Evaluation Report:
CMSI/CUSP University-based Teacher Professional Development Courses

A report to the
Chicago Public Schools
Office of Mathematics and Science

August 31, 2004

By the
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The conclusions drawn in this report reflect the viewpoint of the authors. While there are many potential viewpoints with respect to a given program, one way to facilitate improvement is through open discussions of such differing opinions within the context of data-based reporting.

Abstract

In this report, we focus on the Chicago Public Schools (CPS) initiative of university-based professional development courses for CPS K-8 teachers of math and science. This initiative has been pursued beginning in 2000 with the National Science Foundation funded Chicago Urban Systemic Program through its present reconfiguration as one aspect of the Chicago Math Science Initiative. In this report, we review this project from when it began in fall 2001 through to the summer 2004. This evaluation finds that universities have responded quickly to the 2003 CPS invitation to move from offering single courses to creating teacher professional development programs and that the courses offered provide teachers with experiences relevant to their needs to improve math and science teaching with their K-8 students. We find some tensions as universities try to weigh the benefits they gain from these courses with the uncertainty of enrollments and tuition subsidies. In conclusion, we raise issues for future consideration as CPS and university partners continue this and similar efforts.

Executive Summary

The Chicago Public Schools (CPS) university-based professional development program for K-8 teachers of math and science could be described as going through two primary periods and one interim period of action. The first period was the National Science Foundation Chicago Urban Systemic Program (CUSP) that funded development and piloting of university math and science courses for teachers beginning January 2000 and ending in summer 2002. An interim period, fall 2002 through summer 2003, followed the prototype piloting, but preceded the launch of CMSI university programs. The second and current period is the Chicago Math and Science Initiative (CMSI) strategy of approving university math and science credentialing programs for teachers beginning Fall 2003. Whereas earlier evaluation reports cover the first and interim period of activity, this document focuses on the interim and CMSI efforts.

Responding to a spring 2003 invitation to create CMSI university-based teacher professional development programs in math and science for CPS teachers, 7 universities now have CPS OMS approval for 13 programs for K-5 certification and Middle Grades endorsements. There are also approved Algebra Initiative programs at 3 universities. Middle Grades math endorsement programs are the most prevalent with 7 approved programs. Many of the faculty and universities that developed these programs were also involved in the earlier piloting of these CUSP math and science courses.

The offering of CMSI university-based teacher professional development programs in math and science requires a great deal of support both from universities and from OMS. On the university side, there were 6 university science and 17 university math faculty members who taught at least one of the approximately 50 CUSP/CMSI courses offered to date. While the development and teacher of courses and program fell on these individuals, so too did the work of negotiating university support to dedicate regular faculty to teach the courses, facilities to be used for the courses, and sometimes tuition reduction for these courses. OMS staff members carried out the administrative support for these courses/programs with the major role of recruiting teachers for the courses and paying subsidies for their tuition. There were some concerns from university faculty about the need for improved recruitment and a longer view of the partnership between the universities and CPS.

The courses aimed to have teachers learn about math and science content while at the same time deepening their understanding of pedagogical strategies and assessing student understanding. Course instructors varied in how they described the level of math and science covered in their courses and many noted that teachers found the content challenging. Some faculty members described the math and science content as below “college-level”. However, some faculty noted that they had teachers learn material that on the surface may seemed “elementary,” but that they had them learn it at the level of “profound understanding” making the course graduate level work.

Faculty members teaching the courses were using various pedagogical strategies in the courses--asking teachers to focus on general topics about math and science education, to learn concepts in math and science and focus on themselves as learners, and also to focus directly on their own instructional practices with their K-8 classrooms. The teachers in these courses reported that they took what they learned in the course and used it with their own students. The teachers also reported that they found the courses relevant to their work in schools.

Further attention around the offering of these courses is needed in regard to understanding the impact of these courses on producing more teachers endorsed as “highly qualified” in terms of NCLB. Further study of how these courses ultimately influence the level of instruction of participating teachers and the learning of their students is also needed.

Introduction

The Chicago Public Schools (CPS) university-based professional development program for K-8 teachers of math and science could be described as going through two primary periods and one interim period of action. The first period was the National Science Foundation Chicago Urban Systemic Program (CUSP) that funded development and piloting of courses beginning January 2000 and ending in summer 2002. An interim period fall 2002 through summer 2003 followed the prototype piloting, but preceded the launch of CMSI university programs. The second and current period is the new Chicago Math and Science Initiative (CMSI) strategy of approving university programs for teachers announced beginning Fall 2003. Whereas earlier evaluation reports cover the first and interim period of activity, this document picks up and focuses on the CMSI efforts. For more detailed information on the earlier CUSP funded development and piloting of courses and the interim period see reports by Gomez and Reiser (2002) and by Wenzel et al., (2003).

In September 2002, CPS created their Office of Mathematics and Science (OMS) in order to provide a central home for the districts' many activities in math and science education—at the time distributed among several different CPS departments. By February 2003, OMS staff and stakeholders had designed and announced a comprehensive reform initiative—the CMSI. One aspect of the CMSI was the continued use of university-based teacher professional development.

On March 7, 2003 a city-wide "University Partners" meeting was held at Loyola University Water Tower Campus. This meeting, hosted by OMS Chief Officer Marty Gartzman, had the agenda of providing an overview of the CMSI and then discussing plans for supporting CMSI university courses. The need for these university courses was framed by the No Child Left Behind requirements that teachers be "highly qualified" in their areas of teaching—and the reality that many teachers in Chicago needed to enhance their credentials in math and science. The facilitation of CPS-university partnerships was put in the context that 75% of current CPS teachers have degrees from one of 11 local universities. It was also noted on one of OMS's powerpoint slides that:

> Partnerships with CPS have too-often been "high maintenance" and unreliable.
>
> Strong partnerships must acknowledge and address needs of universities as well as CPS.

OMS talked about their desire to address these issues and to set up administrative structures to work well with universities.

Many questions were asked by university representatives and then answered by OMS. For example, a participant from one of the colleges asked "How close should courses be to CUSP prototype courses?" OMS encouraged faculty to look at the prototypes and ask Dorothy Wilson Davis, the OMS staff member coordinating the university courses, who can provide them access to these materials. Another participant asked if universities could work together on programs? OMS said they are open to ideas but believed the best programs needed to have cohorts of teachers moving through courses together. OMS also noted that courses needed to be offered at the graduate level and be taught by regular faculty – not adjunct faculty.

The March 7th meeting was attended by 67 representatives from 14 colleges/ universities as follows:

University/ College	Attendees	University/ College	Attendees
Univ of Illinois at Chicago	10	Northwestern Univ	3
DePaul	7	Columbia College	2
Chicago State Univ	6	Univ of Chicago	2
National Louis Univ	5	Illinois Instit for Technology	2
Northeastern Illinois Univ	5	Saint Xavier Univ	2
Loyola Univ	5	Illinois State Univ	2
Roosevelt Univ	5	Northern Illinois Univ	1

By May 1, 2003, OMS sent a letter to its Partners to explain that the CMSI hoped to "improve and expand the continuing-education opportunities for Chicago Public Schools mathematics and science teachers." This letter solicited university applications for CMSI approval of university math and science endorsement programs for teachers. Programs with CMSI approval would be able to enroll CPS teachers who would receive tuition subsidies and the university program would receive from OMS "considerable assistance with administrative tasks and recruitment of participants." In this letter the desired programs were described as providing "a solid combination of math or science

content and appropriate pedagogy. Therefore, program applications must describe how individual courses link content and pedagogy and connect the substance of the courses to the teachers' own classrooms."

Application materials attached to the letter described how Grades 6-8 Endorsement Programs were sought and that these needed to fulfill all State of Illinois middle grades endorsement requirements. Web sites describing these requirements were given: http://www.isbe.net/teachers/MiddleGrade/msinfo.htm and http://www.isbe.net/profprep/FormInfo.htm. In addition, it described Grades K-5 Mathematics Certification Enhancement Program and a Grades K-5 Science Certification Enhancement Program, both allowing teachers to become "CPS endorsed" in these content areas. These programs included the following courses, each worth 3 graduate credit hours.

Grades K-5 Math Certification Enhancement Program	Grades K-5 Science Certification Enhancement Program
--Geometry	--Life Science
--Number and Operations	--Earth and Space Science
--Math and Pedagogical Issues in Teaching K-5 Math	--Physical Science
--Mathematics Elective	--Science Elective

On the last page of the application was a page titled "CUSP Course Design Principles." These were noted as follows:

> The research-based, CUSP course design principles assume teachers make greater and more enduring changes to their practices when the teachers themselves partake in the critical activities of the profession.
> - Content: Teachers learn content at and above the level of the learners they teach.
> - Pedagogy: Teachers learn, practice and reflect upon pedagogical approaches represented in current math and science standards.
> - Classroom Connections: The tasks of the professional development require teachers to practice curriculum analysis, implementation, and adaptations in their own classrooms.
> - Student Work: Teachers practice analyzing and assessing student work samples.
> - University/School Partnering: If you opt for a co-instruction model, CPS co-teachers and university faculty will share responsibilities for course development by contributing insights from their diverse perspectives.

The application materials noted that CPS tuition subsidies for teachers taking these courses would allow teachers to pay a flat rate to take a 3-hour graduate course of $250 (at institutions with course tuitions below $750) or $700 (at institutions with course tuition at or above $750). The application materials also conveyed that if the university wished to employ a CPS co-instructor for a course, CPS would pay half of the $3000 stipend for the co-teacher; the university must pay the $1500 balance. Universities were responsible for recruiting and identifying the co-teacher.

Evaluation Strategy and Methods

There are several purposes for evaluating these programs and courses. First, the CPS OMS staff members who work to support these courses and the university instructors who organize and teach these courses can learn from the findings of evaluation. Second, it is necessary to document the process and outcomes of these courses for the National Science Foundation, whose CUSP grant partially supports these courses. Third, the leaders of the CMSI and CUSP initiatives can use the evaluation of these courses as they decide how best to shape their efforts in future years. Finally, the larger audience of university educators who work to support K-8 teaching of math and science may learn from Chicago's efforts with these courses.

This report builds upon an interim report from August 2003 that reviewed some early findings about the interim period of activity where university based teacher professional development courses were offered before the CMSI programs were approved, but after the pilot phase was complete (Wenzel et al., 2003). Additional data were collected in the last year and together with the previous data analyzed to address the following process- and outcome-oriented evaluation questions. These questions were generated from conversations with OMS and from issues that arose in considering the previous interim report.

Process evaluation questions were:
- How have universities responded to OMS goals to create approved programs for K-8 teachers of math and science?
- How has OMS supported universities offering these programs?
- How does this partnership of universities and OMS provide mutual benefit and suggest a sustainable arrangement?

Outcome evaluation questions were:

- What are the characteristics of these university-based professional development courses for K-8 teachers of math and science, in terms of general characteristics, enrollments, and instructors?
- Did these courses help teachers with understanding content knowledge, pedagogy, and student learning?
- Were these courses found to be relevant to teachers' work in high quality instruction using standards based curriculum?

Data collected

The findings in this report are based on data gathered from written district documents prior to 2003 and from interviews, observations and documentation of courses offered between January 2003 and August 2004. Data collection involved the use of a number of protocols developed for this study. The course instructors were interviewed and provided a short background survey, course syllabus, a sample assignment given to the participants, and other supporting documents for the course including attendance records and grade distribution. A sample of teacher participants in the professional development courses participated in a written reflection and provided a sample of the work they did in the course. Some courses were also observed by evaluators. Data used for the analysis in this report are detailed in Table A in Attachment A. These data allow us to comment on findings that offer insights into a variety of situations faced in these courses. We also looked at CMSI written documents and field notes from evaluator attendance at various CMSI meetings.

This evaluation report focuses on the math and science programs targeted at K-5 and middle grades math and science teachers and K-8 teachers interested in improving their teaching of algebra and algebraic thinking. In addition to these courses, CMSI and partner universities also had courses for high school teachers and more short term courses and workshops for K-8 teachers—these courses were not considered in this report.

Findings

University response in offering programs

How have universities responded to OMS goals to create approved programs for teachers of math and science?

The 2003-2004 Application Materials for CMSI Grades K-5 Certification Enhancement Programs and Middle Grades Endorsement Programs were mailed out May 1, 2003 though the intention to ask for these applications was announced at a March 7 meeting that included representatives from most Chicago area universities. The turn-around time for applications was quick with the application overview noting the first deadline of June 1, 2003:

> Provider Application Timeline: To ensure dissemination of program information to teachers prior to t he end of the 2002-2003 school year, program applications for Fall 2003 programs are due June 1, 2003. Applications for programs that begin Summer 2003 will be considered.

Eleven university programs applied and according to the Fall 2003 Catalog of CMSI University-Based Programs for K-12 Teachers, 11 programs for K-5 certification and Middle Grades endorsements were approved. These programs were hosted at 6 different universities. A high school math program at DePaul and the Algebra Initiative at DePaul, UIC, and University of Chicago were also approved and described in the Fall 2003 Catalog. In addition, there was an approved OMS Museum Partners Science Program.

By the time the Summer 2004 and Winter 2005 Catalog was published, there were 13 programs for K-5 certification and Middle Grades endorsements approved from 7 different universities. For K-5 certification in math, DePaul and National Louis had approved programs. For K-5 certification in science, National Louis had approved programs. For Middle Grades endorsements in math, DePaul, National Louis, Loyola, St. Xavier, Roosevelt, University of Chicago, University of Illinois at Chicago had approved programs. For Middle Grades endorsements in science, Loyola and National Louis had approved programs. There was also the Algebra Initiative and DePaul high school math program. The OMS Museum Partners Science Program was offered again as are several new courses. Those listed were: No Child Left Behind Grant courses and workshops at UIC, a MKITS Bioscience Inquiry Collaborative at Northwestern and Friends of the Chicago River workshops.

While the 2000-2003 funding for much of the expense of these courses came from NSF CUSP and other CPS funds, some of the 2004 costs for teacher tuition for these courses drew on a more diverse funding base situated at the level of the universities that included subsidies from: State of Illinois No Child Left Behind grants for UIC math courses, BP America funds for Loyola's Middle Grades science program, National Institutes for Health grant for the MKITS high school biology program at Northwestern, grants for the Friends of the Chicago River and finally a State of Illinois Math Science Partnership grant for the Algebra Initiative, Loyola Middle Grades Science, University of Chicago Middle Grades Math, and DePaul High School Math.

In all, of the 14 colleges and universities who attended the March 7, 2003 University Partner meeting, 8 had programs or courses advertised in the Summer 2004 and Winter 2005 Catalog of CMSI University-Based Programs for K-12 Teachers. Those that did not included Chicago State and Northeastern Illinois (both large suppliers of new CPS teachers) and Illinois Institute for Technology, Columbia College, Northern Illinois and Illinois State.

In sum, there are 3 main findings related to how universities responded to the CMSI request for professional development programs for teachers. First, a quick response by 6 universities led to more than a dozen programs for teachers of math and science approved for the 2003-2004 school year. Second, by the summer 2004, 3 universities were not only offering programs, but had also sought and received outside funding to use to further support the CPS teachers in their programs. Finally seven of the 14 colleges and universities who attended the March 7 2003 meeting for University Partners responded with programs for K-5 and Middle Grades teachers (and other courses) by summer 2004. Another university, while not offering the K-5 or Middle Grade programs, offered another special program. Six of the 14 institutions at the March 2003 meeting do not yet have courses advertised in the CMSI catalog of university-based courses.

OMS support for university courses

How did OMS support universities offering these programs?

Through work at Northwestern CUSP project. During the 2000-2002 period of piloting of courses, CPS CUSP staff carried out the roles of recruiting teachers to take CUSP courses and paying the tuition of these teachers. However during this period they also had the help of Northwestern University staff who oversaw the logistics of supporting the universities creating and teaching these courses. Northwestern staff served as "matchmakers" between potential instructors from the ten participating universities and the Chicago Public Schools. In addition, Northwestern University administered the program in four key areas: In the

- Registration and record keeping
- Support of faculty piloting courses
- Monitoring and collecting of data on the quality of courses, and
- Development of a series of course guides for future instructors.

A 'site manager' employed by Northwestern was assigned to each piloted course during this period. This person attended all course sessions. Site managers collected registration and contact information from pilot participants and assisted in their registration process. They also assisted instructors by helping them order lab materials and get reimbursed from a small CUSP budget. The site manager assisted with room set up. Data collection was a major portion of the site managers' jobs as they obtained research consent from participants and then collected pre- and post-tests and surveys. They videotaped all course sessions. They also conducted instructor focus groups and collected written and audio reflections from instructors (Gomez and Reiser, 2002).

Interaction with the Northwestern CUSP staff or the prototype development teams was mentioned by 9 of the 13 instructors interviewed. Two instructors spoke about interactions with colleagues who were engaged with the Northwestern group and another instructor expressed general impressions of the philosophy behind the work done by this group. Two of the CPS co-teachers interviewed did not mention the work done by Northwestern. Those interacting with the Northwestern group mentioned their work with the development team. The interviewers did not ask for details on this early work, but a couple of instructors volunteered that they enjoyed opportunities to connect with instructors at other universities. The two faculty members not involved with the teams but recruited by Northwestern staff later were especially complimentary about how helpful and encouraging they found the staff.

What was the impact the Northwestern CUSP work on the K-5 and Middle Grades endorsement program courses taught fall 2002 through summer 2004? We looked at the full list of courses offered and the lists of faculty and teachers attending Northwestern CUSP meetings. From these data it appears that of the 19 university faculty and 15 CPS teacher instructors of university-based teacher professional development courses fall 2003 to summer 2004 for K-5 and Middle Grades endorsement tracks, 11 or 33 % of the instructors who actually taught were involved in the design and teaching of the inaugural pilot prototype courses.

Based on the interviews with the 6 instructors that had been engaged in the earlier pilot work, the influence on the shape of their courses were directly shaped by this engagement in some cases, but indirectly in others. For example, 4 of these instructors explained that the courses they taught were not the same as the prototype courses developed. This reflected a very clear message that a number of the instructors mentioned hearing from OMS. As one instructor explained, he designed the course along many of his/her own ideas even after being involved with the Northwestern CUSP process and receiving a binder describing the prototype courses from OMS. He felt quite comfortable doing this because of his understanding of the CMSI call for these courses. He stated:

> The original conception was a very specific course design that was gone through with a pilot. It was our understanding though [based on] the meeting with University Partners that was held at Loyola on March 7th [2003] . . . from Marty [Gartzman] that he was not really interested in adhering specifically to those custom design principles.

This instructor added:

> I've seen some of the custom design principals used. I've heard about that full process of trying to integrate pedagogy, and content and all that stuff. So, I mean, I kept some of that in mind, but I wasn't compulsive about it because Marty didn't seem that, that [this is] really what this is [about]….

We found no evidence of instructors being routinely given binders with the Northwestern CUSP protocols and a couple of instructors interviewed where quite clear that they did not know about these binders.

Through OMS staff work. Since Fall 2002, OMS staff have taken over the responsibility for supporting these courses and working to institutionalize the resources needed to continue these courses. Based on the Summer 2004 and Winter 2005 Catalog and the May 2003 solicitation of applications from universities, CPS supports these courses in the following ways:

- Approval of applications from universities for programs
- Provision of tuition subsidies to teachers taking these courses
- Recruitment of and record keeping on course participants
- Answering of questions about the courses

University instructors commented on their work with OMS and its support of their programs and courses. They spoke about how OMS supported them in the ways highlighted in the catalog.

First, OMS worked to get universities to engage in the continued teaching of courses designed during earlier CUSP development work. Seven of the instructors we interviewed mentioned the interactions they had with OMS as they were creating their CMSI programs and courses. One told how the OMS Chief Officer directly contacted the university's math department chairperson to invite them to create a program. Another worked with an OMS staff person to get materials about previous CUSP courses taught. Two closely reviewed the chosen CMSI K-8 curricula so to keep this in mind when designing their courses.

Second, the availability of these courses and programs relied heavily on the tuition subsidies that OMS gave to the teachers taking these courses. A few (N=5) of those instructors interviewed mentioned this. Two spoke at length about how challenging it was for the private universities to recruit teachers to their courses without the significant subsidies. They spoke about their challenges in working with OMS and their universities to deal with issues like getting the universities to cut tuition to make the course more competitive in cost and to see if the courses could be larger to make the course more attractive to the university. One instructor noted the issues in this way:

> If we don't have Board money, then we can't do it. What teacher is going to be willing to pay, you know like $2,000 to take a course, . . .[when other universities are] offering them, you know, they have grant money. . . .

> But there are plenty of programs around where teachers have to pay almost nothing. And so we're going to be asking students to pay $2,000. It ain't going to happen. So I guess one of the real difficult things for me is on the one hand I'm trying to convince people [at my university] we ought to go for this. But . . . if we go for it, we invest the time and effort and then a year or two from now we got this thing up and going and then there's no more tuition money, then who looks bad? Me. I've invested university resources in a program that we have to scrap. So, I mean, it all makes me kind of nervous.

Third, the active recruitment of teachers to these courses is critical. The enrollment of teachers into these courses has not been consistently high even with the tuition subsidies. We examined the K-5 and Middle Grades endorsement program courses advertised in Fall 2003 catalog to be taught winter 2003 through spring 2004 and in the Summer 2004 and Winter 2005 Catalog to be taught in the summer of 2004. Of the 52 courses that were scheduled to be taught, 5 of the courses had to be cancelled due to low or no enrollments. Of the 9 Algebra Initiative courses planned, one had to be cancelled due to low enrollment (DePaul, summer 2004).

Asked by one of the evaluators about cancellations and low enrollments in other courses, one instructor explained that she would keep offering the course, but worried that the university had their doubts about the continued feasibility of this:

> . . . but if something doesn't change I'm running out of believability. People say I've heard that before. So if I didn't believe in it, it wouldn't be picked up.

All of the cancelled courses were at private universities. Instructors interviewed mentioned their concern for how higher tuitions made recruitment to courses at most private universities more challenging. Several faculty expressed frustration that more active recruitment, in addition to the catalogs, was not undertaken to help avoid the cancellations.

Several instructors talked about how important and helpful it was to them that OMS coordinated the recruitment. One instructor noted:

> The coordination, the catalogue, the taking enrollments, and being able to advertise it for us to have a central location to deposit this. The catalogue is extremely helpful for us to look at. Who was offering what courses when? Where did we fit in? To me that's been extremely helpful--that administrative piece..

Another instructor commented on a number of ways that the recruitment and enrollment process could be improved. For example, in several recent courses teachers had not received CPS acceptance letters (as of halfway through the semester in one case and as of the last day of the course in another) confirming their enrollment in the course/program. Further, according to one instructor the applications that the students filled out for CPS did not provide the instructor with useful information about the teachers enrolled in the course. The process of working on the enrollments was also made more difficult because it was unclear who made OMS policy decisions about the courses. The record keeping methods of course enrollees was done at OMS with paper rosters . The system, at times, has made it difficult to identify which students took which courses.

Related to recruitment and enrollment, a number of instructors commented on the initial expectation that their courses would enroll multiple teachers from the same school. For example, in the CMSI catalog the Algebra Initiative courses are described for teachers who are "willing to apply as a school team" and have the support of their principal for one on the team to "teach an 8^{th} grade class after completing the course sequence." Yet enrollments of teacher in a school team were rare.

The programs of courses (rather than the single stand-alone course) were appreciated --they mitigated disadvantages due to the lack of school-cohorts by creating program-cohorts of teachers. As one instructor noted, he liked having a program-cohort that moved together from one semester to another because they helped each other --- and went from routinely saying things like "I am terrible in math, I can't do it" to saying "I can do this!"

Fourth, OMS had a significant influence on how the teachers were informed about course content and to whom it was aimed. Certainly the catalogs were key sources of this type of information for teachers. However, interviewed instructors mentioned that teachers had some misconceptions about the course content. For example, primary grade teachers showed up for a middle school course—these primary teachers did not have any intention of teaching middle

grade students.. There were students who signed up for Algebra Initiative courses who had been told (they did not specify by whom) that the course was for people who wanted to learn/ relearn algebra. One teacher said she had asked someone when she was signing up for the course if this was a "Math for Dummies" course and she had been told yes it was. Yet others vehemently said they had been told that this was a course for teachers to prepare to teach algebra in 8th grade. In another course that was part of the Algebra Initiative sequence, the majority of teachers did not know what the Algebra Initiative was and had not applied to be part of it.

Finally, a few of the interviewed instructors noted that they would like to get more support through feedback from OMS. One of the Algebra Initiative instructors explained that they would like to know which schools (from among those sending them teachers) were or would be teaching 8th grade algebra. Another instructor wanted feedback on what students in their course thought about the course's relevance. Another instructor wanted to hear from the Northwestern CUSP prototype development group about their findings from the videotape data they collected from earlier courses.

In sum, there are 3 main findings here. First, OMS and previously the Northwestern CUSP staff provided support to universities teaching these teacher professional development courses by helping them to develop courses and programs, through tuition subsidies, by recruiting and enrolling teachers, and by informing teachers about the courses. Second, the Northwestern CUSP prototype development work influenced the current courses, not directly through any written descriptions of prototype courses, but through the involvement of faculty in the process. Third, support to the universities was greatly appreciated, but there were some areas that the instructors explained needed improved support.

Benefits for and sustainability at universities

How did this partnership of universities and OMS provide mutual benefits and suggest a sustainable arrangement?

As we noted in an earlier evaluation report, as CPS moves to solicit university participation in further CMSI approved endorsement programs, it is important to reflect on what universities and their faculty find beneficial for their purposes when offering these courses (Wenzel et al., 2003).

We asked course instructors to talk about what they found as advantages to teaching these courses and what their universities found worthwhile about their participation. Among the benefits mentioned were:

- Universities valued the tuition funds and new students the CMSI courses attracted
- University-school CMSI partnerships helped the university to fulfill community outreach missions
- Universities developed and supported new programs and courses related to the CMSI courses
- Universities strengthened ties to schools through teaching CMSI courses to practicing teachers which was useful in their work on their pre-service teaching programs
- Faculty learned by working closely with their CMSI CPS co-instructors
- Faculty gained opportunities for scholarship, grant-writing, and service work through their CMSI courses

Interviewed instructors spoke about the value their universities placed on the partnership as a way to bring new students to their campuses. In particular, the CPS request offered some institutions a chance to, as one instructor put it, "break into the business" of teacher professional development for CPS teachers. Universities were excited about the "potential to grow" in this area. Instructors at several of the institutions spoke about how these programs gave them a chance to gain more name recognition with CPS teachers. One explained that his institution was "underrated for a lot of years" despite their good work with teachers and that this program could help them move to "another level of importance in the Chicagoland area." More established universities in the teacher professional development work saw an opportunity to increase the numbers of students to their courses. One instructor whose university already was well known to CPS teachers spoke about how the programs might lead teachers to commit even further in pursuing their development and join the university's masters' degree program.

The participating private universities were positive about the tuition stipends teachers received from OMS. One of the instructors talked about this in the following way:

> . . . elementary teachers have to have ongoing professional development . . . And so we could position ourselves to do some of [this]. But traditionally we haven't been successful with that because we're so much

> more expensive than the state institutions. So that's been a real drawback. But with the CUSP, there was a potential to have the tuition, you know, have tuition taken care of and so I made a case for us.

Staff from these universities was optimistic about how the tuition stipends could draw students. These staff were disappointed when they were not able to meet adequate enrollment numbers for their CMSI courses. There was concern by some at private schools when their university needed to discount tuition at special rates for CPS students. One person pondered whether they really "owed" this to CPS. There was also a comment made regarding the long time period needed to get these courses into the university's plans and the short timeframe on which CPS operated.

Instructors also made it clear that negotiations internal to their departments and colleges had to go on in order to free up their time to teach these CMSI courses and, in some cases, to give teachers additional tuition breaks to better compete with other universities. The instructors of their courses often had to "sell" the CMSI courses to their Deans and other university administrators.

> You know they [the University] had to invest my time and agree for me to do it and it counted as part of my load . . . So I convinced [several upper administrators at the University]. And I think, you know, [these administrators] have been real supportive. . . . . It's, I see it as kind of a risky thing . . . for [our University] to do this . . . it takes. . . I mean it's already taken a good deal of my time. We've had a couple of committees and the Provost's been involved. And I'm spending so much time this summer working on a proposal for a four course sequence that I'm trying to sell to the administration here. . . And I am pushing that, you know, that we [at the University] should give a tuition reduction because we're, it's part of our mission to work with CPS teachers and we aren't really doing that now. And if we do that, then we are, we become close to competitive with University X, University Y and those places.

There were implications for universities offering these courses on their staffing needs. One university instructor mentioned this in terms of her thoughts on sustaining these programs. This instructor noted that the creation and teaching of these courses rested with a relatively few individuals, some of whom are adding this to an overfull workload. However an instructor at another institution explained with pleasure that the university had just hired a new person to also work on math/science education teacher professional development—noting that this could help ease his workload because "there's a limit to how many nights I can work!"

Aside from enrollment and tuition, some of the universities saw their participation as part of their service to the community. Some of the instructors, especially those at one university, spoke about how the program helped them fulfill the university's "agenda of social justice" and service to their neighborhood schools.

There were a couple situations where university instructors spoke of how these CMSI courses had influenced other courses and programs they were working on. One instructor explained this:

> I mean [my university] is fully supportive of the program. In fact, you know we're now designing a [new masters degree program] based basically on the same model. We're now realizing that the components that they built into CUSP courses are indeed really important. Now we have a year of experience of teaching such courses. And so you know [my university] is excited about this, you know, designing courses that specifically meet the needs of in-service teachers. We've learned from CUSP.

Another instructor felt that working on the CMSI courses helped as she also worked on her university's pre-service teacher program. In addition, it was a means to develop some stronger relationships with teachers at local schools—schools that also helped through hosting pre-service student teachers.

As individuals, a few faculty explained that they learned something important from teaching these courses. In particular, some of them noted that they learned through co-teaching with a practicing CPS teacher. This was common for faculty interviews during the 2002-2003 year (Wenzel et al., 2003). However during 2003-2004, very few of the university courses had teachers co-instructing with the faculty because the salaries of these teachers would have to be partially paid by the universities rather than being fully paid by CPS. This presented the universities with a financial problem. Typically, universities budget for a faculty member to teach a course. If they don't get a large enrollment, there is no budget to pay an additional person. So building two instructors into a course is not part of the normal budget.

Finally, as individuals, faculty could and some did contribute to their career/tenure portfolio by not just teaching, but also doing research and service related to the CMSI courses. A couple of the faculty told how they either have already or hope to publish and present scholarship around their teaching experiences in this program. For example, one of the university faculty and CPS co-instructor pairs co-authored a paper they presented at a professional conference. Others explained how they were heavily involved in serving their university as a designer of larger efforts in teacher pre-service and professional development related to this program. Still others had been involved in writing and receiving grant funding to cover their efforts with this and related programs. All of these activities were hoped to be positive steps for the faculty instructors as they pursued their careers at the universities. However, some faculty expressed that through their support of the program, they took on some risk to their reputations that depended on the successful and continued enrollment in their CMSI courses.

Both the universities and individual faculty found significant benefits from their participation. These were all issues that could help them to continue to participate as partners with CMSI. However, as mentioned in the previous sections, these benefits came in tandem with a great deal of work on the part of faculty and at times some dissatisfaction with the support they received for their work and disappointment in low enrollments for their courses.

Teachers and university instructors involved

What were the characteristics of these university-based professional development courses for K-8 teachers of math and science, in terms of general characteristics, enrollments, and instructors?

Between its 2001 initiation to the summer 2004, 55 university-based professional development courses for CPS teachers of K-8 math and science have been taught as part of the K-5 and Middle Grades math and science programs and the Algebra Initiative. The breakdown of these courses by type of program is shown in Table 1 below. Table B in Attachment B shows the data from which these figures are drawn.

Table 1: CMSI university-based professional development courses for K-8 teachers of math and science

	Fall 2001-Summer 2002 (CUSP)	Fall 2002 – Summer 2004 (interim/CMSI)	Total	Number of university-based instructors	Number of teacher co-instructors	Number of teachers enrolled*
Grades K-5 Science	3	2	5	4	4	52
Grades 6-8 Science	0	9	9	5	5	84
Grades K-5 Math	3	5	8	5	5	66
Grades 6-8 Math	2	23	25	13	4	199
Algebra Initiative	0	8	8	5	0	101
TOTAL	8	47	55	6Sci + 17Mth	7Sci + 8Mth	502 **

* Through Fall 2003 semester.
** Because some teachers have taken more than one of these courses, the number of unique teachers enrolled is smaller.

The numbers of classes offered was greatest by a large margin in the area of Grades 6-8 math with a total of 25 courses offered to date. Accordingly, there were more instructors (13 faculty and 4 teacher co-instructors) involved in these courses than in other types of programs.

Important to the sustainability of these courses (discussed in the previous section of this report), there were 6 university science faculty and 17 university math faculty who have taught these courses to date. CPS set requirements for the support of these courses contingent on having all courses taught by a "regular" university faculty member—not an adjunct faculty member. Given this, the plan by OMS is that these 22 faculty involved in these courses to date should be available to teach and support future courses in these programs.

Understanding of content, pedagogy, and student learning

Did these courses help teachers with understanding content knowledge, pedagogy, and student learning?

To address this question and the next evaluation question, we draw primarily from interviews with course instructors of K-5 and Middle Grades math and science certification and endorsement programs who taught during fall 2002 to summer 2004 and from observations made of a sample of these courses. Central in the instructor interview questions

were questions about the impact of the course on the teachers taking the course. The pertinent items on the interview protocol included (see Attachment C for full interview protocol):

> 3) We want to understand how this course/workshop is meeting its intended goals.
> Is the course/workshop:
> a) Covering math/science content/pedagogy/student learning?
> b) Connecting math/science content/pedagogy/student learning?
>
> 4) Get a sample of a challenging assignment / activity from the instructor that exemplifies how they worked to meet these goals.
>
> 5) How do you evaluate/judge the effectiveness/success of this course?

Of the courses sampled from those taught in fall 2002 to summer 2004, we found in all of them evidence that instructors attempted to cover and connect math or science content related pedagogical practices and understanding of student learning. The qualities of how this was done and the success of these attempts varied.

Learning the science and math content

How did the content taught in these courses compare to typical college-level content courses in math and science? How successful was the learning of the content? How was the content taught in unique ways given the joint focus on content with teaching and learning in comparison to courses with a sole traditional focus on content—and what did instructors and students think about this?

Instructors grappled with how to compare their courses relative to what "college-level" math or science content should be and with how to assess what their teachers know in terms of content. For example, one math instructor stated:

> You know, I'll be very honest with you. I respect these teachers an awful lot for coming back to school, trying to improve their skills, and so I think they need to be treated with dignity . . .I can't see giving a quiz and a test, and you know, grading homework like that because I mean we have to make a basic assumptions that they have this knowledge and they are in it for their knowledge. Personally when they're relaxed and happy they're going to learn a lot more anyway . . .

Another instructor had a similar dilemma in answering our questions on the level of the course content. She felt that her course was graduate level and explained it in the following way.

> If we're going to change teachers, we're going to ask them to teach different … I believe what we have to do is give them a different experience in learning math. . . . they have to reconstruct themselves as learners of that, before they can reconstruct themselves as teachers. …There is a lot of emphasis on learning in a different way and talking about the learning before we start talking about how you teach. That's difficult work. That's graduate-level work. The transfer to that classroom happens if they've really done that. You don't have to spend a lot of time talking about 'well I did this, therefore you do that.' They have learned differently. We've talked about how they learn. …So they kind of translate the experience not through tips and techniques and 'you do this,' but through trying to recreate . . . You're asking people to change their habits …I think you're asking a lot from them. . . [it] is graduate level work.

She also noted that some may not understand the complexity of why she felt that content was graduate level:

> On the other hand it would be easier to look at the so-called content, and say, oh the content is very elementary. We would be giving credit, math credit. You ought to be at least using calculus if not differential equations. We're talking about a different thing than most math departments, math contents people understand. … a profound understanding of fundamental mathematics is not something that you're going to get in a typical master's degree in mathematics. So the content has to be delivered in a different way.

Other instructors were less nuanced about describing the content level and also discouraged about how challenging the material was for the teachers. One of the science courses was characterized by the professor co-teaching it as being "taught at the rigor and conceptual level of a college core class with maybe a little more mathematics." The instructor

went on to explain that in the course "we did mathematics; we did calculations; we did extrapolations; we did graphing." Another science instructor described the CUSP/CMSI course as designed at the college-level, saying

> We wanted the content to be challenging for the teachers as adult learners, not just teach them what they would then teach to their own students--but go beyond--so they can guide their students in inquiry-based lessons.

This instructor then added that despite a course design at the college-level, the class was not able to cover the college-level material, because the teachers needed too much help with basic science concepts.

One math instructor noted the content in the CUSP/CMSI course was "not college-level" but that it was "going up to 9th grade." Others echoed that they had not designed the course to be college-level. And yet even with content that was not at a college-level, a few of the instructors felt that the teachers in their courses were not doing good work. One noted how the teachers in the course were complaining because they had to do homework. The other instructor felt "dismayed" at the lack of time teachers devoted to their course work and the quality of the work. Another instructor described the course as not at the level of a basic undergraduate course and yet still challenging for the teachers. He noted:

> But it was definitely challenging for the teachers. And it may be it is because of the amount of time that elapsed since they had taken those courses. It also seems that there is a variety of ways that people can get out of taking science courses as an undergraduate program, and maybe that was what the case was. But I think they're knowledge of basic science is not very good.

The instructors of these courses had teachers take part in various experiences with the goal to help the teachers deepen their content knowledge at the same time as they enriched their understanding and reflected upon instructional practices and student learning. One math instructor stated:

> We looked at the curriculums CMSI had chosen . . . and kind of built around that . . . hoping to address content, but maybe in a way that would be more comfortable for the teachers. The teachers want to learn something in class and take it back to their classroom, . . . that is a good practice because if they do it--and do it themselves--it kind of internalizes it. If it is something that has to be put on a shelf until next year, they will have forgot they've learned it, and it doesn't always come through.

In one of the science courses, the instructor described how teachers in the course were assigned to teach their students a science lesson through inquiry, even though the teachers did not yet know the content well themselves. The teachers learned about a new science topic and at the same time learned to do an inquiry lesson and to think about how to learn science this way. This assignment worked very well according to the instructor:

> It takes a lot of guts to do that, and I think it was extremely effective. [The teachers] definitely got the most important parts of this lesson. And it showed how you don't necessarily have to be an expert in everything you teach . . .You can be very effective as someone who shows and has experience in how to learn a new subject and together helps the students explore and then learn themselves through inquiry.

While all of the courses included the content/pedagogy/student learning goals, it was less clear how well these courses did in assuring that the teachers in the courses learned what was taught. Instructor interviews served as a primary means by which we gathered some evidence as to student learning. All of the instructors we interviewed shared some positive evidence that their students learned. One science instructor explained his students gained content knowledge.

> I gave the pre-test, they all knew something, no one knew everything. They all had gaps, they had different gaps. . . I mean, question three, if you look at it, almost everybody got it wrong. A few people got it right, but almost everybody got it wrong. . . . Now I asked questions like that at the end of the term, and they nailed them.

Pedagogy --Types of course experiences. Through a variety of experiences, the instructors in these courses provided opportunities for K-8 teachers to consider issues regarding subject matter, pedagogy, and student learning. These included experiences that we categorize as (a) focused on general topics, (b) focused on the teacher as a learner, and (c) focused on teacher's personal instructional practice. Specific example types of experiences are noted below:

a) Focused on general topics

- Discussing students' and teachers' misconceptions of math or science topics
- Watching and discussing video case studies of students learning math and science
- Using NCTM E-standards documents
- Reading books and journal articles
- Learning how to use technology
- Studying multiple ways of getting to answers for math or science problems
- Reviewing ISAT math vocabulary
- Thinking about how to integrate math and science with other subject areas

b) Focused on the teacher as a learner

- Solving math or science problems
- Writing weekly reflections
- Presenting findings in poster sessions
- Taking exams on content knowledge
- Conducting experiments
- Putting together lesson plans on a special topic

c) Focused on teacher's personal instructional practice

- Discussing teaching strategy and/or well designed student activities, then teacher tries it out with class and then discusses what happened
- Dissecting their favorite lab assignment to understand why each step is done
- Discussing samples of their students' work
- Writing a paper about a problematic situation they have had in class with students
- Doing a case study with one of their students to evaluate how learning takes place
- Focusing on the textbook/curriculum that the teacher uses

There were a myriad of types of teaching strategies that teachers tried out in their own K-8 classrooms and described in assignments for their university courses. A list of some of these strategies gives a flavor of what was being discussed in these university courses. These strategies included teachers having K-8 students:

- Work through in class a few problems rather than working quickly and individually through many problems
- Try out multiple methods of solving the same problem
- Work together in small groups
- Sit in desks arranged in a U-shape rather than in rows or groups of 4 to facilitate more discussion about the content
- Use their surroundings to think about the content, for example how teacher had students find fractions in their classroom like how the area of the door made up a fraction of the wall
- Do investigations using manipulatives and other materials
- Discuss math and science words on a "word wall" posted in the room
- Use reciprocal teaching where students "become teachers" and describe concepts and how to solve problems
- Work with their parents on homework assignments, for example having students explain a word problem to their parents and then have parents answer a question about the child's strengths and weaknesses in problem solving
- Do peer teaching and have less teacher talk
- Use extended response to explain their answer
- Use "games" to reinforce lessons already taught

We offer more detail on how the teachers and instructors make sense of these experiences below.

Raising awareness of assessing student understanding. Most of the instructors noted the various ways they worked at raising the awareness of the teachers in the CMSI courses about how difficult it is to determine whether a student really understands the math or science concept being taught. Instructors described how they attempted to and

succeeded in raising this awareness as they taught general topics, as they placed the teacher in the shoes of novice math and science learners, and as they had teachers focus on the own classrooms.

In terms of raising this awareness using discussion of general topics, one math instructor described how the teachers in her course learned from a video tape she showed them.

> We looked at some video footage of kids . . . and a lot of the teachers just marveled at it because they never, you know. They might have been solving 54 plus 19 in this videotape, but the way students went about adding it: "well, I made the 19 into 20 and made 54 into 53 . . ." [The teachers] they've never seen anything like that before. They've never been promoting it or cultivating that kind of thinking. They've just been taught to teach procedures: "First you add the four and the nine and that's thirteen. You put the three here, carry the one."

In this course, the teachers were also asked to do an "interview" with a student to get an understanding of how the student understood a math concept. The teachers were explicitly instructed about how to listen to students and how to ask the questions to elicit what the students know and understanding. This was a different experience than interacting with students through teaching. As the instructor explained, they were

> . . .not telling them [students] whether they're right or wrong, but really trying to develop an understanding of what and how do you ask questions to elicit what students know and don't know as far as an evaluation tool.

We saw in this course that the teachers agreed with their instructor that the video and then trying out some of the activities with their students helped shape how they thought about student learning. The following are excerpts from reflective writing assignments the teachers turned in to the instructor:

> Yes these math sessions have affected how I think about teaching. . . . .These math sessions have confirmed my position as a facilitator in the classroom. As I work with my students I am anxious to see their thinking. I no longer have the need to teacher but, to learn what they are thinking. As I work with them I'm constantly thinking about what I can ask them to find out more about what they are thinking.

> [One of our lessons] made an impact on my thinking about mathematics, about learning and about teaching. . . . Students are encouraged to contribute and share their ideas. When the atmosphere is supportive and investigative, students come to view these experiences not as mistakes but as learning opportunities. They must feel what they say matters, even if the answer is not correct. I have even told my students, "Wow, what a great mistake." We can learn from our mistakes. … We can understand the thinking process by examining the answer. .. . The teacher needs . . . [to not be] impatient and interfere with students struggling with solutions. Telling students which solution is correct is never as powerful as letting them figure it out for themselves.

> The sessions have affected the way that I think about teaching. . . The shift I have noticed is now I am not concerned with the quantity as much as the quality of the lesson. . . . There might be 5 problems completed at the end of the class, but I would rather have 5 accurate problems completed that they truly understand and I have watched them complete and talked each problem through with each other, than 50 incorrect problems and a whole period wasted.

> This class has affected the way that I think about teaching math. Prior to taking this class I was like most teachers, primarily concerned with the bottom line. When I would give students a math problem I would check to see if they had the correct answer. If they had the correct answer then I would assume they did not understand and I would re-teach the concept the same way that I had initially show the class how to solve the problem. Now I realize that . . . A correct answer does not mean the child can explain the logic of how and why he did what he did. An incorrect answer does not mean the child cannot articulate the logic behind his answer. Asking a child to explain his/her work should become as much of a standard as checking the bottom line.

Allowing the teachers to act as novice learners also may have raised awareness. In one course, the instructor explained she wanted them not only to gain a deeper understanding of the math but also to experience a struggle to learn akin to that of their students. Because the math was challenging for the teachers, the course instructor felt they made some progress toward the course goal, which she described as follows:

> I think the goal was for them to begin to look at what kinds of assumptions they were making about this math topic. And experience what it meant to be a learner when you're really very unsure of yourself and things are mysterious.

In one math course we observed teachers working in small groups on a challenging math lesson. The instructors of this course shared the goal that in doing these lessons, the teachers would gain the following benefits:

- understanding feelings of struggling learner
- learning content
- seeing good teaching modeled by instructor
- learning to work with manipulatives.

We observed these teachers exhibiting an understanding of the content, working with manipulatives, and remarking on their struggles with the material and noting that their students might feel similarly. We were not able to assess in our observation their recognition of the instructors' modeling of good teaching.

Throughout the courses, we did not find teachers writing in assignments or evaluations explicitly about themselves as learners with the exception of a couple teachers. One teacher wrote in an assignment for class:

> . . . I remember learning [about this topic]. Although I memorized the rules and formulas of math, I do not remember ever being asked to explain the logic of what I was doing. Now I wonder if I was the only child operating as a robot. I never constructed my understanding. . . I always wondered why math was simple in elementary school and most of high school, but in college math went from being my favorite subject to my most dreaded subject. I now realize it was because I had the basics of computation, but never had the basic logic of what I was doing. Therefore, I was not able to do any higher order thinking in terms of math. My goal as a teacher is to not teach students the way that I learned. This is a challenge that I face daily. The challenge became less difficult when I realized that I could learn as much from my students as they can learn from me.

Another teacher wrote in response to evaluators' questions about the relevance of the course that the course "makes you take a step back and places you in the students' shoes."

Instructors from one of the math courses noted how their students gained a better sense of how to use questions to gain a better sense of how their student understood math. One of the instructors explained how teachers moved from talking about how their students needed to better learn procedures ("they need to be able to line up the numbers") to understanding that what students really needed was a deeper understanding of place value. The teachers in the course learned:

> . . , the kinds of things that they were looking for and when you need to ask what does the child understand about the number system or . . . what is it in this child's work that tells you that they're a good student or that they understand. . . . It seems like there's this sort of growing realization among them in the last couple of weeks, it's more like testimonial style. "Wow I never looked at this in my students." "I never knew how I didn't ask enough questions." "I wasn't asking the right questions." "I wasn't looking for understanding." "I thought that because they got the answer correct, that meant they understand."

Some instructors, like this math instructor, emphasized an increase in self-confidence and competence among the teachers in their CMSI course to be able to:

> . . . incorporate more of what they are learning. I see it over and over and this semester is even better. . . .They are looking at it with a much different perspective, and bringing in [to their classroom] more rigorous mathematics. Much deeper problems, much richer problems that I am not going to take credit that I gave them all, but at least they have that awareness. The other thing I think we've really created is an atmosphere of you can do this. . . .I have several elementary teachers that are, 'oh I am terrible in math and I can't do it!' Now, we have more of a 'I can do this' attitude!

Relevance to teachers' work

Were these courses found to be relevant to teachers' work in high quality instruction using standards based curriculum?

Although instructors may have attempted to teach certain ideas and teachers may have learned them, was this new learning relevant to teachers' work– and was it applied to their K-8 classrooms? We address how instructors thought about course relevance, how their assignments formally or informally asked teachers to try things out in their classes and what a sample of teachers said about relevance. The findings shared here come from data collected from courses in the K-5 and Middle Grades math and science programs and the Algebra Initiative.

Instructor views. According to our conversations with instructors, various course experiences impacted teachers' short-term teaching to differing degrees. On one end of the spectrum, a course assignment required teachers to try out a lesson in their own classroom. Teachers in one of the courses had to choose a lesson from a curriculum they were discussing in class and write a one-page plan explaining how they would teach this lesson to the student. They were instructed to pay special attention to content, students' conceptions, inquiry, and assessment. At the same time, they needed to put it in context of the grade they were teaching, the number of students in the class, and the challenges to instruction. Next, they were asked to teach and film the lesson jotting down thoughts immediately after teaching the lesson. The third step involved analyzing their teaching, and the fourth part was reflecting on the teaching experience.

On the other end of the spectrum, there were things that teachers learned about in their course that they were not required to use in their classrooms; however, some teachers did so on their own. One professor noted: "We didn't require it although they seemed to be doing that." Another instructor echoed this when describing something teachers did for the course and though not required they took it to their own classrooms and "They just kind of end up doing it."

While all courses included experiences where teachers tried out ideas with their own students, the extent to which course assignments required immediate impact on their classroom teachers varied. One instructor explained to us in an interview that she did not think her course could require teachers to immediately change how they teach and "that wasn't really the way the class was cut out." Her course did have teachers teach an new lesson and also a special assessment with students. But her personal hope was "to change peoples' practice" in the long run. She was adamant about the need for realistic expectations in this regard.

> This is the piece that worries me a little bit, . . . [that someone] is going to expect . . [change in] entire schools test scores. I mean the change is so gradual. I think that the change in these teachers, and I mean they've expressed that it's changing their practice but it is a very gradual thing. You know like some of the teachers that surprised me . . . they've like said, "I've tried it but, you know, we tried one thing this week." But it could be, they're doing it gradually, doing it very gradually.

Another instructor echoed this sentiment.

> So part of the thing really evident to me is that, you know, you're very limited in what you can accomplish in a one shot course like this. You need to build, and I think, I don't know how to do it in this, but I think there ought to be some sort of component where you're actually out in the school with them. But I have a hard time imagining how, without making this much more ambitious than it already is.

Some course assignments required direct interaction with the teachers' own classroom and others were more voluntarily influencing what occurred in their classrooms. One instructor described an assignment that required focus on the teachers' classrooms but the intended impact on the teachers' classrooms was more complex . He described the assignment as:

> . . . a paper describing a problematic interaction [with their student]. . . For this particular course I want them to, in a sense, develop an experimental attitude. So I said . . . what is it here that you would like to transfer to that class? What is it that you feel [your students] are not doing. A typical example would be… 'well, I really feel I need to get students to do more talking.' Okay so how are you going to do that? Talk about some ideas, come back in that class, and here's what I'd do, here's what happens, and you do that three or four sessions. So the transfer is to their students, to try and get their students involved . . .

The paper included a description of what happened in response to these interactions. However he pointed out that the relevance of this exercise was more important to look at from a longer term perspective. She explained:

> You also have to understand this course is not just one course. It is part of a program so they should be following this up [next semester].

Teacher views. A sample of teachers taking classes during 2003-2004 shared comments about the course relevance through written reflection surveys that they filled out for evaluators. Two-thirds (33 of 50) of the teachers in a sample of math courses filled out written reflections and of these around 80% (27 of 33) clearly wrote that they took something learned in their university course and applied it in their own teaching with K-8 students. The types of activities that they tried out were outlined in the section above on types of course experiences. These teachers had much to say about positive experiences related to using things from their course with their own students. In written reflections, some of the teachers made comments that included:

> I have already had the opportunity to employ techniques learned in this class in the normal course of presenting materials.
>
> This class was relevant to me because it allowed me to use more hands-on activities. It made me proud when my students understood a better way (new math) than my old fashion way.
>
> After every [university] class, I've left with ideas to use for the next day of [teaching] class!
>
> A lot of the things discussed in class made me think about different strategies and techniques I could try in my class. One was with getting the students more involved in the class. I tried group work in which all members are responsible for each other.
>
> I had my students learn factors and multiples by using games and hands-on games and lessons that made my students have fun and learn.

The teachers who did not write that they tried things in their courses still said the course was "relevant" but did not say directly that they changed anything in their classes. No one said negative things in the written reflections about the relevance of the courses. Some of their comments included:

> . . .this class has given me a more in-depth study of mathematics so that I have more than a basic understanding of these concepts. I am able to see the foundations which I teach expanded in great detail.
>
> This course gives practical info on how to get info across to the students. It breaks everything down into basics, that sometimes we as adults or teachers take for granted –"you should just know it." It makes you take a step back and places you in the students' shoes.
>
> This course has offered me other models to present to my students. As a more mature person, I was taught to memorize facts. This course has introduced me to another way to look at the same things I learned decades ago.
>
> This course provided insights on using math manipulatives in the classroom.
>
> I have not currently used any of the lessons, activities, or mathematical data in my classroom. However that doesn't mean that I wouldn't in the future. Currently I [am not teaching math].

In sum, both course instructors and teachers thought of these university courses as relevant to the K-8 teaching of math and science in the teachers' classrooms.

Next Steps and Issues to Consider

Given the above findings, two issues appear to be most pressing and deserving of attention as the CPS Office of Mathematics and Science continues to work to support teachers through these university-based teacher professional development courses.

First, given that these CUSP / CMSI math and science courses have been offered since 2001, a thorough analysis needs to be undertaken to determine who has taken these courses and to what extent have the goals of the programs been achieved. To what extent have teachers moved toward becoming credentialed as highly qualified according to NCLB standards? How many have gained Middle Grades endorsements? To what extent have teachers progressed toward the K-5 certification that CPS has begun? To what extent have schools and individual teachers become ready to offer grade 8 algebra—and how many more schools are currently offering this?

Assessing this progress is critical not only in terms of understanding if the current programming is successful. It is also critical in terms of planning for future funding and organization of university-based teacher professional development courses. As this report shows, university stakeholders are clear about the investments they have made in developing these courses and programs and in leveraging support from their universities to offer these courses and at time discount tuition. In return for this work, these stakeholders are hoping for continued cohorts (and in some cases larger cohorts) of CPS teacher enrolling in their programs. They recognize that it is less likely that these teachers will enroll if they do not have tuition stipends as part of the package. The universities would like to get feedback from CPS in terms of projected programming for future years. Understanding the current inroads made toward goals—and how much more work is needed—will provide some of the key feedback needed.

One of the instructors teaching these courses put this issue in the following terms:

> I guess one of the things that we need the most is probably the thing we can't have. It is some sort of assurance that this is going to be a lasting partnership. So I think that any kind of indication that I can get about the longevity of this, then it makes it easier for me to sell it to the administration that it makes sense for us to do this. If there was a way for to believe that this could be an ongoing partnership between my university and CPS because we have common interest here.

Second, while this report finds evidence that the courses offered seem relevant to the instructors and teachers enrolled, there needs to be more concrete documentation of the efficacy of offering teachers these university-based professional development programs. This can be studied in comparison to other programs underway in the CMSI where teachers are involved in implementing new curricula with other means of out-of-school and in-school support. .

Finally, we end with words of two participants in the CMSI courses. Their words represent views on the magnitude and the importance people place on OMS efforts to continue to support their university-based teacher professional development courses. The first view we would like to share comes from a university faculty member teaching one of the CMSI courses:

> I think it's extraordinarily commonsensical that this is where you start. And where you start is with a lot of hard work. . . . What do you say? I mean I think it takes a tremendous amount of courage on the part of CPS because essentially what they're saying is: "We have a real problem here. We have people in the classroom teaching things they're not really qualified to teach." They've sent out letters to parents saying that. Okay, that can work. Parents who receive that letter should be saying "Okay this isn't good, what are you going to do about it?" Well you can either get a whole new set of teachers, not likely, very expensive probably. Or you can work with the teachers you have. Hope that you have sufficiently a large [number] of them who are caring enough about their profession that they want to get better. . . . Well how do you make them better? Well that's the problem. The problem is they don't know math/science and we're teaching math/science.

The second shared view was stated by a teacher in one of the university-based courses when she added these comments to written reflections she gave to the evaluators:

> CMSI classes have been a gift more to me. I needed at least three classes to fulfill requirements for my Middle School Math endorsement. I was getting frustrated as I searched for classes I needed and trying to register as a "student at large" was also stressful. As soon as I heard about the CMSI classes, I leaped on it and registered. I have taken two classes at [this university] and am registered to take my third at [another university] next semester. Then I will have my endorsement and I already have learned much to help me better teach middle school math. And I think all three of these classes will have been fully subsidized! I <u>love</u> that. I am taking good courses at reputable universities—and for free! CPS teachers and their students <u>deserve</u> this.

References

Gomez, Louis and Brian Reiser. (2002). Northwestern University Chicago Urban Systemic Program: Second Annual Report, Submitted to Chicago Public Schools for the period from September 1, 2001 to August 31, 2002.

Wenzel, Stacy, Trautvetter, Lois, Fendt, Carol R. and Sara R. Hallman. (August 29, 2003 with minor revisions October 20, 2003) Interim Evaluation Report: CMSI/CUSP University-based Teacher Professional Development Courses. A report to the Chicago Public Schools Office of Mathematics and Science.

Attachment A

Table A: Evaluation data from CMSI university-based teacher professional development courses

	# of courses between fall 2002 & summer 2004	# of these courses from which data collected	% of these courses from which data collected	Amount and type of data collected
Grades K-5 Science	2	0	0%	--
Grades 6-8 Science	9	3	33%	Interviews of 2 instructors 1 classroom observation Examples of work from 4 students Written reflections from 4 students
Grades K-5 Math	5	2	40%	Interviews of 4 instructors 2 classroom observations
Grades 6-8 Math	23	4	17%	Interviews of 5 instructors 3 classroom observations Examples of work from 18 students Written reflections from 33 students
Algebra Initiative	8	6	75%	Interviews of 2 instructors 2 classroom observation Examples of work from 8 students Written reflections from 8 students

Attachment B

Table B: Listings of 2001-2004 CUSP/CMSI university-based teacher professional development courses

GRADES K-5		2001-2002			2002-2003			2003-2004	
		Fall	Winter/ Spring	*Summer*	Fall	Winter/ Spring	*Summer*	Fall	Winter/ Sp
	Life Science	**Northwestern** Patton&McFall **13**				**Northwestern** Patton&Pardo **13**			**Loyola** Shefn
	Earth & Space Science		**DePaul** Beck-Winchatz& Barge **15**						
	Physical Science		**IIT** Fazzini& Tarpey-Cole **11**						
Math	Number & Operations	**DePaul** Cobb&Turner **15**							**DePaul** Cobb
	Geometry	**Loyola** Kneubuhler& Holly **12**				**Loyola** Kneubuhler& Tarpley-Cole **15**			
	Other Math			**Roosevelt** Carter&Helford **9**		**Roosevelt** Carter&Ditto **15**			

KEY: University in **RED**, Instructor(s) in BLUE, Number of teachers completing course in **GREEN**
SOURCES: OMS and Northwestern internal records, OMS course catalog, Instructor interviews

Attachment B continued

Table B: Listings of 2001-2004 CUSP/CMSI university-based teacher professional development courses, continued,

MIDDLE GRADES		2001-2002			2002-2003			2003-2004	
		Fall	Winter/ Spring	*Summer*	Fall	Winter/ Spring	*Summer*	Fall	Winter/ Sp
Science	Life Science				**Northwestern** Patton&Pardo **14**	**Northwestern** Kanter&Kemp **15**			**Loyola** Shefn
	Earth & Space Science				**DePaul** Beck-Winchatz& Barg **19**	**DePaul** Beck-Winchatz& Katzberger **15**			
	Physical Science					**Loyola** Slavsky& Clevenger **17**			
	Other Science							**Loyola** Shefner **4**	
Math	Algebra		**UIC** Jordon&Holly **18**						
	Number & Operations					**St. Xavier** Knight& Bertucci **15**		**DePaul** Cobb **4** **National Louis** Cirulis& Weaver **20** **UIC** Weinzwieg **17**	**Loyola** Braga
	Geometry	**DePaul** Pereira&Lag& O'Leary **7**						**Loyola** Braga **5**	**DePaul** Perei
	Other Math							**U Chicago Polk Brothers 81** **U Chicago SESAME 32**	**DePaul** TBA **UIC** Weinzwi **National Lou** Jagla/ Peterso (two sections) **St. Xavier** **U Chicago Po Brothers** **U Chicago SESAME**

KEY: University in **RED**, Instructor(s) in BLUE, Number of teachers completing course in **GREEN**
SOURCES: OMS and Northwestern internal records, OMS course catalog, Instructor interviews

Attachment B continued

Table B: Listings of 2001-2004 CUSP/CMSI university-based teacher professional development courses, continued,

ALGEBRA INITIATIVE	2001-2002			2002-2003			2003-2004	
	Fall	Winter/ Spring	*Summer*	Fall	Winter/ Spring	*Summer*	Fall	Winter/ Sp
							UIC Fisher **30**	UIC Jordan
							U Chicago Sally **46**	**U Chicago** Sa
							DePaul Narasimhan **25**	**DePaul** Nara

KEY: University in **RED**, Instructor(s) in BLUE, Number of teachers completing course in **GREEN**
SOURCES: OMS and Northwestern internal records, Instructor interviews

Attachment C: Interview of Professional Development Course/Workshop Instructor

Name of Interviewee:

Name of PD Course/Workshop:

Dates of PD Course/Workshop:

Location of PD Course/Workshop:

Name of Researcher/Interviewer:

Date of Interview:

Researcher first discusses informed consent with interviewee(s):

Remember previously you consented to be a part of our evaluation and research about the Chicago Urban Systemic Program and the Chicago Public Schools Math and Science Initiative. You signed a consent form as part of that process. We talked about the purpose of the research and the type of data we would collect. This interview is part of that data. Now, I want to again make sure you understand and are comfortable giving your consent to be in the study.

Remember that there are potential risks and benefits to participating in this research. For example, I may ask you a question in this interview that may make you feel uncomfortable about answering. Or you may tell me something that, if I told others you said it, they would be upset with you. While these are risks, this study is set up to minimize them. I definitely will not share your answers to my questions with anyone besides my fellow researchers. When we report findings, we will not use your name. And when I ask you questions, you can chose to not answer any questions that make you uncomfortable. There are no sure benefits from participation in the research study; however, you may find it helpful to talk with me and reflect about your work.

Participation in the research is voluntary and the information you provide for the research will be confidential. You can withdraw from the study at any time.

Let me make sure you understand the research again by asking you a couple questions: "Would you please explain the purpose of the study back to me along with your understanding of the risks and benefits to you as participants?" "Do you have any questions about the study and its process?" "Can you please tell me whether you think you are required to participate in this research or can you be teaching CUSP PD courses and not participate in the research?"

If consent is reaffirmed, the researcher then asks the following questions. The interviewee is encouraged to elaborate on answers.

1) How did you come to teach this course/workshop?

a) Where did you first hear about the opportunity to teach it? When?

b) How did you learn about what the course/workshop should include?

c) Did you/ how did you use any materials from CPS that gave guidance on how the course/workshop should be shaped?

d) How did you work with your college/ school/organization to get permission and resources needed to teach this course/workshop?

2) (IF APPLICABLE) How did you come to co-teach this course/workshop?

a) How do you know each other/ the other co-instructor?

b) How do you divide the responsibilities for the course?

c) What do you do separately? What together?

d) What is it that each of you add to the course/workshop?

3) We want to understand how this course/workshop is meeting its intended goals.
Is the course/workshop:

a) Covering math/science content/pedagogy/student learning?

i) Challenging college-level content

ii) Standards-based pedagogy

iii) Student learning

(1) If you are instructing teachers, are you requiring them to look at/ study their students' work? If so, how is this study of student work conceived/structured?

b) Connecting math/science content/pedagogy/student learning?

i) Assignments show that connection-making required

4) Get a <u>sample of a challenging assignment / activity from the instructor</u>

a) Tell us about this assignment and why you think it is particularly challenging for participants in your course/workshop.
How will they benefit in their teaching/other work from doing this assignment/activity?

b) Tell us about how they completed this assignment/activity.

5) How do you evaluate/judge the effectiveness/success of this course?

a) How are the participants in this course/workshop benefiting? How do you know?

b) Do you think there will be any benefits to the participants' students? What might they be?

6) Would you teach this course again? Would you make any changes?

7) What did you get out of this experience personally?

a) What were the pros and cons of instructing this course/workshop?
b) Did you learn anything new? Develop any new insights about CPS, its teachers, students, policies, structures, etc.?

8) What did your university/ college/ school /organization get out of this experience?

a) How do you know?

9) This course/workshop is a part of an overall Chicago Math Science Initiative with one goal of providing CPS schools with more highly qualified teachers of math and science. Tell us how you think this course fits into this effort.