CLOSING THE MATHEMATICS ACHIEVEMENT PROJECT (CMAG) OF NATIVE AMERICAN STUDENTS IDENTIFIED AS LEARNING DISABLED

Progress Report Summary October 2009

Project Description

Development of the **Closing the Mathematics Achievement Gap (**CMAG) Project was motivated by the fact that there is a disproportional number of Native American students identified as learning disabled who demonstrate limited mathematical understanding. The study hypothesis is that by preparing teachers of these students to effectively implement Cognitively Guided Instruction (to base their instruction on student understanding and to focus on the development of mathematical reasoning through problem solving) the students will perform significantly better on the reasoning–based Wisconsin Knowledge and Concept Exam. It is also hypothesized that this improved performance will reduce the achievement gap between Native American and non-Native students within the CMAG participating districts.

Two grant sources funded Year I of the CMAG Project, a WITQ Grant (Title I Part A) and a MSP Grant (Title II Part B). The WITQ Grant provided substantial funding for 16 teachers: four Wabeno School District teachers, four Crandon School District teachers, four Bowler School District teachers, two Seymour School District teachers, and two Green Bay School District teachers. A considerable amount of the cost incurred by these participants was paid with Title II B funds. The Title II Part B grant solely funded eighteen teachers. Nine additional teachers participated; eight funded by the Ho Chunk Nation, and one mathematics coach was funded by the Naytahwaush Charter School, Naytahwaush, MN. Participation of the Ho Chunk teachers was for professional development solely. The Naytahwaush mathematics coach's participation in the project is to prepare her to provide CGI workshop to the Naytahwaush K-8 teachers. All CMAG participant districts serve Native American reservation communities.

Teacher Assessment

Teacher Interview Analysis

Analysis of teacher interviews conducted during site visits revealed that Year I teachers shared many similarities:

*Most were veterans (17 years average experience).

*All were responsible for teaching mathematics to Native students identified as learning disabled.

*All lacked knowledge of the NCTM Content and Process Standards.

*The majority scored less than 60% on the Content pre-test.

*All of the of the special education teachers stated that they did not know how to prepare their LD students for the reasoning-based WKCE.

*Though six of the teachers had background knowledge about CGI, only two were routinely and effectively using this knowledge.

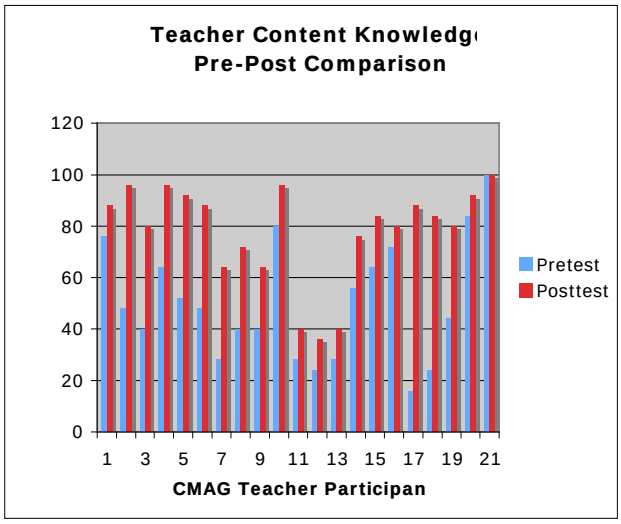
*Only one of the eight participating districts had fully implemented inclusion classrooms, and most of the regular education teachers were uncertain as to how to meet the needs of LD students.

Developing and Assessing Teacher Content Knowledge

During the first 5-day, August 2008, workshop, participants completed the Mathematics Content Knowledge Pre-Assessment, which consisted of 25 multiple-choice items. The items assessed elementary mathematic knowledge in the areas of whole number operations, fractions, decimals, percents, ratio/proportion, geometry, probability, data analysis, and algebra. The mean score of the mathematics content knowledge pre-assessment was 50.3% with a standard deviation of 22.9.

Teachers were post-assessed during the second 5-day workshop. The Mathematics Content Knowledge post-assessment also consisted of 25 multiple-choice items that were similar item by item to those on the pre-assessment instrument. The mean score of the mathematics content knowledge post-assessment was 77.9% with a standard deviation of 19.1.

A two-tailed, paired t-test showed that there was a significant improvement ($\alpha < .01$) in mathematics content knowledge from the pre-assessment to the post-assessment. These results were obtained from the 21 participants who completed both the pre-assessment and the post-assessment (following page).



CMAG Content Knowledge Pre-Post Comparison

Teacher Beliefs Survey

During the Level I workshop (August 4 - 8, 2008), participants completed a survey titled Teacher Beliefs and Knowledge. Analysis of this survey revealed that **not one** of the 31 teachers surveyed was able to list all of the NCTM Process and Content Standards. This finding is perplexing, considering the fact that long ago districts were mandated to developed curriculums aligning with the Wisconsin State Mathematics Standards and also given the fact that the WKCE is a standards-based assessment.

Teachers' Attributions of Student Improvement Survey

An email survey was sent to project teachers in September 2009 with two short answer questions:

> *Since beginning the CMAG Project, have you observed noticeable improvements in your students' mathematics performance and achievement? If so, what are the three main reasons for this improvement? Please begin with the one that you feel had the greatest influence.*

Twenty-three teachers replied, and an analysis of their responses revealed that all respondents believed that their students' math achievement had improved, and the commonly shared reasons were:

- Teachers are working more with other (mainstream) teachers.
- Instruction is not textbook and worksheet driven.
- Teachers are having students use manipulatives when solving problems.
- Teachers are using the chalkboard and whiteboards more.
- Teachers are asking more "Why" questions, even if the answer is correct.
- Teachers are having students work in groups, even if levels of understanding differ. They are having students work in teams, more students teaching students.
- They are giving more word problems and asking students to write their own problems.
- Students are learning how to process the steps, are thinking through math more.
- Students are writing number sentences and understanding what they mean. Students are thinking about what the problem is asking and not just adding numbers.
- Students are solving problems in different ways, trying new ways to solve.

Below is one teacher's verbatim email response:

The largest improvements have come in the area of self-confidence. The kids are not afraid to share or make mistakes. They can also solve more problems because they can do it any way they know how to instead of relying on the one procedure they had been taught in the past.

1. *They have been given permission to use their own thinking*
2. *The students are learning from each other.*
3. *They actually understand what they are doing and can explain it!*

Student Assessment

Student Content Knowledge Assessment and Attitude Assessment

At the beginning of Year I (September 2008), project teachers were asked to select five Native students identified as learning disabled to assess and track during the year. Parent consent for release of assessment data was requested and

granted.

During the CGI Level I workshop, August 4 – 8, 2008, teachers were trained in administering the CGI Word Problem Interview, the Base 10 Interview, and the Student Attitude Assessment, and in fall 2008, they were asked to pre-assess their students with these protocols.

During Project Year I, a number of teachers submitted post-test data but not pre-test data. However, though fewer data sets were submitted than anticipated, a sufficient number of set data (a sampling of 1/3 of the total population) was analyzed to determine whether students' problem solving and base ten understanding improved. Findings confirm that there was significant improvement.

Student Assessment Analyses

Assessment	N	# Points Possible	Pre- test Fall 08 M	Pre-test Fall 08 Sd	Post-test Spring 09 M	Post-test Sp 09 Sd	t	α
CGI Problem Solving	43	14	6.58	3.92	9.23	3.695	+4.24	<.001
Base 10 Interview	36	10	3.51	2.42	5.76	2.76	+6.10	<.001
Student Attitude	30	50	30.70	10.34	34.70	8.50	+2.60	<.014

Forty-three project students were assessed in the fall of 2008 and again in the spring of 2009 with the CGI Problem Solving Assessment. The mean score in the fall assessment was 6.58 with a standard deviation of 3.92. In the spring the mean score increased to 9.23 with a standard deviation of 3.70. A paired t-test indicated a significant improvement in problem solving performance from the fall to the spring of the following year (t= 4.24, $\alpha < .01$).

Thirty-six project students were also assessed in the fall of 2008 and again in the spring of 2009 with the Base Ten Assessment. The mean score in the fall assessment was 3.51 with a standard deviation of 2.42. In the spring, the mean score increased to 5.76 with a standard deviation of 2.76. A paired t-test indicated a significant improvement in Base Ten understanding from the fall to the spring of the following year (t= 6.10, $\alpha < .01$).

Thirty project students were furthermore assessed in the fall of 2008 and again in the spring of 2009 with the Mathematics Attitude Assessment. The mean score in the fall assessment was 30.7 with a standard deviation of 10.3. In the spring, the mean score increased to 34.7 with a standard deviation of 8.50. A paired t-test indicated a significant improvement in attitude toward mathematics from the fall to the spring of the following year at the .05 level of significance, but not at the.01 level (t= 2.60, $\alpha = .014$).

Wisconsin Knowledge and Concept Exam (WKCE) Performance

The WKCE Mathematics scores of 34 fifth through tenth grade students (years 2007 to 2009) were analyzed. The WKCE rates students' overall performance as being Minimal, Basic, Proficient, or Advanced. In order to determine whether improvement from the '07-'08 academic year to the '08-'09 academic year was statistically significant, these categories were converted to the numerical scores 1, 2, 3, and 4 respectively. The mean score in the Mathematics 2007 assessment was 1.44 with a standard deviation of 0.82. The Mathematics 2008 assessment mean score increased to 1.85 with a standard deviation of 3.70. A paired t-test indicated a significant improvement in WKCE Mathematics from the 2007 assessment to the 2008 at ($\alpha < .01$). Furthermore, it was noted that of the 34 students, 13 improved by moving into a more highly rated performance category (e.g. Minimal to Basic, etc.), while only 2 students declined and 19 remained in the same category.

Sampled students' performance on WKCE Mathematics, 2005-2008 Administrations

	WKCE Scores								
	Advanced		Proficient		Basic		Minimal		Valid N
	n	%	n	%	n	%	n	%	n
Math									
2005	1	0.9	3	2.7	2	1.8	7	6.2	13
2006	0	0	5	4.4	2	1.8	8	7.1	15
2007	0	0	5	4.4	9	8.0	30	26.5	44
2008	1	0.9	13	11.5	14	12.4	20	17.7	48