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The Use of the Computational Thinking Process In-Place Value Intervention

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Abstract

In mathematics, students must learn certain skills to build their foundational knowledge. In the researcher's current student teaching placement, it is evident that there is a lack of understanding of the foundational skill of place value in multi-digit numbers. Using computational thinking and its four pillars (decomposition, pattern recognition, abstraction, and algorithm), this study aims to increase students' understanding of place value. Computational thinking is a problem-solving approach that breaks the process into simple steps; this helps the user identify important information and solve the problem. Moreover, the process of computational thinking is a way for students who are struggling to slow down their thinking and rely on background knowledge to solve a complex problem. The focus is for students to learn in a systematic way that is constructed by their perception of number sense. This was accomplished by the implementation of a two-week intervention. The objective was for students' scores to increase from pre-assessment to post. Unfortunately, the objective was not met. Through post-intervention analysis, the researcher found that students' scores decreased while the number of questions students did not attempt increased. There was no clear reason for this occurring in the research conducted; the researcher attributes this to a lack of confidence and time constraints of the classroom.

Introduction

Mathematics is fundamentally complicated, with aspects that build upon each other over years of schooling. As a result, some skills, such as understanding place value, are essential for students to understand so they can move forward. In their article, Reys et al. (2014) claims that humanity would not be able to use numbers if they did not have place value. Place value is a skill that is typically mastered by second grade in most states. If any student, especially students with learning disabilities, lacks this understanding, it can make it more difficult for them to comprehend future mathematical concepts.

Research continues to find the best pedagogy for all types of students. The purpose of this study is to use an emerging practice, the computational thinking process, to enhance students' deeper understanding of place value. According to Dahshan and Galanti (2024), when computational thinking is paired with existing strategies (like physical models and ten frames), it supports students in "moving past

procedural understanding." As a result, this study focused on the following research question: "How can the utilization of a computational thinking process in mathematics impact the application of place value for a small group of five fourth-grade students?"

Methodology

This study involved four fourth-grade students who participated in a two-week intervention using the computational thinking process. The researcher identified participants through the district-wide STAR Assessment (Renaissance). Participants scored 65% or below in both place value standards. Before the start of the intervention, a pre-assessment quiz was given to collect baseline data on the students who scored below the designated threshold. The teacher also monitored the students during the quiz to take anecdotal notes on their thought processes and comfort level about place value. On the last day of the intervention, students practiced solving problems with the full computational thinking process. Ultimately, data was collected through a dual design of quantitative and qualitative assessment. Students were given a score that indicated the points they earned out of the points available on both the pre-assessment and post-assessment of the quantitative assessment (quiz).

Results

In summary, the data collected on the number of points earned of the 16 points available decreased from the pre-intervention test to the post-intervention test for every student. When looking at the pre-intervention test, all students scored over 40%, but all students scored below 40% at post-intervention. When looking at the pre-intervention qualitative data, there was a range of frequencies in which the various observational markers were seen. It was a mixed result. When looking at post-intervention qualitative data, the frequent use of some observational markers also decreased. On the other hand, the marker "Skipped Questions or Instructions" increased for every student from pre-intervention to post-intervention.

Conclusion

This study aimed to use the computational thinking process to build the foundational knowledge of students regarding place value in multi-digit numbers. This intervention did not produce the expected improvement. On average, each participating student's score decreased by around 30%. Additionally, the researcher did not observe as many positive observational indicators. This study shows that there is a need to find a more effective way to reinforce the essential topic of place value in this fourth-grade classroom. Computational thinking was not well-received by the students, as observed by the researcher. A better way to support student growth and confidence should be sought out. As mentioned, time availability for implementing the step is a major alteration that could be made. Although this intervention was not a success, it provided insight into interventions relating to place value and the effectiveness of computational thinking.

References

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