



Research Brief

Math Interventions

Question: What can schools do to help improve Mathematics achievement?

Summary of Findings:

Schools are continually faced with the challenge of helping students improve their motivation and attitude toward mathematics, as well as, advance their performance and achievement in that subject. The following interventions have been shown to improve student motivation to do mathematics and/or math achievement:

- a modification of the curriculum to include application and real-life math problems
- a restructuring of the teachers daily lesson plans to implement a variety of teaching strategies
- enrolling in more college preparatory math classes
- having the teacher acquire old ACT tests and use them for problems of the day
- an increase in writing both reflective and content journals
- using cooperative groups
- a curriculum redesign that minimized tracking
- a constructivist teaching approach
- establishing a community of learners
- place-based learning

Further, research has shown that increased use of the graphing calculator enhances students' understanding of mathematical concepts and improves problem-solving abilities. Use of the graphing calculator also fosters positive attitudes among both students and teachers. Other schools have found success using online virtual manipulatives such as those at the National Museum of Virtual Manipulatives for Interactive Mathematics.

Offering monetary awards was ineffective at improving performance.

Online Resources:

(Note: ERIC documents can be found by going to <http://www.eric.ed.gov/> and entering the ERIC ID#)

Principles and Standards for School Mathematics (NCTM)

Executive Summary

Principles and Standards for School Mathematics outlines the essential components of a high-quality school mathematics program. It calls for and presents a common foundation of mathematics to be learned by all students. It emphasizes the need for well-prepared and well-supported teachers and administrators. It acknowledges the importance of a carefully organized system for assessing students' learning and a program's effectiveness. It also underscores the need for all partners— students, teachers, administrators, community leaders, and parents—to contribute to building a high-quality program for all students. Six Principles for School Mathematics include: Equity, Curriculum, Teaching, Learning, Assessment, and Technology.

http://www.nctm.org/standards/12752_exec_pssm.pdf

National Council of Teachers of Mathematics (NCTM)

<http://www.nctm.org/>

NCTM online resources for High School Math Teachers

http://my.nctm.org/eresources/school_level.asp?lv=3

National Museum of Virtual Manipulatives for Interactive Mathematics

This is an NSF supported project of uniquely interactive, web-based virtual manipulatives or concept tutorials, mostly in the form of Java applets, for mathematics instruction (K-12 emphasis).

<http://nlvm.usu.edu/en/nav/vlibrary.html>



Research Brief

Improving High School Students' Mathematics Achievement through the Use of Motivational Strategies.

Portal, Jamie; Sampson, Lisa;

This report describes a program for motivating students in mathematics in order to improve achievement at the high school level. The targeted population consisted of high school students in a middle class community located in a suburb of a large metropolitan area. Two major categories of intervention were selected: a modification of the curriculum to include application and real-life math problems, and a restructuring of the teachers daily lesson plans to implement a variety of teaching strategies. Post data was gathered to determine whether the intervention improved student motivation. It was discovered that the implemented strategies improved positive behaviors in the classroom. Slight improvements were also observed in student attitudes towards mathematics.

ERIC #: ED460854

A Study of the Effects of Test Preparation Programs on ACT Mathematics Scores.

VanScoy, Ted L.;

Colleges and universities are using the ACT test as a tool to help decide which students are awarded scholarships, admitted into programs, and declared eligible to participate in athletics. The purpose of this study was to see if students could improve their ACT mathematics score during junior year. A comparison was made of 52 Ritchie County High School students' mathematics scores on the October, 1995 PLAN (Pre-ACT) test to the mathematics scores on the April, 1997 ACT test. It was concluded that the best way students can improve their math scores is to enroll in more college preparatory math classes. Another way students can improve their scores is to have the teacher acquire old ACT tests and use them for problems of the day.

ERIC #: ED416098

Monetary Incentives for Low-Stakes Tests. CSE Report 625

O'Neil, Harold F.; Abedi, Jamal; Lee, Charlotte; Miyoshi, Judy; Mastergeorge, Ann;

US Department of Education

Recent information on international assessments (e.g., the Third International Mathematics and Science Study) indicates that 12th-grade students in the United States are doing extremely poorly on such assessments compared with their peers in other countries. These poor results are usually attributed to cognitive factors such as students' opportunities to learn. However, a partial explanation of these results may be motivational. Because the low-stakes tests were administered in these 12th-graders' final year in high school, this timing may have negatively affected motivation, and thus performance. Using money as an incentive (\$10.00 per item correct), on a test using the Third International Mathematics and Science Study (TIMSS) released math items, the amount of money per item correct was manipulated, so as to increase a motivational effect and thus increase performance. A focus group, pilot study, and main study were conducted. The monetary incentive was not effective in improving performance.

ERIC #: ED483391

Improving Student Attitudes and Performance in Mathematics.

Olson, Kirsten Ann;

This report describes a program for improving attitudes towards mathematics and problem solving in order to improve performance in these areas. A review of solution strategies suggested by knowledgeable others and an analysis of the problem setting resulted in the development of a three-pronged intervention utilizing an increase in realistic application problems, an increase in writing both reflective and content journals, and the use of cooperative groups. The benefits of these aspects of the intervention are to increase student interest and motivation as well as encourage students to solve problems not by memorization and regurgitation but by understanding the concepts and how to apply them. Post intervention data indicated an improvement in both student attitudes and student level of performance in mathematics. Teacher anecdotal records and post intervention student surveys support the change in student attitudes. The increased level of performance was documented through application problems and content journals. The program described in this report was successful in achieving both of its desired outcomes.

ERIC #: ED436354



Research Brief

A Curriculum Redesign in Response to Students' Anxiety to Math Competencies at the Secondary Level.

Morgan, Susan;

This action research project was designed to increase students' math competencies and reduce math anxiety in targeted high school classes in a Midwestern suburb. Factors influencing students' math achievement included self-perceptions of math competence, teachers' perceptions of students' abilities, and an overemphasis on remediation which left students unchallenged and behind their peers (Fiore, 1999). Curriculum redesign is one way of improving students' confidence and competence in their math abilities (Alleksaht-Snider and Hart, 2001). Given this, a curriculum redesign was selected as an intervention for this study. A review of solution strategies suggested within the literature, combined with an analysis of the setting, resulted in the selection of three primary solutions to be used as interventions: (1) a curriculum redesign that minimized tracking; (2) a constructivist teaching approach; and (3) the establishment of a community of learners. Data also revealed that students in the targeted groups were successful as a result of curriculum redesign.

ERIC #: ED482912

Achieving Academic Goals through Place-Based Learning: Students in Five States Show How To Do It.

Loveland, Elaina;

Rural Roots, v4 n1 p1, 6-11 Feb 2003

Place-based education roots learning in real issues and needs and helps students become both academic achievers and good citizens. This article profiles programs in five states that are fostering academic achievement. The Alaska Rural Systemic Initiative (AKRSI) links Alaska Native culture and indigenous knowledge with the formal educational system and develops specialized curricula to relate basic math and science concepts to the local environment. The Russian Mission School dramatically improved test scores and student attendance and dropout rates after local subsistence activities and Native culture were tied to the curriculum. In Tillamook, Oregon, students worked with the Oregon Department of Forestry to survey the status of logged areas and to create an interpretive walkway featuring animal tracks in concrete. At Guffey Community Charter School (Colorado), students help to gather astronomical data and monitor meteors as part of a Denver museum program. Albion, Nebraska, high school students in an entrepreneurship class raised funds to purchase and renovate an old theater and operate the theater on weekends. In Ojai, California, a Hispanic student-initiated club matches student tutors with students who need help in math, English, or computers.

ERIC #: ED473969

Improving Student Knowledge of the Graphing Calculator's Capabilities.

Hubbard, Donna;

This paper describes an intervention in two Algebra II classes in which the graphing calculator was incorporated into the curriculum as often as possible. The problem of a lack of understanding of the capabilities of the programmable graphing calculator were documented through student surveys, a graphing calculator pre-test, and direct teacher observation. Research has shown that increased use of the graphing calculator enhances students' understanding of mathematical concepts and improves problem solving abilities. Use of the graphing calculator also fosters positive attitudes among both students and teachers. Post intervention data indicated an increase in students' understanding of the functions and capabilities of the graphing calculator.

ERIC #: ED422175

Submitted Date: 12/13/05 By: Mike Muir, Maine Center for Meaningful Engaged Learning

<http://www.principalspartnership.com>

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