

RESEARCH PROJECT PROPOSAL

**TITLE OF THE PROJECT: DEVELOPMENT OF A MATH LABORATORY AT
THE PROFESSIONAL DEVELOPMENT SCHOOL (PDS)**

Presented to the Faculty Development Committee

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PROJECT SUMMARY

This project is being developed for the purpose of funding a math laboratory to be set up during the 2002-2003 school year where preservice (college students) will work with at-risk K-5 students at the Professional Development School (PDS) at Jackson Elementary School. Professional Developments Schools (PDS) are public school settings in which a school district and a college/university partner to provide on-site educational courses and field experiences for preservice (college students) teachers that are integrated with on-going professional development for inservice (certified) teachers. The math lab at the school will benefit mathematics education because of its two-fold purpose. The first being a change in self-efficacy towards math for the at risk K-5 students and the preservice teachers and the second an improvement in mathematics communication for both groups.

Working in conjunction with at-risk K-5 students, these preservice teachers will have many rich opportunities to grow in the areas specified by the NCTM math communications standard. Through these opportunities they will “organize and consolidate their mathematical thinking, communicate their mathematical thinking coherently and clearly to peers, teachers and others, analyze and evaluate the mathematical thinking and strategies of others, and use the language of mathematics to express mathematical ideas precisely.” (NCTM, 2000) An additional benefit to this project would be that the teachers at the school would be able to see firsthand the results of working with the students in the math exploratory lab. They will be able to adapt the procedures and methods to their own classrooms to bring about more effective mathematics communication with their students.

NARRATIVE

Current Situation

As teacher educators, we believe that school districts have “paid closer attention to math instruction than reading” because the National Council of Teachers of Mathematics (NCTM) Standards explicitly have been communicated and integrated in math curriculum and teaching methods. However, since the revision of the Principles and Standards, school districts and colleges of education have had to re-examine their curriculums to include this second wave of reform. One area, in which we have noted a lack of research, as well as preparedness on the part of preservice (college students) teachers studying to become elementary school teachers, is in the area of math communication skills. Although many math researchers have noted the importance of teacher discourse practice to constructivist teaching in math (Inagaki, Morita, & Hatano, 1999; Wood, Cobb, & Yackel, 1990) and student motivation for mathematics (Hatano,

1988; Kloosterman & Gorman, 1990), there remains a dearth of research about effective ways to help teachers become math communicators.

Developing mathematical communication skills, especially among non-math majors, has many potential challenges. One such challenge is the common belief among preservice teachers that they are “not good at math” and have difficulty explaining their thinking.” In many cases these novice teachers may have experienced math programs that emphasized algorithms and completion over process and understanding. And in most cases, they represent women who chose to have minimal exposure to math coursework, so important to subject-matter knowledge (Stein et al., 1990). Therefore, an equally important goal in improving mathematical communication skills is providing opportunities for teachers to build their teaching efficacy regarding mathematics. Thus, the proposed study examines this potential within an elementary school based “math lab” for supporting the development of mathematics communication and teaching efficacy for preservice teachers. The simultaneous co-product of this investigation is the potential to help at-risk K-5 students develop their mathematical communication skills and math efficacy (Nicholls, Cobb, Wood, & Yackel, 1990) through activity-based experiences.

Project Plan

This research study will be completed with two parallel studies. The first study will focus on the preservice teachers enrolled in a K-8 math methods course at Elmhurst College, EDU330 -- Math for Elementary and Middle School Students. The second study will focus on the K-5 elementary students at Jackson Elementary School participating in the math lab sessions. Jackson Elementary School is partnering with the Education Department at Elmhurst College to form a Professional Development School (PDS) and thus a collaborative relationship as well as vacant instructional space that provides a unique opportunity for this project. In sum, the research project has two guiding goals -- mathematical efficacy and communication. The first goal is to discern the changes in math self-efficacy in both the K-5 students and preservice teachers. The second goal is to examine if the K-5 students and preservice teachers participating in a math lab, which is centered on reflective activities and mathematics communication skills, improve as math communicators.

Preservice teacher growth and development in mathematical teaching efficacy and communication.

The two research questions pertaining to the preservice teachers are as follows: Do the preservice teachers increase in their mathematical teaching efficacy (i.e., their belief that they can teach math effectively to all children)? Do the preservice teachers' math communication skills improve as a result of tutoring K-5 students in the math lab? This research study will investigate two classes of math methods college students (approximately 24 preservice teachers per class). The research group will be the preservice teachers in a math methods course (EDU 330) that will be taught on site at the cooperating school. They will be involved in the math lab at the school for a fifteen-week semester. The comparison group will be the preservice teachers in a second section of the same math methods course (EDU 330), taught by the same instructor and using the same syllabus and materials, but taught in the traditional college classroom. These preservice teachers will complete the same number of field hours as the experimental

group, but will chose *where* and *how* they wish to complete their field experience hours in math instruction.

K-5 students' growth and development in mathematical efficacy and communication.

The second part of the proposed study will involve the students at Jackson Elementary School from grades K-5, who do not meet the mathematical grade level standards. The research questions for these students are as follows: Does the involvement with the math lab improve the students' self-efficacy towards math? Do the students' math journals reflect growth in mathematical communication? The changes in self-efficacy will be measured by a pre- and post-survey using a modified version of the PALS Self-Efficacy Subscale for students (Midgley & Maehr, 1991). To determine growth in the students' math journals, journal entries will be scored by two independent raters (experienced teachers) on a five point rubric based on the NCTM standard for communication: (a) organization of mathematical thinking, (b) clear communication of mathematical thinking, (c) analysis and development of mathematical thinking and strategies; and (d) correct usage of the language of mathematics.

Faculty Expertise

The reason that I am presenting this proposal is that I have background and expertise in mathematics education. During my career in the San Diego Unified School District, I was an exemplary math teacher as I taught fifth and sixth grade gifted students in elementary school higher level mathematics such as high school geometry and algebra. I worked with teachers at my school and other schools in formulating programs for at-risk students. I was a mentor teacher from 1986 until 1994 and my specialty in this position was to go into classrooms where elementary teachers were having difficulty with math instruction and help revise their instructional techniques so they were employing more up to date methods and manipulatives. As a mentor teacher, I presented math workshops to elementary teachers in the new methods of teaching math.

Because of this background, since I have come to Elmhurst College, I have been instructing the math methods course to preservice teachers. My classes have been successful, as many students have commented to me that they feel very secure in their math instruction when they are student teaching. Feelings of "math anxiety" also have been either lowered or completely erased as a result of the instruction that they have received in EDU 330.

Evaluation

Evaluation of Preservice (college students) teachers growth and development in mathematical efficacy and communication

Both groups of preservice teachers (EDU 330) will be given a modified version of the Personal Teaching Efficacy subscale from the *Patterns for Adaptive Learning Survey* (PALS, Midgley & Maher, 1991) as a pre- and post- survey and their ratings will be compared at the beginning and the end of the project. For the second research question both groups of preservice teachers will be videotaped during their initial tutoring sessions with the K-5 students in September 2002 and again during the final tutoring sessions during December 2002. For both times (pre- and post-) the tutoring sessions will be scored by two independent raters (experienced teachers) on a five point rubric based on the NCTM standard for communication: (a) organization of mathematical thinking, (b) clear communication of mathematical thinking, (c) analysis and development of mathematical thinking and strategies; and (d) correct usage of the language of mathematics.

Evaluation of K-5 students' growth and development in mathematical efficacy and communication.

The second part of the proposed study will involve the students at Jackson Elementary School from grades K-5, who do not meet the mathematical grade level standards. The research questions for these students are as follows: Does the involvement with the math lab improve the students' self-efficacy towards math? Do the students' math journals reflect growth in mathematical communication? The changes in self-efficacy will be measured by a pre- and post-survey using a modified version of the PALS Self-Efficacy Subscale for students (Midgley & Maehr, 1991). To determine growth in the students' math journals, journal entries will be scored by two independent raters (experienced teachers) on a five point rubric based on the NCTM standard for communication: (a) organization of mathematical thinking, (b) clear communication of mathematical thinking, (c) analysis and development of mathematical thinking and strategies; and (d) correct usage of the language of mathematics.

Dissemination

The research results from this project will be appropriate to present at the following local and national conferences:

- 1.) Association of Supervision and Curriculum (ASCD) - April 2003
- 2.) Association of Teacher Education (ATE) - February 2003
- 3.) National Council of Teachers of Mathematics (NCTM) - April 2003
- 4.) Elmhurst College Research Symposium – March 2003
- 5.) Illinois Association of Teacher Education

The research can be further disseminated in articles published in the *Journal of Research in Mathematics Education*, *Journal of Educational Research*, *Journal of Teacher Education* and *Educational Leadership*. The journals that are published by NCTM would also be an appropriate avenue for research from this study.

TIME LINE

Plan and Project Timeline.

This research project will begin in June 2002 and conclude in June 2003. The data collection will be carried out from September 2002 through December 2002. The analysis of the data will take place during the period from January 2003 through May 2003. Materials will be purchased and the lab will be organized during the summer months of June, July, and August. Preservice (college students) teachers in both sections of math methods course (EDU330) will be given the mathematical teaching efficacy subscale and will be trained to tutor students during September 2003. Both groups of preservice teachers will be exposed to the NCTM standards and strategies for improving mathematical communication, including the hands-on materials used in the math lab. The at-risk K-5 students will be given the math self-efficacy subscale during September 2003. These students will begin participating in the lab for tutoring sessions beginning October 1, 2002, continuing through May 2003. The preservice (college students) teachers will be videotaped in early October to evaluate their baseline math communication skills.

At the conclusion of each tutoring session in the lab, the at-risk K-5 students will write in their math journals regarding the concepts, processes, strategies, and learning outcomes of their math lab activities. Every two months the journals will be checked against the communication rubric to record their progress. In December the preservice teachers in both math methods courses and all at-risk K-5 students will be given the self-efficacy subscales as post-assessments. The preservice teachers will be videotaped for a second time giving a math lab tutoring session or practice tutorial in class and rated on their mathematical communication skills. Growth from the pretest videotape to the posttest videotape will be assessed using the rubric as outlined previously. The at-risk K-5 students will be given a second self-efficacy post-survey in May 2003, at the end of a full year of participation in the math lab.

BUDGET

Item	Descriptions	Cost
NCTM Standards Book, CD-ROMs and Videotape	Tutor training materials (2 sets)	\$210.00
Commerical materials for number operations	Materials to help students with the basic processes of addition, subtraction, multiplication and division.	\$320.00

Commerical materials for problem solving	Materials to help students build critical thinking, analysis and problem solving skills	\$440.00
Math Manipulatives	Hands-on materials to use in teaching the preservice teachers math methods and for the math lab with the K-5 students	\$1,320.00
AV Project	3M portable overhead projector with cart and screen	\$570.00
Calculators	To be used for problem-solving	\$140.00
Storage Cart	Cart to be used for storing math manipulatives	\$500.00
Total Cost		\$3500.00

CURRENT AND PREVIOUS GRANTS

Toshiba Foundation Grant Co-authors: Sheila Mehigan and Debra Meyer

This grant was funded to initiate a Mathematics Exploratory Laboratory at Jackson Elementary School/Professional Development School {PDS} for Spring 2002. The \$878 grant was awarded to purchase materials for third, fourth and fifth grade students at Jackson to develop a math exploratory lab.

Illinois Campus Compact Funding Award Primary Author: Kathy Sexton-Radek Secondary Author: Sheila Mehigan

This grant was funded for the purpose of applying academically appropriate materials about conflict resolution skill development with third, fourth and fifth graders during the school year 2001-2002. The award was given for \$1100 with matching funds from Elmhurst College.

Edward G. Begle Grant Co-Authors: Sheila Mehigan and Debra Meyer

This grant was written for \$8000 and submitted for the purpose of funding the math laboratory at Jackson School/Professional Development School (PDS). It was written to fund the research study with the students from EDU 330. This grant was not funded.

PRESENTATIONS

“Internet Sites for Gifted,” Illinois Association for the Gifted Conference, Chicago, IL, February, 1999.

Validation of the Impact of the Multiple Intelligences Theory on Female Secondary Students in a Private School, Loyola University of Chicago Research Symposium, Chicago, IL, April, 1999.

Validation of the Impact of the Multiple Intelligences Theory on Female Secondary Students in a Private School, Loyola University of Chicago Doctoral Seminar, Chicago, IL, May, 1999.

“Rubric Development for Skills Required for First Year Teachers,” Association of Teacher Educators, Denver, Colorado, February, 2002 (Conference presentation developed with Dr. Mary Selke and Professor Judy Fiene, but I was unable to present due to illness.) February, 2002.

“Strategies in Problem-Solving for Primary Grade Students,” Workshop presented for Certified Teachers in the Satellite Program. Elmhurst College, March, 2002.

PUBLICATIONS

Mehigan, Sheila (1999) Validation of the Impact of the Multiple Intelligences Environment on Female Secondary Students in a Private School. Loyola University Press.

Mehigan, Sheila (1995). “Home Schooling for the Gifted.” *Update*, San Diego Association for the Gifted Newsletter.

Mehigan, Sheila (1990-1994). Editor-*Update*, San Diego Association for the Gifted Newsletter

Mehigan, Sheila (1987). “Innovative Ideas for Open House.” National Education Association Publication, May.

In Revision

Mehigan, Sheila (2001). “What is the Impact of the Multiple Intelligences Environment on Female Secondary Students?” Journal of Educational Research.

In Process

Mehigan, Sheila (2002). “Elmhurst College Satellite Program: A Unique Field Experience.” Educational Leadership.

**Earl and Members of the Faculty Research Grant Committee,
good afternoon. Just a quick note in support of Dr. Sheila Mehigan's
research grant proposal. The grant funds would be used for a project
that addresses triplicate needs in our state: on-going professional
development of teachers in the state-identified high need area of
mathematics education; hands-on, field-based preparation of pre-service
elementary education students in the content area of mathematics; and
additional support for innovative ways to increase the learning of
Illinois's children in the key area of mathematics. The proposed grant
project also builds on a partnership connection with an emergent
professional development school, Jackson Elementary School, in District
#205. I wholeheartedly endorse the proposed project and am confident
that Dr. Mehigan and her students would benefit from your support as
well.**

**Cordially,
Dr. Mary Selke
Professor and Chair
Department of Education
Elmhurst College**