CMSI University-based Programs:
Quality, Relevance and Support Toward Endorsement
Interim Report

A Data Brief for the CPS Office of Mathematics and Science
Prepared by the PRAIRIE Group, UIC College of Education

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This is a data brief in a series of external evaluation studies being conducted over the 2007-08 school year by the PRAIRIE group in order to examine the systemic educational reform underway as part of the Chicago Math and Science Initiative (CMSI) supported by the CPS Office of Math and Science (OMS). The aim of these studies is to provide OMS and other key stakeholders with a deep, nuanced understanding of the processes and outcomes of the CMSI. These studies build upon the PRAIRIE group's external evaluation of various facets of the CMSI from 2003 to 2006.[2] As with past evaluations, the 2007-08 evaluation studies are based on rigorous data collection and analysis that are conducted in such a way as to provide timely and useful feedback to the audiences including the leadership team of the Office of Math and Science (OMS), the Chief Educational Officer of CPS, and the CPS Department of Program Evaluation, as decisions are made about the allocation of resources in the effort to continually improve math and science teaching and learning.

This data brief addresses the following key questions:

1. What are the qualities of CMSI university programs and courses being implemented?
2. What relevance do program and courses have to teachers' work?
3. How do these courses contribute to teachers' achievement of endorsement to teach middle grades math and science classes?

This data brief builds on a November 30, 2007 data brief that addressed the goals for the courses and is based on analysis of eight interviews and seven observations, representing programs at three universities in both math and science courses. Of the courses, all seven lead to endorsement, two were part of the CPS Algebra Initiative and two were also part of a Master's degree program. These data are part of an ongoing formative evaluation, and

[1] Authors produced this report collaboratively. They share responsibility for its contents. The conclusions drawn in this report reflect the viewpoints of the authors. While there are many potential viewpoints, these reflect a systematic analysis of data by external evaluators. The hope is that these findings can facilitate improvement of this and related programs through open discussion and consideration of data-driven understandings. For further information, please contact Stacy Wenzel at swenzel@uic.edu or (312) 413-9221.

[2] The numerous reports of findings from this external evaluation are available on the CPS Department of Program Evaluation websites at http://research.cps.k12.il.us/cps/accountweb/Evaluation/View_Evaluation_Reports /View_Evaluations_by_Date/

additional interviews and observations, which will be incorporated into subsequent briefs and reports, will take place throughout the remainder of the year. Previous evaluation reports on university-based programs were also examined to better understand the context of these programs.

Findings

1. Quality of Programs: *What are the qualities of CMSI university programs and courses being implemented?*

Instructors' Discussion of Success

Most (7 of 8) interviewed university course instructors talked about success in terms of teachers attending class, engaging in class, and getting a better idea of how math and science work. Thus, these instructors tended to frame success as it pertained to the experiences of individual teachers. Their view did not focus on teachers' progression toward endorsement or certification, or the program as a whole, although Algebra Initiative instructors did speak of teachers passing the certification exam and students being able to place out of 9th grade algebra as measures of program success.

Three of the interviewed instructors did not discuss the concrete ways in which they measured teacher learning/success. In these courses, teachers were not awarded grades but were instead evaluated on a pass/fail basis. Instructors relied on informal observation, attendance, and homework completion to determine whether a teacher would pass or fail.

The other five instructors indicated that they used one or more of the following assessment techniques to explore teacher learning and gauge success:

- Exams
- Rigorous in-class or homework assignments
- Group research projects
- Lab reports

Teacher Engagement

Most of the instructors believed their teachers to be highly engaged during classes. Of the seven classes observed, engagement was indeed present, but appeared in different ways. In three, teachers answered questions posed by the instructor, asked questions of the instructor, and in some cases took notes; these courses were relatively instructor-centered. In the other classes, engagement took the form of group work, lab assignments, and less instructor-led class time.

Rigor of Math or Science Content

Instructors indicated they stressed deep conceptual understanding arrived at independently, rather than "cranking out a formula." They were after the "big ideas" of how math and science work, suggesting that such preparation would infuse whatever work teachers did,

regardless of specific subject matter. Sample comments were: “The point is to not have teachers teaching at their frontier of knowledge,” and “Teachers are better prepared, so students will do better.”

Five of the eight instructors did not consider their courses to be equal in rigor to typical college level math or science courses, although they did see them as challenging. They also indicated that they spent a good deal of time reviewing basic math/science concepts in order to bring teachers’ subject knowledge to the level required to learn the course content. As one stated, “The content of most of what we do… is not up to what I teach [in] my undergraduate courses.” Observations of these classrooms supported the instructors’ self-reports of the level of rigor. Both math and science courses were included in these five courses. Three of these five were the above mentioned courses where instructors did not measure teacher learning in concrete ways.

The five courses not considered to be as rigorous as typical college courses were taught by both university faculty and instructors who previously taught or currently teach in CPS (“practitioners”). They varied in terms of the instructor-centeredness of the course. Three observed classes relied heavily on instructor-led class time, while the remaining classes employed more activity and group-based class time. These courses also shared the following characteristics:

- Time spent reviewing basic content topics
- Teacher assessment based on homework completion and/or attendance

Of the three courses considered by interviewed faculty to be college level, all were part of a sequence leading to an endorsement, and two were also part of a sequence leading to a Master’s degree. Two were taught by university faculty, and one by a practitioner. Based on observations and interviews, the courses deemed college-level shared the following characteristics:

- A small group (fewer than 20)
- Classroom amenable to group work (e.g., tables rather than desks in rows)
- Group and/or lab work
- Challenging assignments and assessments, including written exams

Focus on Pedagogy

There were differences in approach between university faculty and practitioners, in that practitioners focused more explicitly on pedagogy. Faculty members seemed to consider the teachers themselves the experts on pedagogy, while their own expertise lay more in content areas. As one indicated, “I want to challenge them as adult learners, to help teachers understand the unifying concept of science, not to train them to use a curriculum.”

Three of the seven classes observed did directly address pedagogy in some way: the methods course on teaching adolescent students; and, to a lesser degree, an algebra course. Both of these were taught by practitioners. The third, part of a master’s degree sequence, was taught

by a faculty member who indicated he "highlights" pedagogy. In these courses instructors gave specific examples of types of problems and strategies that could be used in participants' classrooms, and directed them to resources and materials that could be useful to their students.

Each faculty member interviewed referred to "modeling" pedagogy, rather than offering direction instruction in methods or curriculum. Five underscored their goal of helping participants understand the "Why" (conceptual understanding) rather than the "How" (computation).

In all observed classes, faculty members devoted a relatively small proportion of class time to lecture. In four, they had participants working primarily in groups. Even when room configurations were not conducive to small group work, instructors constantly interacted with participants, questioning them about how they solved problems, why they chose certain strategies, what other strategies they might have used, etc. All asked participants to show how they arrived at answers, whether working out the problem on the chalkboard or overhead, or explaining to the whole class.

Both groups of instructors (faculty and practitioners) drew on participants' prior knowledge, and referenced multiple learning access points and strategies. In two different classes, for example, instructors encouraged participants to come up with ways to solve a problem different from the ones they had demonstrated.

Both groups also had occasion to refer to making choices about grade-appropriate materials. One instructor, after explaining a complex concept, asked if participants would use this with 5^{th} graders; they said they would not. In another class, participants commented on a specific curriculum, saying it was too hard for the designated grade level, and shared ways they modified lessons.

Regarding the way participants themselves viewed the stress on content, teacher talk in one class indicated the high value they placed on a science course over an "education" course. Participants were enthusiastic as, at each step of an experiment for which they themselves had constructed the instruments, they called out findings, questioned each other, came up with ideas on how to measure in different ways to back up their conclusions, etc. and reiterated how much they enjoyed the opportunity to learn like this – compared to what they described as much less interesting experiences in "education" courses.

<u>Focus on Student Learning</u>

The ways elementary school students learn was not explicitly addressed, except for the methods course which, by virtue of its subject matter, focused almost exclusively on how to teach adolescent students. However, in several observed classes, participants appeared to be in the role of students, as they struggled with challenging problems and had to explain their answers orally and in writing. "Because of their own difficulties with the problem," one faculty member indicated, "they will be more aware of students, and use more examples to get the point across."

Two faculty members referred to common misconceptions among students (for example, "multiplying the tops and bottoms of fractions"), and ways participants could be prepared to address them. "These are the kinds of mistakes you can expect from students," one said in class. Another demonstrated how arithmetic errors he himself made in working out a problem could be used to teach larger concepts to participants' students.

With regard to targeted instruction for English Language Learners or students with disabilities, interviews indicated that instructors knew very little about the relationship between their university programs and serving the needs of teachers who work with students of different backgrounds. They were aware that some participants taught bilingual and special needs students, but none could give numbers, other than in general terms of "a lot" in neighborhood schools.

- One practitioner cited the usefulness of contextual material, explicit vocabulary instruction, hands-on activities and manipulatives, and multiple strategies for teaching students with disabilities.
- A second practitioner indicated that she had several special education teachers in her class who had developed an interest in science. However, they did not tend to teach science to their special education students.
- One faculty member mentioned that special education teachers tended to have language arts or childhood development backgrounds and therefore needed more explicit math education.

Use of CMSI-Supported Curricula

None of the instructors constructed their courses around CMSI-supported curricula materials or textbooks. One practitioner mentioned there was no textbook for her course, so there was "not really a bridge to CMSI curriculum." A faculty member spoke of a "curriculum-free mode," emphasizing, as most did, the content focus of the course. However, they all were willing to address questions regarding the curricula when teachers raised them in class, and did so regularly. One practitioner included examples from Math Trailblazers and Connected Math in the observed class session.

All courses did reflect underlying CMSI philosophy as instructors modeled an inquiry-based approach targeting deep conceptual understanding, and using one or more of the following elements: multiple problem-solving strategies, written explanations and reflections, small-group work, and presentation.

There were instances of specific CMSI text content being openly questioned. Two math instructors said, "we spend as much time telling them what's wrong [with the curricula] as what's right." A third felt the problems were too short to allow for true inquiry. These faculty members focused largely on questioning axiomatic approaches to math, encouraging a critical approach to math precepts that are often taken for granted. Teacher talk in one course compared the relative merits of different curricula, with a negative comment about the ease of use of a particular teachers' guide.

All instructors felt the learning gained in the university courses would contribute to better classroom instruction, regardless of curriculum choice.

2. Relevance of Programs: ***What relevance do program and courses have to teachers' work?***

We found that the primary focus of most of the CMSI-supported university courses was on promoting teachers' knowledge of math and science concepts to a level beyond what they are currently teaching their students (even if not always to what could be regarded as "college level" understanding). Although only a few instructors addressed pedagogy explicitly, there was evidence that participants were learning strategies for teaching math and science as modeled in these courses.

The data on which we drew for our analysis of the extent to which teachers' learning in university courses was relevant to their current work in CPS did not include direct observation of their K-12 classrooms or teacher interviews about their practices. Teacher survey data will be collected as part of the ongoing evaluation. However, we did gain some sense of relevance from the view of instructors and the teacher talk in observed courses.

Interviews yielded mixed responses. One practitioner noted that some participants seemed to expect a methods course, rather than one focusing on content and conceptual understanding; and that in a few instances participants just wanted help with passing the algebra test. In class, however, this instructor explicitly referred to work participants' students would be expected to do, and explained the connection between those skills and the problem-solving participants were engaged in. A faculty member remarked, "I know for a fact they are adopting activities that we are doing in their classroom. They always write about that in their reports." Another designed a take-home exam requiring participants to show how certain concepts could be taught in their classrooms. A final project for a degree program required design of a whole-school math improvement initiative**.** However, only the methods course instructor referred to specific assignments based in classrooms, with participants debriefing with each other after working with their students.

Teacher talk in several observed classes did indicate participants were applying some of the ideas learned in their courses to their own classrooms: "I tried that," "I'm going to use that."

Overall, instructors emphasized the value of content and seemed to expect it to translate into improved teaching practice. Several pointed to effects of teachers with more advanced knowledge teaching lower grades and giving students a sense of how what they were learning would connect to concepts in upper grades; and of middle school teachers whose instruction would look toward learning at the high school level.

3. Contribution to Endorsement: *How do these courses contribute to teachers' achievement of endorsement to teach middle grades math and science classes?*

Influence on Status of Completing Endorsement

Instructors had little knowledge of teachers' status in either pursuing or attaining endorsement, so they could not speak specifically to how their course or program supported endorsement completion.

Several were aware that endorsement can have an impact in the form of higher pay, pursuing a high school teaching credential, or more mobility in choice of school. There were general references to participants moving on to work as coaches, specialists, or team leaders. Four instructors expressed concern that teachers who received their endorsement were not being placed in positions in which they could put their expertise to use, or would leave the school or district that had helped them earn the endorsement. One felt pursuing the endorsement "shows willingness to go outside their own box to help students get farther along."

Self-Selected Versus Mandated Participants

Information about teachers' motivation in enrolling in their university's endorsement program and courses – specifically, whether they self-selected or were mandated by participation in the Cluster 4 Middle Grade Project or by their school administrators – varied broadly among university instructors. Three had no information. Three believed all their students were there by choice. Two, with more direct experience in CPS, were familiar with the issue of voluntary or required participation, and indicated they had a mix of participants. Algebra instructors spoke of NCLB pressures, and teachers' need to secure tenure.

Regarding participant success, instructors tended to group students by levels or preparation and ability, rather than whether they elected to or were required to take the courses.

Instructor Encouragement of Endorsement Completion

Instructors were not focused on or necessarily knowledgeable about the progress participants were making toward endorsement; some were unclear on endorsement requirements or CMSI, District, and/or ISBE support strategies. We did not find evidence of specific work by instructors to encourage endorsement completion. However, instructors were observed to be deeply engaged in efforts to support teachers by helping them learn content material so to be able to apply it to their teaching. In addition, several instructors reported offering review sessions and other academic help outside of class.

The most commonly mentioned support that teachers needed, according to instructors, was peer interaction -- ongoing communication and networking with other teachers that provides a sense of community and sharing of ideas for instruction. This was particularly true in those programs that served cohorts of teachers. A professional learning community was the one support most instructors felt should be stressed. Instructors actively promoted collaboration

(through online discussion, discussions outside of class, a group from a single school attending the same courses) and felt it made teachers more successful.

Challenges to Achieving Endorsement

All of the instructors referred to the broad spectrum of the teachers' backgrounds and abilities. They saw this as an impediment to teachers' success in their class and as related to their progress toward achieving endorsements. Some suggested ways to address their concern about teachers with poor backgrounds. While, as we noted previously, many instructors worked to provide extra help to these teachers, some also raised the possibility that there be a screening process to eliminate teachers from the program if their low content knowledge made it extremely unlikely they could complete the required work. Other instructors suggested that there could be CMSI-sponsored remediation supports to help those teachers with lower skills but high motivation.

Instructors also mentioned other challenges that teachers faced. Three suggested participants might be more motivated if they had an assurance, upon completion, of being placed in a position in which they could use their expertise. Others acknowledged the teachers' competing time commitments due to family or other professional responsibilities.

Three instructors were also concerned about the conflicting/overlapping authority of different units with CPS, or between CPS and ISBE when it came to approving who achieved endorsements or credentials to teach grade 8 algebra. Two spoke of the need for clear information about course requirements, sequence, and availability, as well as the possibility of more site-based options. One practitioner, for example, noted the need to "lay out a big plan of where they need to go… [my university] doesn't really have, unless you're in the master's program, a comprehensive package for teachers to follow. When that happens… the completion rate is higher… as opposed to piecemealing it here or there." It was suggested that a cohort structure might address this challenge.

Reflection Questions

1. University instructors use differing strategies for assessing teachers' learning in measured ways on exams/projects or through more focus on attendance and participation. Some instructors consider their courses at "college level" and others do not. How do these findings fit within the Office of Math and Science's expectations for these university courses? If OMS views differ from some of the university instructors, how might the Initiative foster productive dialogue around these differences?
    - Would courses be more effective if a more rigorous attendance and punctuality policy were in place and was consistent across universities? What are the pros and cons to such a policy?

2. Should pedagogy and student learning be more explicitly addressed in all courses? Through modeling of pedagogical practices and placing teachers into situations where they are learners of challenging math and science, all instructors were potentially offering

teachers lessons on pedagogy and learning. However, it is not clear yet how much of this teachers will find relevant and useable.

- In what ways can courses integrate more information on pedagogy and student learning? Using CPS co-instructors partnering with university faculty may be one option under consideration. Are there other ways that university math and science faculty alone can do this?
- Are there ways to scaffold what is modeled so that it is more accessible/easily transferred to classroom practice?

3. Future evaluation work will learn directly from teachers about if and how they find these university courses relevant to their classroom practices. However, are there ways of assessing teachers' application of course lessons that can be incorporated into the work of university instructors planning these courses each year, or as part of the OMS management of tuition for these university courses?

4. What additional supports can OMS and the District provide to increase endorsement completion rates, especially given that some teachers are weak in some of the background math and science knowledge needed to succeed in these courses? Do teachers in different university programs complete endorsements at rates different than teachers in others? If so, can this offer clues as to how to better support teachers?