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Title	Analysis of Task Sequence and Critical Behaviors of Engineering Students and their Understanding of Conic Sections
Year	2003
Program	Doctor of Philosophy in Science Education (Mathematics Education)

ABSTRACT

This study investigated the quantitative and qualitative aspects of the sequence of steps taken in a solution path for solving conic sections (parabola, ellipse and hyperbola) problems. It identified critical behaviors or incidents, habits or mannerisms of students during problem-solving to determine the relation of these to the understanding of the concept of conics. The think-aloud interview technique was used in conjunction with an interpretive method of case study observation.

The data came from sixteen (16) case studies of first-year students in the Bachelor of Science in Agricultural/Civil Engineering programs, also referred as General Engineering. The result of the Prior Knowledge Test on Conics was the basis in selecting the subjects. Starting with the highest score, the 8 top-scoring students were classified as the Top-8 Group, and the 8 lowest scoring students were classified as the Bottom-8 Group. The subjects were asked to solve six problems in conic sections, two problems each (one routine and the other an application problem) on parabola, ellipse and hyperbola. Their verbalizations were tape-recorded, and their behavioral characteristics were observed as they individually solved the problems.

The quantitative and qualitative data obtained showed that the unsuccessful problem solvers had difficulty in solving the conic problem because of:

- a) Insufficient knowledge and recall of the standard equations for conics for specific conditions or situations;
- b) Incomplete use or non-use of the properties for graphing the curve ;
- c) Poor understanding of the concept of asymptotes ;
- d) Lack of mastery of skills in algebraic manipulations; not carrying out the operations accurately; confusion in using coordinates of points;
- e) Poor understanding of the English language;
- f) Failure to make illustrations using information about the task; inability to explore real-world application problems; not representing the variables correctly, and failure to develop an algorithmic procedure.

In-depth analyses of the students' computation worksheets, their think-aloud utterances and the researcher's observation protocols produced 25 behavioral tendencies distinguishing successful from unsuccessful problem solvers. Successful problem solvers generate solutions in neither too few nor too many steps; had more organized

and integrated knowledge; used powerful heuristics or strategies such as developing algorithmic procedures, were more confident and manifested minimal body gestures. Unsuccessful subjects tried to get rapid solutions in 1 or 2 steps but sometimes ended up with many because of repetitive steps that show non-mastery of the concepts and procedures for solving the problems. Their sequences of tasks were accurately organized nor well-ordered. They showed the inability to remember and identify the concepts correctly and to apply them in appropriate sequential steps; they frequently used trial-and-error or hit-and-miss technique, as well as guessing; they demonstrated very obvious and unusual mannerisms, showed high self-consciousness, confusion and anxiety, and they showed facial and verbal lack of interest in generating solutions correctly.

The findings suggest a need for instructional programs for teachers to develop intervention strategies to ease the students' difficulties related to solving problems on conic sections.