

Using Calculators to Develop Problem-Solving Skills

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Calculators can be powerful tools in the study of mathematics, particularly in the area of problem solving. This action research project was conducted to examine the effects of calculator use in the development of problem-solving skills in a class of fifth grade students. It was intended to support the research already available on the topic of calculator use and problem solving.

The investigation took place in an Indianapolis Public Schools fifth grade classroom. After signing informed consent forms, the students were given a questionnaire, which consisted of seven statements relating to calculators and word problems. These statements were designed to give insight into students' knowledge and perceptions of calculators and their uses. Each student was then assigned a Texas Instruments Math Explorer calculator to use for the duration of the investigation. Over the course of the investigation, students completed 9 problem-solving activities selected from the *Problem Solver with Calculators* by Terrence G. Coburn, Shirley Hoogeboom, and Judy Goodnow [1]. The *Problem Solver with Calculators* focuses on eight problem-solving strategies. These strategies are guess and check, use or look for a pattern, use or make a table, make an organized list, make it simpler, use logical reasoning, make a picture or diagram, and work backwards. At the conclusion of the investigation, students were given a postquestionnaire identical to the one that they completed in August.

Three methods of data collection were used: pre and postquestionnaires, problem-solving activity sheets, and student observations. After the investigation was complete, the three kinds of data were analyzed for similarities and differences across individuals and groups. Each kind of data was separated by gender, as well as by ability level.

The pre and postquestionnaires were collected and studied for patterns and changes in students' attitudes towards calculators and problem solving. In general, the postquestionnaire showed that students felt they gained knowledge about calculators. The majority of students appeared to change their attitudes

towards story problems as well. No students showed a negative change in attitude towards story problems. When students were asked to tell what they did not understand about calculators, male and female students gave varying responses on both questionnaires. Boys seemed more confident of their knowledge of calculators and how they work. They also were more likely to ask technical questions such as “How does the solar power work?” The girls seemed to have different concerns. They wondered about different symbols and keys that we did not discuss in class. One girl asked, “Why does it matter what order we put the numbers in?” They seemed more inquisitive about the actual mathematical operations. The questionnaires were also divided into two categories based on student ability. When students were asked how they felt about story problems, 43% of students in the lower ability group responded positively on the prequestionnaire, while 79% percent of the same students responded positively on the postquestionnaire. These data show a change in attitude towards story problems for some of the lower ability students. The change in attitude was even greater for the students in the higher ability group. Only 20% of these students gave positive responses to this prompt on the prequestionnaire, while 70% responded positively on the postquestionnaire.

Data also came from activity sheets completed by the students. These activities were analyzed to see how effectively children used the calculators to solve problems and how correctly they solved the problems. These data show no distinct increase or decrease in scores, which might be attributed to the varying difficulties of the activities. The data also showed a difference between the performance of the boys and the performance of the girls on the activities in this investigation. The boys performed better than the girls on all but two of the calculator activities. On average, the males scored slightly better than the females on the activities. Student data were also divided according to ability level and analyzed for similarities and differences. The lower ability group was 50% boys, whereas the higher ability group was 64% boys. As was expected, many of the perfect scores belonged to students in the higher ability group. However, this was not always the case. There were a few students who did not perform as expected.

The third method of data collection consisted of observations made by the investigator. Observations were taken throughout the investigation in order to gain further insight on the project. Students were all generally excited and very willing to participate in this project. They were curious about what they would be learning and about what they would be doing with the calculators. When the student observational data were grouped according to gender, a few patterns appeared. The male students were more likely to ask for help from the teacher. Female students asked for help too, but it was observed that they were more likely to attempt to get assistance from a classmate first. The girls were usually the ones to ask if they could work with a classmate and were more likely to choose to work with a partner once that option was given.

These results support the assertion that calculator use in the classroom does not hinder student performance on problem-solving activities. Calculator use may even improve student performance and attitudes towards problem-solving activities. Since professional organizations such as the National Council of

Teachers of Mathematics, the Indiana Professional Standards Board, and the International Society for Technology in Education promote the integration of calculators in elementary mathematics classrooms, all educators should consider how to integrate them into their classrooms to best enhance mathematics instruction and benefit our students, particularly in the area of problem solving.

References

- [1] T.G. Coburn, S. Hooeboom, and J. Goodnow, Problem Solver with Calculators, Creative Publications (1989).