Development and Testing of a Mathematics Learning Application

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Abstract

Distance learning, or online learning, is essential for both teachers and students as they work to create a system of education to function during a pandemic. Therefore, this research aims to develop a CAI media-based learning application for teaching fractions in mathematics. The survey results conducted at SDN 1 Sukerejo Boyolali revealed that students encountered the most trouble with fractions. Hence, their comprehension of the mathematics learning application was evaluated. The pre-test and post-test results of 30 students in both the control and experiment classes demonstrated that the application was easier to use than direct or traditional learning methods.

Keywords: *Development, Testing, Mathematics Learning Application*

1. Introduction

One of the lessons with a lasting impact on students' perspectives is fractions in mathematics. Moreover, the way fractions are taught in elementary schools exemplifies the concept of learning by catering to students of all skill levels.

In elementary fractional mathematics, many teachers need help understanding the character of each student. They teach fractions to students only by explaining the material directly to them, without exposing a basic concept of fractions to them, leading some students to feel unable to grasp what is conveyed, resulting in a decline in their interest in learning.

Despite its usefulness, some critics believe there are still too many drawbacks to using i-Learning [1]. Media literacy education still needs to be represented in K-12 classrooms. Therefore, the current method of education implemented in many institutions is less efficient and excessively dull for students. It explains why approaches to education, such as i-Learning, are highly required because they let students learn whenever and wherever they want—inconvenient.

The development of this mobile-based mathematical application, also known as an i-Learning platform, is supported by the findings of previous research conducted on students in various educational institutions to collect the necessary information. This study employed various methods to investigate this issue, including paper-based questionnaire distribution, in-person interviews with fourth to sixth-grade students and teachers in each elementary school, and an online search of academic journals and articles discussing the challenges students faced in learning fractions in mathematics. Moreover, mathematics learning media bridge the abstract notion of mathematics and the actual world when used in conjunction with realistic fractions [2].

That the teacher acts as a mediator at the stage of the student's learning transformation is supported by research on the effects of learning media on students' psychology in developing a desire and interest in learning [3]. This study expects that students will be better able to remember and recognize the concept of learning with the help of this media

aid. Such media is expected to make learning excellent for students' development in a particular field, such as fractional mathematics. Paivio claimed that humans have two different memory systems: one for storing and retrieving linguistic symbols and another for handling visual information. Therefore, optimal learning results can be achieved by combining visual and sensory inputs [4].

According to [5], the convenience of access is a significant consideration in the transition of knowledge from traditional print-based educational materials to digital (e-learning and m-learning) formats. Using computers as instructional aids and creating learning models, particularly programmed learning models, is one of many examples of technological applications known as Computer Assisted Instruction (CAI) media. Using CAI media is an approach for education that tries to simulate realistic situations to provide students with a more immersive learning environment. CAI learning, an interactive medium meant to be an integral part of the educational process, must be able to facilitate the implementation of interactive communication between computer media and students to be effective [6].

2. Method

Specifically, it has been noticed that students at all three institutions had trouble grasping the concept of fractions, confirmed by the data gathered. Subsequently, a quantitative quasi-experimental method was employed for the investigation. Research close to the experimental type is known as quasi-experimental research. This study greatly benefits education and other domains where human beings cannot be manipulated and controlled carefully [7].

The quantitative method has been beneficial to test and build theories, and it is only one of the many methods that could be derived from the many research procedures. This study also deployed the concrete pictorial abstract (CPA) method, which has been proven effective in helping students learn systematically. In this case, the CPA method was applied to help students progress through three distinct phases of learning, including practice with concrete objects, familiarization with pictorial representations, and mastery of notation and fraction shapes.

A. Population and Research Sample

The research population can be defined as the set of all possible instances of the thing or people being investigated that share the attributes and characteristics the researcher has selected for the study. The sample represents a subset of the population in size and distribution. Random sampling, in which all individuals of a population have an equal chance of being selected as a research sample, was applied to determine the sample for this study [8].

B. Research Variables

The attributes, characteristics, or values of students, objects, or activities are the study variables from which the researcher draws inferences [9]. Two variables were identified in this research: independent and dependent.

C. Instrument Testing

Data were collected from the learning outcomes assessing students' cognitive levels. If applied using a score, the scoring system for the students could be determined. Students' proportion of correct answers on the test device was defined with a passing score range of 0-100% [10].

Table 1. Paired sample t-test on pre-test questions

Paired Samples Test

| | | Paired Differences | | | | | | | |
| | | | | | 95% Confidence Interval of the Difference | | | | |
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pre Test - Pre Test	.333	7.649	1.396	-2.523	3.189	.239	29	.813

Table 2. Paired sample t-test on post-test questions

Paired Samples Test

| | | Paired Differences | | | | | | | |
| | | | | | 95% Confidence Interval of the Difference | | | | |
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Post Test - Post Test2	-1.333	4.342	.793	-2.955	.288	-1.682	29	.103

2.1 Hypothesis Testing

The hypothesis test results were intended to compare the pre-test score of the control group with the post-test score of the experimental group. T-test generated a pre-test score of 0.030 and a post-test of 0.083. Since the same materials were employed for both groups, the difference between the two groups on the pre-test was slight.

The first experiment employed the same questions as before, while the second experiment utilized CAI media. The post-test depicted drastically different results, with scores of 0.013 and 0.055, indicating significant differences between the two groups.

2.2 Validity and Reliability Tests

The findings of the first and second pre-tests, as well as the first and second post-tests, were compared using validation and reliability tests to identify any significant discrepancies. The next step was to decide whether or not the data from the control and experimental tests could be incorporated into the final analysis.

Table 3. Static Reliability Validation

Reliability Statistics

Cronbach's Alpha	N of Items
.870	4

Following the decision-making, Cronbach's alpha acquired a value of 0.870, implying normal distribution and proving data reliability.

3. Result and Discussion

The pre-test and post-test results depicted a significant difference in the outcomes between students who learned with CAI media and those who did not use it. The pre-test yielded an average score of 76.33, while the post-test acquired 85.67.

Table 4. Pre-test results of students before using CAI media

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre Test	76.33	30	9.994	1.825
	Pre Test	76.00	30	9.685	1.768

Students who learned without CAI media exhibited less than optimal results. In contrast, those who learned using CAI media demonstrated improvement, as evidenced by the average pre-test score of 76.00, while the post-test average score reached 87.00.

Table 5. Post-test results of students after using CAI media

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Post Test	85.67	30	8.584	1.567
	Post Test2	87.00	30	8.769	1.601

Table 5 summarizes the results from student assessments administered using CAI media. When comparing the pre-test and post-test results from before and after utilizing CAI media, students exhibited a 20% improvement.

4. Conclusion

Students who utilized CAI media gaineda 2% advantage over those who did not. It is evidenced by the pre-test and post-test results, suggesting that this media could benefit fractional mathematics learning.

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