Volume 6, Number 1, December 2024
Journal of Research on Mathematics Instruction
DOI: https://doi.org/10.33578/jrmi.v6i1.108
Journal's Webpage: http://jrmi.ejournal.unri.ac.id

The Effect of Contextual Learning Models Assisted by Wordwall Media on Students' Mathematical Concept Comprehension Ability in Elementary Schools

Rena Istiqomah
Pendidikan Guru Sekolah Dasar, Universitas Pasundan, Bandung, 40154, Indonesia, INDONESIA

ARTICLE'S INFORMATION

Article history:

Received: Oct-03-2024

Reviewed: Dec-01-2024

Accepted: Dec-31-2024

Keywords: Contextual Learning Model, Mathematical Concept Comprehension, Wordwall Media

ABSTRACT

This study aims to evaluate the effectiveness of a contextual learning model assisted by Wordwall media in enhancing elementary school students' mathematical concept comprehension. The research used a quantitative approach with an experimental design for a pretest-posttest control group. The sample consisted of two groups: an experimental group taught using the contextual learning model assisted by Wordwall and a control group that followed conventional teaching methods. The instruments used included tests for validity, reliability, difficulty level, and discrimination power. The results showed that the learning process supported by Wordwall was highly effective, significantly increasing students' active engagement in the learning process. Statistical analysis revealed significant differences between the experimental and control groups, with a large effect size, indicating that the contextual learning model assisted by Wordwall significantly improved students' mathematical concept comprehension. Additionally, this approach successfully enhanced students' learning motivation and fostered a more meaningful and relevant learning environment in alignment with the needs of the digital era. The study concludes that applying technology-based contextual learning models such as Wordwall can create a more interactive, relevant, and meaningful learning experience, effectively improving students' learning outcomes. This model is also appropriate for supporting the development of 21st-century skills, such as critical and creative thinking, in today's digital age.

Corresponding address:

Rena Istiqomah,
E-mail: renaistiqomah6@gmail.com

INTRODUCTION

Education is a fundamental foundation in human life, playing a key role in shaping a person's character, knowledge, and skills. Every individual has the right to receive proper education and hopes to develop intellectually and emotionally. Human life can grow through education, creating civilized and educated individuals. In this context, education is not merely a necessity but also a fundamental right for every learner to have the opportunity to become a quality individual. This aligns with the strategic role of education in building a generation capable of contributing positively to the nation, the state, and the world.

As a formal institution responsible for education, schools play a very important role. Schools are not just places for learning but also spaces for interaction between teachers and students, enabling the transfer of knowledge, moral values, and life experiences. Teachers are expected to teach and educate students as the leading facilitators in the learning process. Educating in this context involves guiding students to become mature, responsible individuals who can think critically and creatively. In carrying out their duties, teachers must ensure that the learning methods used are effective and

engaging to students. Unfortunately, learning provided by teachers is often perceived as less meaningful by students, which diminishes their interest and motivation to learn. Therefore, it becomes the teacher's responsibility to create learning experiences that are relevant, contextual, and enjoyable.

Another problem faced in today's education world is the lack of students' ability to understand abstract concepts, particularly in mathematics. Mathematics is often considered a difficult and less interesting subject by many students. This happens because the teaching methods are monotonous and fail to connect the material with real-life contexts. As a result, students feel that mathematics is irrelevant to their needs. Yet, understanding mathematical concepts, such as calculating money, measuring, or solving logical problems, is highly important in daily life. Therefore, there is a need for a teaching approach that can bridge the gap between abstract mathematical concepts and students' real-life experiences.

Implementing a contextual learning model has emerged as one possible solution to address these challenges. The contextual learning model aims to help students understand learning materials by relating them to real-life contexts. This approach enables students to see the relevance of the materials being taught with real situations around them, thereby improving understanding and interest in learning. In mathematics learning, for instance, teachers can relate concepts of numbers and arithmetic operations to daily activities such as counting items, managing pocket money, or solving simple problems in their home and school environments. Additionally, technology-based learning media is urgently necessary in today's digital era. Students in the current generation are very familiar with technology, such as smartphones, tablets, and other digital devices.

Furthermore, the application of technology-based learning media has proven to be an effective solution for improving the quality of learning in various disciplines, including mathematics. Technologies such as GeoGebra Applets allow for the visualization of complex mathematical concepts, helping students develop a deeper and more interactive understanding of the materials being taught [1], [2]. In a broader context, platforms like Wordwall and Wizer.me provide opportunities for teachers to design gamified and interactive digital worksheets, which not only enhance student engagement but also offer a more personalized and relevant learning experience [3], [4], [5]. For example, research has shown that using Wordwall significantly improves student learning outcomes through engaging in educational game-based activities [4]. With the rapid advancements in technology, the adoption of digital learning media not only provides an interactive learning experience but also helps students develop 21st-century skills such as critical thinking, collaboration, and creativity [1], [6].

One of the innovative and effective technology-based learning media is the Wordwall application. Wordwall is an application that provides engaging educational games to facilitate interactive learning. Wordwall can be used in mathematics education to present exercises as enjoyable games. Students can learn while playing, making the learning process more interesting and less monotonous. Wordwall has various features that support mathematics learning. This application provides exercises with varying difficulty levels, from easy to moderate and challenging. Additionally, its use is highly flexible, as it can be accessed anytime and anywhere. For instance, students can use Wordwall to learn numerical concepts by counting objects around them, such as pencils, books, or toys. Thus, Wordwall serves as a learning aid and a means of developing students' logical and creative thinking skills.

Another advantage of the contextual learning model assisted by Wordwall is its ability to

enhance students' motivation to learn. In an interactive learning atmosphere, students feel more involved in the learning process. They act not just as passive recipients of information but become active participants in discussions, problem-solving, and concept exploration. This model also allows teachers to provide direct feedback to students, helping them understand their strengths and weaknesses in learning.

Through this study, the author aims to examine the effectiveness of the contextual learning model assisted by Wordwall media in improving students' understanding of mathematical concepts. This study focuses on elementary school students, particularly fifth graders, who require learning approaches suitable to their cognitive development level. Using a quantitative research design, the author seeks to measure how contextual learning models can positively impact students' learning outcomes. This study also aims to provide empirical insights into effective learning processes, which can be a reference for teachers and education practitioners in developing innovative teaching strategies.

Various studies have explored the effectiveness of technology-based learning media, including applications such as Wordwall and Wizer.me, which offer interactivity and flexibility in supporting education. Previous research has shown that Wordwall enhances students' motivation to learn through its engaging gamified features and interactive activities, such as quizzes and educational games [7] [8]. Meanwhile, Wizer.me is a platform that helps teachers design interactive digital worksheets combining text, images, videos, and quizzes, supporting distance and hybrid learning. Studies show that Wizer.me provides a rich learning experience and facilitates formative assessment, especially during the pandemic when online learning became essential [9]. Implementing these technologies has been studied in various contexts, from mathematics to language learning, and has resulted in improved cognitive learning outcomes and increased student engagement in the learning process [8].

Although many studies have discussed the effectiveness of applications such as Wordwall and Wizer.me, this study offers novelty in three main aspects. First, it focuses on integrating Wizer.me as a tool to support contextual mathematics learning, an approach that has not been widely explored previously. Second, it evaluates the impact of Wizer.me on students' critical thinking skills, a key competency in the 21st-century curriculum, beyond the focus of earlier research, which mostly centred on cognitive learning outcomes. Third, this study employs an experimental research design with a control group to provide higher validity to its findings and a combination of quantitative and qualitative analyses to offer a comprehensive view of the effectiveness of Wizer.me in elementary school mathematics education. Thus, this study aims to fill the gap in the related literature and propose innovative solutions for improving technology-based learning.

With this background, the author hopes this study can contribute meaningfully to developing teaching methods in elementary schools. Not only to enhance students' understanding of mathematical concepts but also to create enjoyable, relevant, and meaningful learning experiences. Quality education does not only produce students who are academically intelligent but also individuals who are capable of thinking critically, creatively, and adaptively in response to the changing times.

METHODS

The research method used by the author is a quantitative research method aimed at explaining and testing the relationships between measured variables. In this study, there are two variables: the independent variable and the dependent variable. The independent variable is the influence of the contextual learning model assisted by Wordwall media, while the dependent variable is the

understanding of mathematical concepts among fifth-grade students at SDN 259 Griya Bumi Antapani. The quantitative research method used involves determining scores from the tested samples.

In this study, two groups were formed. The first group is the experimental group, which received treatment in the form of learning using the contextual learning model, and the second group is the control group, which received conventional learning, i.e., regular daily instruction conducted at school. Both groups were given written tests before and after the treatment was administered.

The research design used is the control group pretest-posttest design. This research design involves conducting a pretest before treatment and a post-test after treatment. It can be concluded that the treatment results can be determined more accurately because comparisons can be made using conditions before and after the treatment. This design was adapted to align with the research objectives, namely to determine the mathematical concept comprehension of elementary school students.

Sugiyono explains that the quantitative research method is based on positivist philosophy and is used to study a specific population or sample [10]. Data collection uses research instruments, and data analysis is quantitative/statistical, with the aim of testing predetermined hypotheses.

Therefore, it can be concluded that the quantitative research method is based on the positivist philosophy of observing samples. Data collection is carried out using research instruments, and data analysis is quantitative, aimed at testing the hypotheses established by the researcher.

Normality testing was used in this study to determine whether the data in this research is normally distributed. The data is considered normally distributed if the significance value is > 0.05. Homogeneity testing was used to determine whether the data in the research had homogeneous variance. The criteria for data to be considered homogeneous are as follows: If the significance value of the data > 0.05, then H0 is rejected. If the significance value of the data < 0.05, then H0 is accepted.

In this study, a t-test was used to examine the influence of the contextual learning model on the comprehension of mathematical concepts among elementary school students. The criteria for determining whether the data is significant are as follows: If the significant value (2-tailed) > 0.05, then H0 is accepted. If the significant value (2-tailed) < 0.05, then H0 is rejected. An effect size test was used to determine the effectiveness of the influence of the contextual learning model on the comprehension of mathematical concepts among elementary school students.

RESULTS AND DISCUSSION

This study examines the effect of the contextual learning model assisted by Wordwall media on elementary school students' mathematical concept comprehension abilities. This section discusses the research results in detail, including the learning process, data analysis, and the effectiveness of the learning model used.

Using the contextual learning model assisted by Wordwall media, the learning process proceeded effectively. This process was carried out systematically, from preparation to authentic assessment. Each stage was designed to ensure that students understood the material and could relate it to their daily lives. The stages applied included learning preparation, modelling, question and answer, discovery and constructivism, and authentic assessment.

In the learning preparation stage, the teacher prepared a lesson plan (RPP) tailored to the contextual approach. During this stage, the teacher also selected relevant materials using the Wordwall application to help students understand mathematical concepts practically and enjoyably.

In the modelling stage, the teacher provided examples to students on how the mathematical concepts being taught could be applied in real life. For example, the teacher demonstrated how to count the number of books or pencils in the classroom using numbers and arithmetic.

In the question-and-answer stage, the teacher engaged students in interactive discussions. The teacher posed questions to explore students' understanding of the material being taught and connected it to their daily experiences.

Students were invited to solve problems based on the contexts provided in the discovery and constructivism stage. In this stage, students understood the material and constructed new knowledge with the help of Wordwall media. For instance, students were given challenges in Wordwall games to complete independently or in groups.

In the authentic assessment stage, the teacher evaluated the learning process. This evaluation included direct observation of student activities, assessment of learning outcomes, and feedback provided during the learning process.

Observations during the learning process revealed that this learning model successfully increased student engagement from the first to the last session. Students appeared more enthusiastic and active in learning activities, particularly when using Wordwall media.

Normality testing was conducted to determine whether the data obtained from this study were normally distributed. The results of the normality test are shown in the following table.

Table 1. Results of Normality Test for Experimental Class

Tests of Normality	**Kolmogorov-Smirnov**	**Shapiro-Wilk**
Pretest	.166	22
Posttest	.112	22

Table 2. Results of Normality Test for Control Class

Tests of Normality	**Kolmogorov-Smirnov**	**Shapiro-Wilk**
Pretest	.148	26
Posttest	.211	26

Based on the normality test results using Shapiro-Wilk in Tables 1 and 2, it was found that the experimental class had a significance value of 0.061 for the pretest and 0.168 for the post-test. Meanwhile, the control class had a significance value of 0.276 for the pretest and 0.077 for the post-test. Since the significance values for both classes in the pretest and post-test were greater than 0.05, it can be concluded that the data were normally distributed.

Homogeneity testing was conducted to determine whether the two groups (experimental and control) had homogeneous variance. The results of the homogeneity test are shown in the following table.

Table 3. Results of Homogeneity Test for Pretest

Levene Statistics	**df1**	**df2**	**Sig.**
2.709	1	46	.107

Table 4. Results of Homogeneity Test for Post-test

Levene Statistics	**df1**	**df2**	**Sig.**
.888	1	46	.351

Based on Tables 3 and 4, the homogeneity results show that the pretest significance value was 0.107, while the post-test significance value was 0.351. The data were declared homogeneous since the significance values were greater than 0.05. This means that both groups had relatively similar characteristics before the treatment was given.

The t-test was used to examine the effect of the contextual learning model on students' mathematical concept comprehension. The t-test results are shown in the following table.

Table 5. Results of t-Test

Mean	N	Std. Deviation	Std. Error Mean
Pretest	65.91	22	10.980
Posttest	78.18	22	11.807

The analysis results in Table 5 show that the average pretest score for the experimental class was 65.91, while the average post-test score increased to 78.18. This indicates improved student comprehension after the contextual learning model was applied. Conversely, the average pretest score for the control class was lower than that of the experimental class, indicating that the control group did not experience a significant improvement. The significance value (2-tailed) was less than 0.05, leading to the rejection of H0 and acceptance of Ha. This means that applying the contextual learning model significantly affected students' mathematical concept comprehension.

These results align with previous research by [11], which showed that learning assisted by Wordwall media increased students' average post-test scores to 75.83 compared to the control group with an average of 57.74. This study emphasizes that using Wordwall in learning improves learning outcomes and actively engages students during the learning process.

Furthermore, research conducted by [12] found that Wordwall-based approaches produced significant improvements in students' numeracy skills, with a t-value greater than the t-table (2.405 > 2.145). This confirms that interactive media like Wordwall create a more meaningful learning environment.

Additionally, the results are consistent with those of [13], who stated that the use of Wordwall in mathematics learning significantly improved student outcomes, as evidenced by a paired sample t-test with a t-value greater than the t-table (20.913 > 2.021). In their study, the post-test average score increased significantly from 55.76 to 77.68 after applying Wordwall. These findings reinforce the idea that technology-based learning media like Wordwall effectively facilitate interactive learning and improve students' comprehension of the material being taught.

To measure the effectiveness of the contextual learning model assisted by Wordwall media, the effect size test based on Cohen's d formula was used. In this study, the effect size value was 1.07, categorized as a large effect, indicating a significant impact of this model in enhancing students' mathematical concept comprehension. This finding aligns with the research by [14], which reported that the use of Wordwall had a positive influence, with an effect size of 1.9, demonstrating a 79.4% improvement in students' learning outcomes in the experimental class compared to the control class.

In addition, the study by [15] supports the idea that Wordwall media can enhance students' motivation to learn, with an effect size of 1.1. It created a more interactive and enjoyable learning atmosphere while improving students' understanding through a game-based approach. Thus, the application of Wordwall-based learning media not only improves conceptual understanding but also motivates students to engage in the learning process actively.

The results of this study are consistent with the theory of contextual learning, which emphasizes the importance of connecting learning to students' real-world experiences. Wordwall media, as a learning aid, has been proven effective in enhancing students' comprehension by providing various interactive and enjoyable activities, such as math games with varying difficulty levels.

Contextual learning has been shown to impact students' understanding of mathematics positively. As found by [16], implementing a contextual approach significantly helped students grasp mathematical concepts by directly relating them to everyday life. The study showed that students practising this approach could solve problems more quickly and understand the concepts deeply.

In line with this, other research indicates that contextual learning can improve students' learning outcomes by creating a meaningful learning environment. Pradnyana stated that context-based mathematics learning, such as implementing CTL (Contextual Teaching and Learning), improved students' learning outcomes in the second cycle, with a percentage increase of up to 76.23% [17]. This study supports the idea that when students can relate lessons to real-life experiences, they are more motivated to learn and understand the material more effectively.

Furthermore, [18] highlighted that one of the strengths of the contextual approach is its ability to transform learning, often considered boring, into something more engaging and relevant. Through this method, students not only understand mathematical formulas by rote but can also apply them in real-world situations.

An interesting aspect of this approach is how teachers facilitate learning by using concrete objects or interactive media, as described by [18]. For example, in early-grade learning, teachers can use small toys to help students understand the concepts of addition and subtraction. This is also relevant to the findings of [16], which showed that students taught contextually tend to solve problems more quickly because they can visualize and practice the concepts.

Several key reasons why this model is effective include student engagement, meaningful learning, and the variation in difficulty levels. Wordwall media motivates students to learn because they feel like playing rather than simply studying. This increases students' active participation during learning. Furthermore, by connecting mathematical material to daily life, students find it easier to understand the abstract concepts being taught. Lastly, Wordwall provides exercises with varying difficulty levels, allowing teachers to tailor learning to the students' abilities. Additionally, this study shows that the contextual approach is relevant for improving mathematical concept comprehension and can be applied to other subjects. Teachers must integrate learning with media that is appropriate to the students' needs.

This research's impact is evident in improving students' mathematical concept comprehension and the changes in learning behaviour, making students more active and motivated. Using Wordwall media in learning creates an interactive, enjoyable, and relevant learning environment that meets the needs of students in the digital era. In addition to enhancing cognitive abilities, the contextual learning model assisted by Wordwall also positively impacts students' affective abilities, such as increasing self-confidence, a desire to collaborate, and critical thinking skills. Wordwall-based learning allows students to learn independently or in groups, indirectly developing their social skills. This is highly relevant to the 21st-century skill requirements, where students are expected to think creatively, solve problems, and work in teams. Therefore, the impact of this research is not only limited to mathematical learning outcomes but also contributes to the holistic development of students' character.

CONCLUSIONS AND SUGGESTIONS

Based on the study's results on the effect of the contextual learning model assisted by Wordwall media on elementary school students' mathematical concept comprehension abilities, the following conclusions can be drawn. First, the contextual learning process assisted by Wordwall media in fifth-grade elementary school classrooms showed increased activity levels from the first to the fourth meeting. This was evidenced by the observation results of teacher and student activities, which ranged from good to very good categories.

Second, the mathematical concept comprehension abilities of students taught using the contextual learning model assisted by Wordwall media were better than those taught using conventional learning methods in elementary schools. Third, the effectiveness of the contextual learning model assisted by Wordwall media on elementary school students' mathematical concept comprehension abilities was categorized as significant.

The results of this study demonstrate a significant positive impact on students' mathematical concept comprehension abilities through implementing the contextual learning model assisted by Wordwall media. In addition to improving learning outcomes, this approach successfully created a more active, interactive, and relevant learning environment that connects with students' everyday lives. The increase in learning motivation and active participation among students during the learning process was one of the main impacts, supporting the development of students' cognitive, affective, and social abilities. This model also provides opportunities for teachers to integrate technology into teaching, aligning with the demands of 21st-century skills such as critical thinking, collaboration, and creativity.

Based on these findings, it is recommended that elementary school teachers consider adopting the contextual learning model assisted by Wordwall media as an innovative strategy for teaching mathematics. Teachers are also encouraged to continuously develop their creativity in utilizing technology-based learning media to enhance student engagement and the material's relevance. Additionally, schools should support providing adequate technological facilities to implement learning media such as Wordwall. For future research, it is suggested that the scope of this study be expanded to other educational levels or subjects to explore the effectiveness of this model in different contexts.

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BIOGRAPHY

Rena Istiqomah
She obtained his Strata-1 (S1) in Pendidikan Guru Sekolah Dasar Universitas Pasundan. Email: renaistiqomah6@gmail.com.