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The Application of Contextual Teaching and Learning for Increasing Learning Outcomes and Reducing Anxiety in Elementary School Mathematics

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ABSTRACT

The study aimed to determine the effectiveness of Contextual Teaching and Learning (CTL) in reducing and improving learning outcomes and math anxiety among students at a private elementary school in Indonesia. The research utilized a one-group control pre-posttest design with a sample of 51 4th-grade students. The study used a combination of pre-test and post-test and a closed-ended questionnaire as the data collection instruments. The independent variable in the study was CTL, while the dependent variables were learning outcomes and math anxiety. The paired t-test showed a significant increase in the students' average learning outcomes and a decrease in the average math anxiety levels. The findings suggest that implementing CTL is a practical approach to reducing math anxiety and improving student learning outcomes.

Introduction

Mathematics is a subject taught in schools, and it plays a crucial role in developing skills such as counting, measuring, and applying mathematical formulas in daily life [1-3]. Some

consider mathematics as the science of numbers and the universe, a symbolic language, or a form of logical thinking. The study of mathematics is fundamental in improving critical thinking and problem-solving skills in everyday life [4],[5]. It teaches individuals how to manipulate specific numbers and symbols and how each subject matter is interrelated. Mathematics is often considered a challenging subject, but it is a crucial component in life, as many everyday problems require the ability to calculate and measure. The common assumption that mathematics is a measure of intelligence highlights the importance of improving the quality of education in schools [6]. The low academic performance of students is influenced by various factors related to the learning process in schools, such as abstract and uninteresting learning materials, teacher-centred teaching methods that make students passive, and a lack of opportunities for students to think mathematically [7-10]. Despite the importance of mathematics, there is a problem related to the subject called mathematics anxiety [11]. This anxiety has a negative impact on mathematical practice and learning outcomes [12],[13]. Students who suffer from math anxiety tend to view mathematics as complex, dislike the subject, resist doing mathematics assignments, or even skip mathematics classes [11]. It is due to anxiety, which makes it difficult for students to learn and apply mathematical concepts. Good interpersonal relationships are essential in academically understanding mathematics in school, and teachers play a crucial role in creating a positive classroom environment that promotes learning and reduces math anxiety [13].

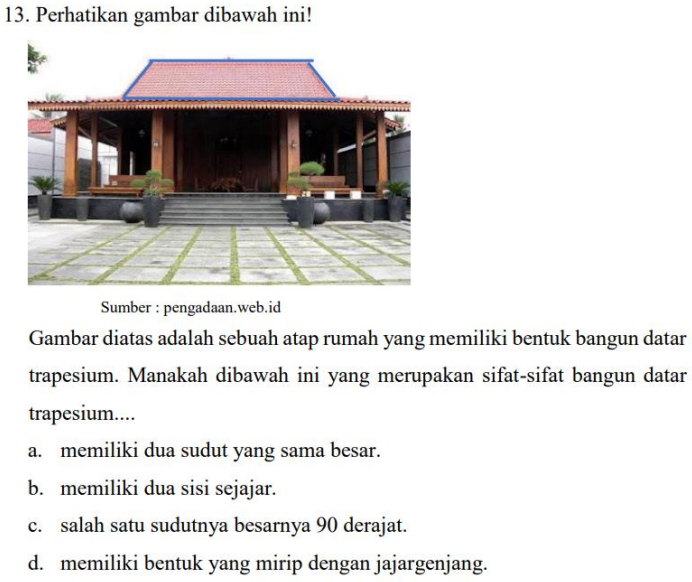
CTL is a teaching approach emphasizing the connection between the learning content and real-life situations. This approach is grounded in constructivist learning theories [14], which suggest that learning is an active process in which learners construct new knowledge based on their prior experiences and understanding [15]. One of the key ways in which CTL can reduce anxiety in students is by creating a more engaging and relevant learning experience [16]. When students see how their learning content relates to their own lives and experiences, they are more likely to feel motivated and invested in the material. This increased motivation can help to reduce anxiety by creating a sense of purpose and meaning in the learning process. Another aspect of CTL that can help reduce anxiety is its focus on active learning. Constructivist learning theories emphasize the importance of learners taking an active role in the learning process rather than passively receiving information from the teacher [17]. This active involvement in the learning process can help to reduce anxiety by giving students a greater sense of control and agency over their learning. CTL often involves problem-solving and critical thinking activities designed to help students apply what they have learned to real-world situations. These activities can help reduce anxiety by giving students a sense of accomplishment and success and providing opportunities to build confidence in their abilities. The relationship between CTL and reducing anxiety can be understood through constructivist

learning theories, which suggest that an active and engaging learning experience that connects the material to real-life situations can help to reduce anxiety in students. This research aims to determine whether the CTL model effectively minimizes anxiety and improves the learning outcome.

Methods

This research uses an experimental method to find a particular treatment's effect on another variable in a controlled environment. The technique used is a one-group control pre-posttest design, where a pre-test is given to the intervention group before the treatment. The treatment is taught using CTL, and a post-test is provided to measure the method's effectiveness. The research was conducted at a private elementary school in Indonesia, due to the students' low academic achievement and high anxiety levels. The study subjects were 51 students in 4th grade at the same school. The research was conducted between September 27th and October 11th, 2021.

The research uses two variables: independent and dependent variables. The independent variable is CTL, which affects the dependent variable. The dependent variables in the study are the learning outcome and math anxiety. The pre-test does not use CTL, but the post-test involves treatment with CTL for the students. The research uses two techniques for data collection: a test and a questionnaire. The test used in the study is a pre-test and post-test to evaluate the effectiveness of the material taught to the students. One of the example of this tets is showed by Fig. 1.


13. Perhatikan gambar dibawah ini!

Sumber : pengadaan.web.id

Gambar diatas adalah sebuah atap rumah yang memiliki bentuk bangun datar trapesium. Manakah dibawah ini yang merupakan sifat-sifat bangun datar trapesium....

a. memiliki dua sudut yang sama besar.
b. memiliki dua sisi sejajar.
c. salah satu sudutnya besarnya 90 derajat.
d. memiliki bentuk yang mirip dengan jajargenjang.

Fig. 1. The example of the test based on CTL on the two-dimensional shape. This problem used the traditional house as the case to learn two-dimensional shape

The questionnaire is used to gather data from the designated respondents and is closed-ended with predetermined options for the respondent to choose from the questionnaire's item. It measured the anxiety score, including unconfident, afraid, worried, depressed/threatened, disruption of concentration, and want to avoid. The questionnaire is used to help the select researcher subjects. The test and questionnaire are essential instruments in collecting data for the research.

Results

The average score of the pre-test and post-test of 4th-grade students was 6.27 on the pre-test and 7.59 on the post-test. The scores were obtained by administering a mathematics test to the 4th-grade A students. The mean score of the pre-test was 6.5, with a standard deviation of 1.44. The mean score of the post-test was 7.5, with a standard deviation of 0.90. The average anxiety score of the 4th-grade students on the pre-test was 7.72, and 3.96 on the post-test. The mean anxiety score in the pre-test was 8 with a standard deviation of 1.63, and 4 in the post-test with a standard deviation of 2.61. The anxiety questionnaire was about feelings of fear or tension towards a problem, especially during mathematics exams. Based on descriptive testing, both learning outcomes and anxiety levels showed differences in the average scores between the pre-test and post-test. There was an increase in the learning outcomes before and after the implementation of CTL. There was a decrease in the anxiety level of the students after CTL was applied. Table 1 shows the score of the pre-test and post-test for each dependent variable.

Table 1. Example table

	Pre-test	Post-test
Learning Outcome		
• Mean	6.27	7.59
• Median	6.5	7.5
• STD	1.44	0.9
Anxiety		
• Mean	7.72	3.96
• Median	8	4
• STD	1.63	2.61

Based on the mean of both variables, Fig. 2 shows the interaction.

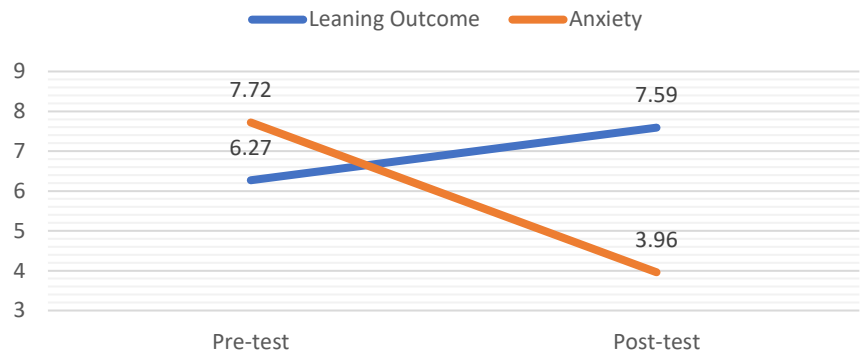


Fig. 2. The comparison of the mean of the pre-test and post-test

Table 2 at the Pair 1 (Learning Outcome) shows that the mean of the paired t-test was -1.323. The paired t-test showed a t-value of -6.404 and a significance value of <0.05, which means that the t-value is greater than the t-table value (-6.404 > 2.010). The paired t-test hypothesis test showed a significant result. Additionally, there was an increase in the student's learning outcomes, as indicated by the average score that increased from 6.27 during the pre-test to 7.59 in the post-test. Hence, implementing the CTL model impacted minimizing the students' anxiety in mathematics and improving their learning outcomes.

Table 2. Paired Sample t-test of learning outcome and anxiety

	Variables	Mean	Std. Deviation	Std. Error Mean	t	Sig. (2-tailed)
Pair 1	Learning Outcome (before) Learning Outcome (after)	-1.32353	1.47588	0.20667	-6.404	0.000
Pair 2	Anxiety (before) Anxiety (after)	3.76471	2.35447	0.32969	11.419	0.000

Using the same table for anxiety, the results show that the mean effect of the paired t-test was 3.764. The paired t-test results showed a t-score of 11.419 and a significance value of < 0.05. The t-score was higher than the t-table value (11.419 > 2.010). The paired t-test hypothesis test showed a significant result. Additionally, there was a decrease in the anxiety level, as indicated by the scores from 7.72 (pre-test) to 3.96 (post-test). Therefore, the effective implementation of the CTL model positively reduced students' anxiety levels.

Discussion

A. The relationship between learning outcome and CTL

According to the results of the observation conducted by the researcher, the learning outcomes were assessed by administering pre-test and post-test mathematics questions to 4th-grade students At school, and mathematics learning is associated with everyday life using

the CTL model. The implementation of CTL has increased the average learning outcome of the students. The increase in the middle learning outcome of the students is low. It is because some students still experience difficulties in learning mathematics and sometimes have a mindset that mathematics is complex, challenging and scary for students.

The application of the CTL model has an impact on the student's learning outcomes. This can be seen from the paired t-test significance test results, where the significance value was 0.000 < 0.05. The paired t-test hypothesis test showed a significant influence, as well as an increase in students' learning outcomes. It is indicated by an average increase from 6.27 in the pre-test to 7.59 in the post-test. Thus, it can be concluded that the practical application of the CTL model minimizes mathematics anxiety and increases students' learning outcomes.

This finding is in line with other research, which states that while implementing a contextual approach in the learning process is essential, the learning outcomes are also influenced by the student's initial abilities [18. Students have different academic skills, such as high, medium, and low initial capabilities. Expected learning outcomes in mathematics can be caused by internal and external factors [9]. Internal factors include a lack of interest in mathematics and low motivation among students during lessons. External factors include inadequate teacher stimuli, which can cause students who struggle in mathematics to remain silent and not ask questions.

This research confirmed the significance of problem-solving strategies in mathematics education to enhance 21st-century skills, as mentioned by Ref. [5]. It also explains the relevance of metacognition in instructional design within the domain of mathematics [6]. Student engagement is a crucial aspect of student success in education; there is a relationship between student engagement and academic achievement [8]. These studies emphasize the need for innovative and practical approaches in mathematics education that can boost student engagement, critical thinking, and problem-solving skills.

B. The relationship between anxiety and CTL

This discussion is based on observations obtained during a study. Based on the researcher's observations, students' anxiety towards mathematical questions in 4th grade can be addressed using the CTL model. The CTL approach emphasizes the connection of two-dimensional shape learning material to daily life. By connecting the learning material with everyday life, students will find it easier to understand the material. In the CTL model, when solving questions, students can do so through discussion and seeking the truth of concepts from reference sources, teachers, and others. In this way, students do not keep difficulties for too long, and the anxiety caused by problems solving mathematical questions can be addressed.

Thus, the CTL model is effectively able to reduce the level of anxiety of students towards mathematics.

The CTL model has an impact on anxiety. It is evident from the paired t-test results with a significance value of 0,000<0.05. Other research describes that the CTL model effectively reduces student anxiety [12]; this is because the experiencing activities in CTL provide facilities for students to understand the concepts of mathematical learning through exploration and discovery. The activities were conducted in a pleasant environment, where students worked the activity through group discussions to find solutions to their problems, thus reducing student anxiety [13]. Anxiety in students in learning mathematics can be addressed in various ways. Learning must encourage students to work together. It must enhance students' understanding of the concepts they have. Learning must involve students actively and independently.

Additionally, learning must be linked to real-life situations. Thus, CTL model effectively reduces student anxiety because the learning process is aimed at helping students understand the meaning of teaching materials and connect them to their daily life context (personal, social, and cultural). So, students have dynamic and flexible knowledge/skills to construct their understanding actively.

Conclusion

In conclusion, the findings on CTL demonstrate the importance of incorporating real-world and relevant contexts in the classroom. This approach has been shown to enhance learning outcomes, increase student motivation and engagement, and reduce anxiety. By placing students in situations that mirror the natural world and allowing them to apply what they have learned, CTL has been found to promote deeper understanding and retention of information. Furthermore, CTL has also been found to help students develop critical thinking, problem-solving, and collaboration skills. CTL positively impacts the learning process and should be considered a practical approach for teachers to use in their classrooms.

Conflict of Interest

The authors declare that there is no conflict of interest.

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