Graphing Calculators

Why Is This Strategy Useful?

Graphing calculators can be promising tools for enrichment in mathematics education. They allow students to visualize mathematics and make connections that might otherwise be missed. Research shows that using graphing calculators can lead to higher achievement among students due to the increased use of graphical solution strategies, improved understanding of functions, and increased teacher time spent on presentation and explanation of graphs, tables and problem solving activities. Graphing calculators can be used as: (1) tools for expediency, (2) amplifiers for conceptual understanding, (3) catalysts for critical thinking, and (4) vehicles for integration. Although the evidence supporting the use of calculator technology is not unanimous or conclusive, it does suggest that, when used appropriately, calculators assist in increasing conceptual and procedural knowledge of mathematics. This strategy is best-suited for general education high school students.

Description of Strategy

Calculators should be carefully integrated into the classroom to strengthen the mathematical skills of high school students. Teachers should design lessons that integrate calculator-based explorations of mathematical problems and mathematical concepts with regular instruction. In order to make sure graphing calculator instruction is accessible to high school students with and without learning problems, teachers can utilize the following strategies:

- Use mnemonic strategies to help students memorize steps and procedures.
- Present directions for using the graphing calculator in handouts, lecture, and emulator software
- Present models and scaffold instruction for new procedures and problems using the graphing calculator
- Break down the steps in long problems involving graphing calculators, and provide additional practice and review
- Have students demonstrate and explain problems on the calculator to check understanding
- Encourage students to ask questions about the steps for using graphing calculators for problem solving
- Use real life examples to explain the use of the calculator and also for the practice problems

Research Evidence

At least one meta-analysis supports the use of this strategy. This was a meta-analysis of 54 high-quality studies, 22 of which specifically focused on graphing calculators. This analysis looked at the effects of calculator use on students' performance in five skill areas: conceptual, computational, operational, problem solving and selectivity. For those using calculators during instruction, performance was measured and compared between students who both did and did not use calculators during assessment. Additionally, survey data was collected on students' attitudes toward mathematics and related to calculator usage. There were three main findings:

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• Students who received instruction using graphing calculators performed as well or significantly better in conceptual, problem solving and operational skill areas.

• Students using calculators during instruction – but not during assessment – performed as well or better in all five mathematics skill areas. This key finding also indicates that student mathematics skills did not suffer even without calculator use specifically during assessment.

• Students using calculators had better attitudes toward mathematics than their noncalculator-using counterparts.

Sample Studies Supporting this Strategy


The findings of 54 research studies were integrated through meta-analysis to determine the effects of calculators on student achievement and attitude levels. Effect sizes were generated through Glassian techniques of meta-analysis, and Hedges and Olkin's (1985) inferential statistical methods were used to test the significance of effect size data. Results revealed that students' operational skills and problem-solving skills improved when calculators were an integral part of testing and instruction. The results for both skill types were mixed when calculators were not part of assessment, but in all cases, calculator use did not hinder the development of mathematical skills. Students using calculators had better attitudes toward mathematics than their noncalculator counterparts. Further research is needed in the retention of mathematics skills after instruction and transfer of skills to other mathematics-related subjects.

Additional Resources


Useful & Powerful Graphing Calculator. [http://www.mste.uiuc.edu/courses/ci407su01/students/south/ychen17/termproject/graphingcal.html](http://www.mste.uiuc.edu/courses/ci407su01/students/south/ychen17/termproject/graphingcal.html)

Sample Activity

Source: Graph This! [http://www.teacherlink.org/content/math/activities/gc-graphthis/guide.html](http://www.teacherlink.org/content/math/activities/gc-graphthis/guide.html)