

**Title:** A Guided Inquiry Approach for Word Problems in College Algebra

**Project Member(s):** Kurt Overhiser

**Describe the problem, issue, or area of interest and the context.**

The ability to write proofs in mathematics is related in many ways with the ability to solve word problems in algebra. Typically, students in both areas often struggle with questions such as, “Where do I begin?” or “What should I do next?” As a faculty member, I have noticed similarities between the obstacles my college algebra students struggle with when learning how to solve word problems and the obstacles I encountered as a graduate student when I learned how to write formal proofs. A teaching method I was exposed to as a graduate student helped my classmates and me to develop and expand our cognitive abilities to write correct proofs. This method was based on the principles of problem based learning. In using this method, our professor acted as a facilitator and guide to us as we solved problems and make discoveries for ourselves. Problem-based learning is so named because it facilitates the development of problem solving skills. By gaining such skills, my classmates and I were able to refine and develop our capacities to write sound proofs. Consequently, we were able to prove novel theorems in subsequent classes that none of us encountered before. Because this method was successful for me in graduate school for learning how to construct proofs, it warrants an investigation to see if a similar method might be beneficial for college algebra students when they learn how to solve word problems.

**Define your desired goals, or “outcomes.”**

The framework for the learning outcome, centered on student exposure to methods of guided inquiry, was based on W.G. Perry’s Four Stages of Cognitive Development. More specifically, the learning outcome was “for students to progress from a dualistic view of solving word problems to one of multiplicity.”

The research question examined for this project was: Do more students gain the problem solving skills needed to solve novel word problems by using methods of guided inquiry than by using traditional methods of instruction? It was my hypothesis, before the pilot study commenced, that the answer to this question was yes.

**Describe your “indicators” of success.**

The criteria used to measure this student learning outcome were *Application, Representation, Explanation, Justification, and Organization*. These criteria were taken and modified from a rubric written by the mathematics department of Baltimore City College. They are essentially five basic problem-solving related skills used to assess student work involving word problems. Let me know if you want a copy of this rubric.

**Describe your project.**

Students were given three sets of practice word problems to work on during the course of the semester. For each set, the students were to go through three rounds of attempts. Students were introduced to the rubric and taught the meaning of each of the criteria and levels of student achievement. They were instructed to use the rubric as a guide in their first attempt at the practice word problems. Every student was required to go through the three rounds of attempts including those whose answers were correct in early rounds. Such individuals were admonished to use the rubric to polish and improve their responses in later rounds.

After completing the first round of attempts for each set of word problems, students were given a set of clues in the form of rhetorical questions to be used as a crutch and guide when writing up their revised solutions to the same set of word problems for the second round. The clues were meant to break up the problem solving process into more manageable pieces. They were also designed to guide the student to discover patterns in the given information that lead to full-blown equations in the actual solutions.

After the second round, and in addition to the rubric and clues, students were given a third tool to be used in their final round of attempts. This third tool was in the form of personalized written feedback. The personalized aspect of this was necessary to be inclusive of everyone including those whose approach was different from the one outlined in the clues. This feedback pointed out errors in the student’s thought process. It was carefully crafted so as to keep the “guided discovery” aspect of the project in tact.

**Describe your results.**

The research yielded rather surprising results when compared to the original hypothesis. It was not the case that more students gained the problem solving skills needed to solve novel word problems by using methods of guided inquiry than by using traditional methods of instruction. Students were less motivated with the guided inquiry activities than with the traditional activities.

**Describe your evaluation methods.**

The student scores using the rubric were significantly lower for those engaged in the guided inquiry process than with traditional techniques. There were no revisions made to the project as I went along. It seems to me that there is a rather large student population that is conditioned to learn in more traditional ways. Progressive ideas like guided inquiry don’t seem to work as effectively with the traditional student. I would like to pursue research that addresses the issue of student motivation as it relates to math classes.