower Demand (%)	No. of Classrooms at Higher Demand (%)
CPS recommended curriculum with supports (n = 8)	1 (13%)	7 (88%)
CPS recommended curriculum with no supports (n = 2)	1 (50%)	1 (50%)
Non-CPS recommended curriculum with no supports (n = 7)	5 (71%)	2 (29%)

Pacing. Covering the algebra content that students need to learn for their exit exam in May requires tight pacing of lessons taught. Of the 17 teachers, only three were actually on pace or ahead of schedule in terms of their algebra content coverage. These teachers each used different curricula and only one used a district-supported curriculum. The majority of teachers explained that they were anywhere from two days to three weeks behind where they were supposed to be—either according to the CPS-provided pacing guide or, if they were using a non-CPS-supported curriculum, according to their own sense of the pacing. The three teachers who seemed to be furthest behind by two or three weeks were all veteran algebra teachers and all used the Glencoe curriculum. Two teachers candidly explained that they did not know where they were according to what pace they should be keeping.

In a 2007-2008 study of CPS middle grades algebra courses, we found a positive relationship between students in classes that were within two weeks of being on pace. Table 7 summarizes by type of school the extent to which teachers were on pace within this two-week range based on their self reports. A greater proportion of teachers using a CPS recommended curriculum and receiving district supports reported being on pace.

Table 7
Teachers on Pace Within 2 Weeks of Pacing Guidelines by Curricular Category

Type of Classroom	No. of Teachers On Pace (%)	No. of Teachers Off Pace (%)	No. of Teachers Who Don't Know Pace (%)
CPS recommended curriculum with supports (n = 8)	7 (88%)	1 (13%)	0 (0%)
CPS recommended curriculum with no supports (n = 2)	1 (50%)	0 (0%)	1 (50%)
Non-CPS recommended curriculum with no supports (n = 7)	3 (43%)	3 (43%)	1 (14%)

Reasons attributed to not being current with their pacing included:

- Assemblies, field trips, holiday schedules, standardized test preparation time, and other school-related activities
- First year using a new curriculum and not being very prepared (i.e., receiving materials late and trying to align supplemental materials on a trial and error basis)
- Not wanting to move too fast for slower students

Generally, these teachers did not know how the district could help them with their pacing other than being given more clock time to teach the course.

Student engagement. Teachers pointed out that students in each of the 17 courses we examined were hand-picked by them personally and were considered to be strong and motivated math students. All but one of the lessons we observed found students to be highly engaged in listening to the teacher and each other and working on the tasks they were supposed to.

In summary, the major findings from this analysis have to do with teacher professional development and rigor of instruction. For example, the majority of teachers not receiving professional development wished that they were, and those that did participate in it found it beneficial for a variety of reasons. Teachers who attended cohort meetings found those to be beneficial as well. We found that teachers working with district-supported curricula seemed more likely to have their students work with manipulatives. Also, teachers using a district-supported curriculum and receiving district supports tended to work in collaborative learning groups more regularly, and were more likely to have students engage in deeper conversations about mathematics. Further, teachers who taught from a district-supported algebra curriculum and received other district supports tended to be within two weeks of pacing guidelines. Teachers who did not use a recommended curriculum or did not receive the supports tended to be further off pace.

REFLECTION QUESTIONS

Qualified teachers:

- Is a refresher course in mathematical content knowledge for algebra or beyond available for teachers currently approved to teach algebra in grade 8? If not, is there a need for this?

CMSI-Supported curricula:

- What has CPS communicated to schools that are using a previously approved curriculum that is no longer approved and how has the message been communicated (to whom)?
- A number of schools were “early” implementers of 8th grade Algebra; however, now the curriculum used in these schools are no longer “approved.” What might the district or OMS do to make a change in curriculum palatable to these schools that are frustrated by changes in which curricula OMS will support?

Professional development workshops:

- What options are feasible for holding professional development outside of the school day or providing qualified substitutes for teachers such that teaching continues in their absence?
- What kinds of supports could be provided for teachers not working with district-supported curricula? Can support be provided to these teachers in terms of assistance in moving from a non-supported curriculum to a supported one? Should support be provided to these teachers?

Cohort meetings:

- What support are algebra coaches receiving to help them to fulfill the purpose of cohort meetings?
- How can program planners be assured that the structure of the meetings as agreed upon by planners and coaches is followed?

Algebra coach visits:

- How can visits be scheduled so that each teacher has the benefit of going through the coaching cycle, specifically the pre and post-conferences? Might that involve visiting a teacher during a prep period to ensure that the one-on-one dialogue occurs?
- What supports might be needed to make this happen on a more regular basis? (Might it be helpful to institute a cadre substitute program similar to that used in the C4MGP?)

Using manipulatives:

- What are the program planners’ expectations about the use of manipulatives/tools in the 8th grade algebra classroom?

Collaborative group projects:

- What support have teachers received in terms of how to form and use collaborative groups for instruction in 8th grade algebra?
- What are the expectations for their use? (What amount of class time and for what purposes should collaborative groups be used?)

Intellectual demand:

- What support have teachers received in terms of determining what kind of work demands higher intellectual challenge? Has training focused on teacher questioning strategies that increase the demand? What are the expectations?

Pacing:

- With respect to pacing, how are the CPS Chief Educational Officer and leadership teams of OMS, OHSP, and Area offices working together to help schools minimize interruptions to the school day (i.e., number of assemblies, field trips allowed during the year, including start of day activities within the first period class)?
- How do professional development workshops, coach visits, and cohort meetings prepare teachers to utilize the curriculum effectively for all students?

REFERENCES

Blank, Rolf K. (February 6, 2009) Surveys of Enacted Curriculum: Tools for Aligning Instruction, Standards and Assessments. Presented at the Chicago Symposium: Excellence in Mathematics and Science Teaching. Chicago IL.

APPENDICES

Appendix A

8th Grade Algebra Classroom Observation Protocol

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:

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.)

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.

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?

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?

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?

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?

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?

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?

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 B

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 C

FILE CODE –

PRAIRIE Evaluation Team
8th Grade Algebra Coach’s Cohort Meeting 2008-2009

Evaluation project:

Location of visit: Program/Activity:

Date/time/duration of visit:

Observer recording notes:

Date notes written:

Individuals present:

Description of site:

List of materials collected:

Description of activities with time intervals:

(This section should include detailed description of interactions and dialogue during observation, with time indicated at key activity intervals (for instance, as move to next point on agenda).

Analytic themes:

(This section should include evidence about activities, interactions, comments that will contribute to evaluating the program. The following prompts will help you relate your observations back program goals and evaluative questions.)

1. Evidence of quality of the learning environment, and of learning experiences that promote development of a professional learning community, for instance:

- time for reflection on practice --alone and together; written and verbal
- time for applying/using new ideas during the seminar/workshop
- active participation through attendance, discussion, writing, activities
- Ideas have relevance to participants’ work
- Participants move from new ideas to constructing original solutions to problems
- Participants communicate their understanding and engagement (to each other)
- Participants’ prior ideas/assumptions are reflected upon in light of new challenging ideas

- Participants are engaged as sources of knowledge and experience
- Participants receive constructive feedback on their work

2. Evidence of acquisition of new content or pedagogical knowledge:

- Participants engage with instructor(s) around aspects of good instruction in mathematics and science
- Participants engage with instructor(s) in processes by which good instruction in math/science can be promoted in Chicago Public Schools

3. Evidence of learning experiences that promote leadership development

- Participants reflect upon/reconsider their roles as teacher leaders and/or as classroom teachers
- Participants acquire new knowledge/understanding about their ability as teacher leaders to support math and science inquiry in schools and classroom

4. Other analytic comments:

(i.e. additional thoughts in which you relate your observations to the immediate scope of the program objectives or evaluation questions)

Interpretive comments:

(i.e. additional thoughts in which you relate your observations to broader issues and contexts beyond the immediate scope of the program objectives)

Self-reflective observations:

(i.e. ways in which the event or activity observed affected you, how you responded to aspects of the activity that might influence your observations, etc.)

Follow-up needed:

(In this section identify any additional information that needs to be gathered, gaps filled, etc.)