

## **Mathematics Teaching Classroom Manipulatives**

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**Approved by:** Dr. Gary Lewandowski  
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**Amount of Request:** \$2,500

### **Abstract:**

This proposal requests funds for the acquisition of mathematics manipulatives. The manipulatives will be used primarily in the training of early and middle childhood mathematics teachers. This training will simultaneously deepen their understanding of elementary school mathematics, demonstrate how they can use these manipulatives in their future classrooms, and attend to the mathematics anxiety many of these students have. This proposal directly addresses the goals of the Women of Excellence. It focuses on a predominantly female audience of students and the training received by these students will allow them to serve as positive female role models for young children, breaking the cycle of those who believe women cannot succeed at mathematics.

## Budget

Prices come from the catalog of **EAI Education**, the likely vendor for these items.

Item	#	Page	Price Each	Total
<b>Geometry</b>				
5 Sets – Conic Sections	9MS-532477	89	23.50	117.50
5 Sets – GeoModel Folding Solids	9MS-531832	87	33.95	169.75
3 Sets – Polydron Geometry Set	9MS-530296	90	89.50	268.50
5 Sets – Geometric Volume Shapes	9MS-530001	88	12.50	62.50
Set of 30 – GeoMirror	9MS-532981	84		69.95
25 Hinged Double Mirrors	9MS-530302	84	4.25	106.25
9” Two-Sides Geoboard Class Kit	9MS-560063	81		109.50
<b>Measurement</b>				
3 Sets of 10 Protractors 6”	9MS-533066	77	2.60	7.80
3 Sets of 10 Rulers 12”	9MS-530825	68	3.60	10.80
25 Helix Graduate Compasses	9MS-531230	76	1.55	38.75
5 Trundle Wheels	9MS-533057	67	14.95	74.75
3 Sets of 10 Tape Measures	9MS-531485	67	4.30	12.90
5 Stopwatches	9MS-40113	14	8.95	44.75
<b>Probability</b>				
Set of 36 Dice	9MS-530082	64		3.95
Polyhedra Dice Set of 60	9MS-531345	62		16.95
<b>Number Sense</b>				
Two-Color Counters Set of 200	9MS-530097	60		7.95
¾” Transparent Counters Set of 250	9MS-525005	18		2.50
5 Sets (250) Pattern Blocks	9MS-531007	20	16.50	82.50
Fraction Rods	9MS-531349	53		174.95
Unifix Cubes Set of 500	9MS-531128	24		47.95
Base Ten Blocks Class Set	9MS-531219	30		148.50
<b>Algebra</b>				
5 Sets – VisuAlgebra Blocks	9MS-532476	100	28.50	142.50
Algebra Tiles Classroom Kit	9MS-533160	99		82.95
30 Scissors				150.00
Storage Containers				200.00
Storage Cabinets				300.00
				<b>2454.40</b>

## **Narrative:**

This proposal seeks funds to purchase classroom manipulatives for the mathematics content courses for elementary education majors. These courses for early and middle childhood preservice teachers have been a major portion of my teaching load for over fifteen years. About 95% of the early childhood and 80% of the middle childhood majors are women. Mathematics can be a difficult subject for many of these education majors, especially those in early childhood and middle childhood without a concentration in mathematics. I hear comments like “math is too hard for me,” “I just can’t do math,” “I’ll never get it,” and “I don’t like math.” I have even heard the comment that “guys are better than women at mathematics.” In their experiences with mathematics, most have tried to memorize a set of rules, formulas, or algorithms which ultimately have no meaning for them. They have no understanding of why the algorithms or formulas are needed or what they could do for them. This raises the concern that misconceptions and attitudes will be communicated to the young children they will teach and the math phobia will propagate. Research shows that elementary preservice teachers have high levels of mathematics anxiety (Battista, 1986; Gresham, 2004; Kelly & Tomhave, 1985; Singh, Granville, & Dika, 2002; Sovchik, Meconi, & Steiner, 1981; and Vinson, 2001; Zettle & Raines, 2002). Research also shows that “Math-anxious teachers can result in math-anxious students” (Martinez, 1987, p. 117). The National Council of Teachers of Mathematics Standards (2000) advise that “good teacher actions” include “selecting and using suitable curricular materials, using appropriate instructional tools and techniques, and engaging in reflective practice and continuous self-improvement.” In the study, *A Comparison of Preservice Teachers’ Mathematics Anxiety Before and After a Methods Class Emphasizing Manipulatives* (2001), Vinson found that overall math anxiety was reduced in a preservice teachers’ methods course using mathematics manipulatives. The preservice teachers also indicated that they were better able to understand the mathematics concepts and procedures when they were presented on a concrete level.

Dr. Danny Otero and I have recently revised the mathematics content curriculum for elementary education majors with a grant through the Ohio Higher Education Network. Dr. Debora Kuchey, Dr. Joy Moore and I have been working on assessing the impact of these courses with a research mini-grant from the West EXCEL Center for Excellence. The six new courses developed are restricted to elementary education majors only and are designed to deepen the student’s understanding of the mathematics of the elementary classroom. For example, most of us have an understanding of place value and know how to add, subtract, multiply, and divide, but we rarely have to think about how to communicate those ideas to someone who has no concept of place value or any of the operations. What does it mean to divide a fraction by a fraction?

Since young children are very visual and tactile, these ideas are best communicated through the use of manipulatives that students hold, touch, and explore. With this grant, I want to purchase sets of manipulatives explicitly for the mathematics content courses for elementary education majors. They could, however, be used for any mathematics course. For example the conic sections or geometric solids and building sets could be used in our mathematics majors’ geometry courses. The algebraic manipulatives could be used in the mathematics courses for high school education majors or in our Fundamentals (MATH 105) or Elementary Functions (MATH 120) courses. It is possible that more probability tools would be useful for our Elementary Statistics (MATH 116) courses. When I have used some of these manipulatives in the education content courses, students remark how they wished they had been able to use these when they were learning the concept. The ideas were finally making sense to them.

I will seek grant money outside of the university to eventually acquire and equip a room on campus, perhaps in the newly renovated Alter Hall, to use as a Mathematics Teaching

Lab/Classroom. This room would serve all of the elementary mathematics content courses for education majors. It would have storage areas for the manipulatives, calculators and calculator based laboratory equipment. Tables would be easily arranged for both group work with the manipulatives and individual work. The classroom would also be equipped with computers for educational software such as the Geometer's Sketchpad which is used frequently in the geometry courses and internet virtual manipulatives. When not in use for the education content courses, it would serve as a much needed mathematics computer lab for other courses in the Mathematics and Computer Science Department. In the meantime, the manipulatives will be stored in cabinets in faculty offices.

I believe this request meets the mission and purpose of the Women of Excellence Giving Circle and Xavier's mission in many ways. First it is focused on women students because these courses have a very high percentage of female students. Elementary teachers are predominately women. Currently each semester we have three sections of these courses with 15-25 students in each section. By engaging and forming these students in Xavier's classrooms, they will be better prepared to teach the young children of our community. They will feel more confident about their abilities in mathematics and less fearful of the subject. As a result, the women will be a positive feminine role model for the children they guide. As teachers, they will affect countless numbers of children. Mathematics in the United States is a subject that needs both good teachers and good examples for girls. A study found that Asian and European countries are doing a better job at cultivating the skills of girls with mathematics ability. One author of the study says "the culture [in the U.S.] has become almost anti-math" (Andreescu, 2008).

Debbie Kuchey, Joy Moore, and I have found, through our current research, that it is not easy to assess the impact of these courses. One of the items we have used is a Mathematics Teacher's Self Efficacy Belief Instrument adapted from the Science Teaching Efficacy Beliefs Instrument developed by Enoch and Riggs. It is used to measure the teachers' judgment of their self-efficacy in teaching mathematics. Since we are hoping to both develop students' intellectual understanding of elementary mathematics and form more positive attitudes about mathematics, an adaptation to this Self Efficacy Belief Instrument would be a possible way to determine attitude changes after the use of the manipulatives. We are also currently using a testing instrument from the Center for Research in Mathematics & Science Teacher Development at the University of Louisville as a pre-test and post-test in the middle childhood classes. We are waiting for more grant money from West EXCEL to continue these tests.

If the purchase of these mathematics manipulatives is funded by the Women of Excellence Giving Circle, the containers can be marked as "***Acquired by a grant from the Women of Excellence Giving Circle.***" When we eventually get a Mathematics Teaching Lab/Classroom, a plaque on the wall would be posted to note our thanks to the Women of Excellence Giving Circle. I also would be willing to present our project results, if funded.