Assessing Students' Conceptual and Procedural Learning for Graphing Lines and Functions through Application Problems.

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Introduction

Students have difficulties with problem solving in various subjects because their conceptual understanding (comprehension of mathematical concepts, operations, and relations) of these subjects, and related procedural knowledge (skills in carrying out procedures flexibly, accurately, efficiently, and appropriately) are not established and supported enough in mathematics instruction. Today's employers are looking for professionals that are able to generate, process, and interpret written and quantitative data to improve on existing processes. Employees with these skills will result in greater efficiency and cost savings for the company generating better conditions for both the employee and the employer. Therefore, employees' ability to analyze such data correctly is crucial for their future success. They need to be able to explain and quantify the logic behind their findings to other colleagues and superiors, in a way that is understandable by all stakeholders involved.

The purpose of my research was to increase my students' conceptual and procedural understanding of graphing functions by modifying my lesson plans to incorporate relevant application/word problems.

I identified two different problems for graphing (piecewise functions and exponential decay/growth functions) and taught these concepts by integrating application and word problems into my lesson plans. I collected and analyzed data from 30 Algebra 2 students during a period of 2-3 weeks.

Findings

Real life connections through application problems helped increase student motivation. Application problems also increased the "likeability" of math concepts in students' minds. Increased student interest in math concepts helped overall student learning both conceptually and procedurally. The main areas of improvements in student learning were:

- ❑ Increased conceptual understanding of different types of graphs and their components, such as meaning of slope of a line and relationship between variables on a graph.
- ❑ Improved ability to analyze a given data set and to create a graphical solution to a real life math problem.
- ❑ Increased student confidence in explaining the meaning of numbers, mathematical signs, vocabulary, and interpreting data on graphs.
- ❑ Fewer procedural algebraic mistakes in math calculations because the real life context of problems encourages students to think before doing the math.

Future Classroom Practice

- ❑ Integrate application problems/real life connections into my lesson plans to make math more meaningful for students.
- ❑ Create a learning environment that encourages all students to communicate math concepts and ideas by writing, explaining, and discussing among them.
- ❑ Measure student learning periodically and make necessary adjustments to my teaching to accommodate all students' diverse learning needs.