THE DEVELOPMENT OF STUDENTS' PROBLEM-SOLVING SKILL FROM INSTRUCTION EMPHASIZING QUALITATIVE PROBLEM-SOLVING.

A THESIS

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This is to certify that I have examined this copy of a doctoral thesis by

THOMAS MICHAEL FOSTER

And have found that it is complete and satisfactory in all respects,

and that any and all revisions required by the final

examining committee have been made.

PATRICIA HELLER

Signature

Date

GRADUATE SCHOOL

DEDICATION

To Ann Elaine Robertson for her love, support, food, and encouragement throughout this long process.

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ABSTRACT

Successful learning of introductory college physics requires students to acquire not only the content knowledge of physics, but also the skills to solve problems using this knowledge. In the physics department at the University of Minnesota, this duality is understood and attempts are being made to teach successfully. One such attempt has an instructor explicitly teaching a problem-solving strategy that emphasizes the qualitative analysis of a problem before the manipulation of equations. This class provides a unique case for examining the development of problem-solving skills. However, since there has been no similar study conducted on a class were an explicit problem-solving strategy was not taught, it was necessary to examine another, more traditionally taught class. This interpretive case study will examine the development of the problem solving ability of students in two college introductory physics courses where cooperative-group problem solving was used. In one class there was an explicit problem-solving strategy used. In the other class, no additional attempt was made to teach problem solving.

The primary data used is the student's exam solutions. Student's solutions to exam problems provide valuable insights into the students understanding of physics. These solutions were analyzed using a coding rubric developed from the extensive research literature on problem solving. The coding rubric examined four skills: General Approach, Specific Application of the Physics, Logical Progression, and Appropriate Mathematics. From the codes, the development of the students' problem solving skills was examined.

The results of the study were skewed slightly by the students in the more traditionally taught course who had average grades higher than their peers. This was not a problem in the course where an explicit problem-solving strategy was taught. In general, the students in the course who were taught an explicit problem-solving strategy tended to develop their skills faster, but did not score any higher than the students in the more traditionally taught course by the end of the year. However, the students in the explicit problem-solving course consistently performed better on the multiple choice concept tests given during the year. Implications for further research and instruction are also discussed.