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Contextual Learning Based on Project Assessment: The Review of its Impact on Mathematics Learning Achievement Based on Students' Numerical Ability

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ABSTRAK

Masih banyak siswa yang kurang memahami pentingnya belajar matematika. Selain itu siswa merasa sangat bosan ketika mempelajari matematika. Berdasarkan hal tersebut, tujuan penelitian ini yaitu untuk menganalisis penerapan pendekatan kontekstual berbantuan asesmen proyek erhadap prestasi belajar matematika ditinjau dari kemampuan numerik pada Kelas V. Jenis penelitian ini adalah penelitian eksperimen yang menggumakan rancangan penelitian Post only Control Group Design. Sampel penelitian berjumlah 180 orang yang dipilih dengan menggunakan teknik Random Sampling. Metode pengumpulan data menggunakan tes. Instrumen pengumpulan data menggunakan soal tes. Data yang diperoleh diolah dengan menggunakan analisis varians (ANAVA) dua jalur melalui uji F dan dilanjutkan dengan uji Tukey. Hasil penelitian ini menemukan bahwa pertama, prestasi belajar matematika siswa yang belajar dengan pendekatan Kontekstual berbantuan asesmen proyek lebih tinggi daripada siswa yang belajar dengan pembelajaran konvensional. Kedua, terdapat pengaruh interaksi antara pendekatan pembelajaran dengan kemampuan numerik terhadap prestasi belajar matematika siswa. Ketiga, siswa yang memiliki kemampuan numerik tinggi, prestasi belajar matematika siswa yang belajar dengan pendekatan Kontekstual berbantuan asesmen proyek lebih tinggi daripada siswa yang belajar dengan pembelajaran konvensional. Disimpulkan bahwa pendekatan Kontekstual berbantuan asesmen proyek berpengaruh terhadap prestasi belajar matematika ditinjau dari kemampuan numerik pada siswa kelas V.

ABSTRACT

Many students still need to understand the importance of learning mathematics. In addition, students feel very bored when studying mathematics. Based on this, this research aims to analyze the application of a contextual approach assisted by project assessment on mathematics learning achievement in terms of numerical ability in Class V. This type of research is experimental research that uses only a Control Group Design research design. The research sample consisted of 180 people who were selected using the Random Sampling technique. The data collection method uses tests. The data collection instrument uses test questions. The data obtained was processed using a two-way analysis of variance (ANOVA) through the F test, followed by the Tukey test. The results found that the mathematics learning achievement of students who studied with a contextual approach assisted by project assessment was higher than those who studied with conventional learning. Second, there is an interaction effect between the learning approach and numerical ability on students' mathematics learning achievement. Third, for students with high numerical abilities, the mathematics learning achievement of students who study with a contextual approach assisted by project assessment is higher than those who study with conventional learning. It was concluded that the contextual approach assisted by project assessment affected mathematics learning achievement regarding numerical abilities in fifth-grade students.

1. INTRODUCTION

Mathematics is one of the subjects taught in school, it is hoped that it can be a means of improving students' reasoning power. Mathematics can also improve the ability to apply mathematics to face life's challenges in solving problems (Godino et al., 2021; Jaynelle G. Domingo et al., 2021; Mailizar et al., 2020). Mathematics is a subject studied by all students from elementary school to higher education. Several reasons for the need for students to study mathematics include: first, it is a means of clear and logical thinking (Ekowati et al., 2021; Fatah et al., 2016; Marliani, 2015; Nur et al., 2018). Second, a means of solving problems in everyday life. By solving math problems, students learn to face challenges

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systematically, break them down into small steps, and find solutions (Gotwals et al., 2015; Kamid, Rohati, et al., 2021; Kowiyah et al., 2019). Third, a means of recognizing relationship patterns and generalizing experiences. Fourth, a means to develop creativity. Fifth, a means to increase awareness of cultural developments. Mathematics plays an important role in students' lives because it has many benefits (Rahma & Pujiastuti, 2021; Santagata et al., 2021; Siregar et al., 2020). Knowledge of mathematics plays an important role in understanding other subjects, such as science, social studies, art, and music. This provides a foundation for why students need to understand concepts and solve problems in various disciplines (Russo et al., 2020; Santagata & Yeh, 2014).

However, the current problem is that there are still many students who do not understand the importance of learning mathematics. Previous research also states that students are very bored when studying mathematics (Dinayusadewi & Agustika, 2020; Pramestika et al., 2020; Suryawan et al., 2021). Other findings also reveal that there are still many students who get low mathematics learning outcomes (Dinayusadewi et al., 2020; Setiawan & Ari Oka, 2020; Yuniarti & Radia, 2020). Other research also explains that students' difficulties in learning mathematics are caused by less-than-optimal learning processes in the classroom (Kamid, Sabil, et al., 2021; Kamid, Syaiful, et al., 2021; Monika & Ramadan, 2022). The lack of optimal student achievement in mathematics is caused by many factors. One of them is thought to be due to the inadequate quality of the learning process. Nowadays the learning process tends to be theoretical. Even though contextual learning is easier to improve student learning achievement in mathematics. So far, the learning process in class has often been oriented toward the quantity of learning material (Hidayat et al., 2020; Kusumawardani et al., 2018; Susiana, 2021). Teachers are of the view that their main task is to complete the teaching materials contained in the GBPP and textbooks. In fact, the quality of education is largely determined by the quality of learning, such as the strategies used in presenting lesson material or the atmosphere in which the learning is carried out.

The research results show that it is very important to innovate in learning so that learning is more meaningful (Ahmad & Nasution, 2018; Dewi et al., 2021; Masana, 2022; Sugiyanto et al., 2018). There is an increase in learning motivation after students are given learning using learning strategies that are oriented to the problems students experience every day. Conditions like this cause the information received by students to be remembered longer and students' understanding of the problems given will be deeper so that students will be able to improve their learning achievement (Brinus et al., 2019; Santoso, 2017; Suastika & Rahmawati, 2019). However, in reality, so far, both in the school mathematics curriculum and in mathematics learning at school, learning habits have been stuck with a conventional approach using sequence; First, theory or definitions or theorems are taught (Suarjana et al., 2017; Yuliyanti & Sunarsih, 2019). Second, examples of questions and their solutions are given. Third, practice questions are given for students to work on. Conventional mathematics learning results in students only working procedurally and understanding mathematics without reasoning and tending to use existing data without paying attention to the context of the problem.

The importance of mathematics in schools means that an appropriate strategy is needed in learning mathematics so that the expected goals can be achieved as desired (Bakhri et al., 2019; Dewi et al., 2021; Hernawati, 2016; Sutrisno, 2022). Many innovations in the education sector have been pursued by the government, such as improving the quality of teachers through training, educational seminars, and further education. In innovation in mathematics learning, teachers must prioritize contextual rather than theoretical learning (Mawardi et al., 2019; Santoso, 2017). This learning innovation will make the mathematics learning process more meaningful. Meaningful learning is a learning process in which new information or knowledge is connected to the structures that someone who is learning already has (Najib, 2016; Rahmah, 2018). Thus, in a mathematics lesson, there will be a meaningful learning process for students, if the concepts or material studied by students are presented in the form of contextual problems. Contextual problems are problems that are related to students' real world or at least close to real-world conditions (Islami & Armiati, 2020; Mawardi et al., 2019; Santoso, 2017). Contextual learning is a learning approach that connects reality with material or teaching materials, teachers do not only present theory in learning but rather prioritize direct practice so that it is easy for students to understand (Ramdani, 2018; Suastika & Rahmawati, 2019). In learning mathematics, students can be given project-based assessments so that they can improve their creative thinking abilities.

Project-based assessment in learning refers to the evaluation of student learning and skills through the completion of real-world projects or assignments (Ernawati et al., 2018; Sukmasari & Rosana, 2017). This assessment is designed to measure student understanding, application of knowledge, problem-solving abilities, and collaboration skills. Project-based assessment requires students to use, integrate, apply, and transfer a variety of different information and skills into projects (Simamora et al., 2019; Widiartana et al., 2015). The project assignments are given aim to improve problem-solving skills and decision-making skills. Students can work on projects over a period allowing for in-depth exploration,

critical thinking, and development of complex solutions (Simamora et al., 2019; Sukmasari & Rosana, 2017; Widiartana et al., 2015). Project assignments given to students are based on real-world problems or problems that are relevant and meaningful for students. This will certainly help students improve their creative thinking skills in solving problems. The ability to think creatively in students refers to the student's ability to think innovatively, generate new ideas, and find unique solutions to a problem (Maya et al., 2019; Sanjaya et al., 2017; Suparmi, 2019). Creative thinking involves developing innovative solutions to problems. Students with strong creative thinking skills can analyze facts, exchange ideas, and work collaboratively to find effective solutions (Apriana et al., 2020; Ningrum, 2016; Wulandari et al., 2019). This skill is highly valued in various careers and is considered a valuable soft skill, especially in the 21st century.

Previous research findings reveal that project-based assessment is important to apply to students because it can measure problem-solving abilities (Sukmasari & Rosana, 2017; Widiartana et al., 2015). Other findings also reveal that mathematics learning must be innovative so that it can improve students' abilities (Datreni, 2022; Hendrawan & Marlina, 2022; Sutrisno, 2022). A contextual approach can improve student learning outcomes significantly (Masalubu, 2018; Suarjana et al., 2017). Other research also confirms that mathematics is an important subject so teachers must be able to design appropriate learning activities for students (Bahar & Juhrianto, 2022; Faturohman et al., 2022). There has been no study regarding the application of a contextual approach assisted by project assessment on mathematics learning achievement in terms of numerical ability. Through a contextual approach, students will develop as a whole. Students not only develop in cognitive aspects but also develop in affective and psychomotor aspects through internal appreciation of the problems they face. This research aims to analyze a contextual approach assisted by project assessment on mathematics learning achievement in terms of numerical ability.

2. METHOD

This research is experimental research using a post-only Control Group Design research design. In this research, there are two variables consisting of one independent variable and one dependent variable. The independent variables are the learning model (A) as the treatment variable, and numerical ability (B). The dependent variable is mathematics learning achievement (Y). The learning model treatment variable (A) is divided into two, namely the contextual approach assisted by project assessment (A1) for the experimental group, and the conventional learning model (A2) for the control group. In this study, the population was all class V students in cluster 1 Gianyar. After random sampling, class V students at SDN 2, class V SDN 5, and class V students at SD N 6 Gianyar were obtained as research samples. Based on information obtained from class V teachers in the three elementary schools, it was explained that both of them were the equivalent classes of all class V in cluster 1 Gianyar. Two sample groups were used, namely one experimental group and one control group. To determine the sample in this study, a random sampling technique was used, namely by randomly selecting two classes as experimental classes, namely class V1 SD N 2 and class V SD N 5 while class V2 SD N 2 and class V SD N 6 as controls. Before the research is carried out, a mean difference test is first carried out between the two existing groups, to ensure that the two existing groups are the same, and based on the results of the t-test the two groups were declared equal.

The method used to collect data is a test. Data was collected using the numerical ability test method, while the mathematics learning achievement test was prepared based on the KTSP curriculum which was first tested by two experts. The validation content of the mathematics learning achievement test was 0.825, and 33 questions were found to be valid. The reliability of the test is 0.939 which is very high. The instrument used to collect data is test questions. Before analyzing the data, the prerequisite tests were tested, namely, the normality test and the homogeneity test manually, and the results of both tests succeeded in rejecting H1 and accepting H0. Test the hypothesis using a two-way ANOVA and if there is an interaction between the contextual learning approach and students' numerical abilities, then continue with the Tukey test to find out which interaction effect is better.

3. RESULT AND DISCUSSION

Result

Based on the normality test, the data is normally distributed and the homogeneity test is 1.93< from the table 0.05, or it can be concluded that it is homogeneous. A recapitulation of the results of calculating student mathematics learning outcomes is presented in Table 1.

Table 1. Recapitulation of Calculation Results of Student Mathematics Learning Outcomes

Learning Approaches Statistics	A1	A2	A1B1	A1B2	A2B1	A2B2
N	60	60	30	30	30	30
Mean	76.33	72.7	83.3	69.3	72.1	73.3
Median	76.9	72.65	86	70.8	74.5	74.5
Mode	77.6	73.16	79.5	70.8	69.5	69.5
Standard Deviation	9.8	7.8	7.1	6.73	7.59	8.2
Variance	96.73	61.6	50.09	45.33	57.68	66.9
Range	38	30	30	32	25	25
Maximum	95	85	95	89	85	80
Minimum	57	55	65	57	60	55

The results of the analysis presented in Table 1 show that the average mathematics learning achievement of students who follow the contextual approach is 76.7, higher than students who study using conventional learning, namely 70.7. For students who have high numerical abilities, the average mathematics learning achievement who study using a contextual approach is 80, higher than students who take conventional learning, which is 72.1. Meanwhile, students who have low numerical ability who study with a contextual approach are 73, higher than students who study with conventional learning, which is 72.1. Summary of Two Path Variance Analysis Mathematics Learning Results for All Treatments are presented in Table 2.

Table 2. Summary of Two Path Variance Analysis of Mathematics Learning Outcomes for All Treatments

Sources of Variance	JK	et al	RJK	Fcount	Ftable(0.05)	Information
A	396.04	1	396.04	7.2	3.94	Significant
B	1228.76	1	1228.76	22.43	3.94	Significant
AB	1732.76	1	1732.76	31.5	3.94	Significant
In	6380.43	116	55			
Total	**9737.97**	**119**				

Based on the results of hypothesis testing, it appears that the four hypotheses proposed in this study have successfully rejected the null hypothesis, details of the results of these hypotheses are as follows. First, the results of the first hypothesis test have succeeded in rejecting Ho and accepting H1, which means that there is a difference in performance learning mathematics between students who take lessons with a contextual approach assisted by project assessment and conventional learning in class V students in cluster 1 Gianyar, on average performance mathematics learning for students who took lessons using a contextual approach assisted by project assessment = 76.67 and the average mathematics learning outcome score for students who took lessons with conventional learning = 70.7. So overall, the performance learning mathematics of students who take lessons with a contextual approach based on project assessment is better than conventional learning. The results of the hypothesis test showed that the contextual approach assisted by project assessment is superior in improving performance learn mathematics rather than conventional learning.

The results of the second hypothesis test succeeded in rejecting Ho and accepting H1, which means that for students who have high numerical abilities, there is a difference in performance learning mathematics between students who take lessons with a contextual approach assisted by project assessment with students who take lessons using conventional learning models for class V students in cluster 1 Gianyar. The average score performance mathematics learning for students who have high numerical abilities who take lessons with a contextual approach assisted by project assessment = 80 and the average score for mathematics learning outcomes for students who take lessons with conventional learning = 72.7, so it can be concluded that for students who have high numerical abilities, performance learning mathematics of students who take lessons with a contextual approach assisted by project assessment is better than students who take lessons with conventional learning for class V students in cluster 1 Gianyar.

The results of the third hypothesis test succeeded in rejecting Ho and accepting H1 which states that for students who have low numerical abilities, a difference in performance mathematics is learning

between students who take lessons with conventional learning and students who took lessons using a contextual approach assisted by conventional learning project assessments for class V students in cluster 1 Gianyar. The average score performance of students who have low numerical abilities who take lessons with a contextual approach assisted by project assessment = 73.3 and the average score performance of mathematics learning for students who take lessons with a conventional learning model = 69.3 so it can be concluded that for students who have low numerical abilities, the mathematics learning outcomes of students who take lessons with a conventional learning model are better than students who take lessons with a contextual approach based on project assessment in class V students in cluster 1 Gianyar.

The results of the fourth hypothesis test succeeded in rejecting Ho and accepting H1. This means that there is an interaction effect between the learning approach and numerical ability on performance testing mathematics for class V students in cluster 1 Gianyar.For students who have high numerical abilities, the average score of mathematics learning outcomes of students who take lessons using a contextual approach assisted by project assessment = 80, and the average score of mathematics learning outcomes of students who take lessons with conventional learning = 72.1 so it can be concluded that for students who have high numerical abilities, the mathematics learning outcomes of students who take lessons using a contextual approach assisted by project assessments are better than students who take lessons with conventional learning. Furthermore, for students who have low numerical ability, the average score performance mathematics learning for students who take lessons using a contextual approach assisted by project assessment = 69.3, and the average score for mathematics learning outcomes for students who take lessons with conventional learning = 73.3, so performance learning mathematics of students who take lessons with a contextual approach assisted by project assessment is better than students who take lessons with conventional learning.

Discussion

The results of data analysis show that there is an influence of contextual approach assisted by project assessment on mathematics learning achievement in terms of numerical ability. This is caused by several factors. Firstly, a contextual approach assisted by project assessment can improve mathematics learning achievement. The contextual approach assisted by project assessment involves students actively in the learning process, starting from planning, and implementation to the assessment process (Ariyani & Ganing, 2021; Hernawati, 2016; Masalubu, 2018). A contextual approach based on project assessment is carried out by looking at students' abilities, thereby enabling students to be motivated to learn continuously and filled with content related to real problems. The contextual approach focuses on observing and studying a phenomenon or daily event, thereby enabling students to understand a learning phenomenon from all sides (Buchori, 2019; Gitriani et al., 2018; Watini, 2019). Previous research findings also state that a contextual approach makes students more active and wise in responding to or dealing with existing events (Hernawati, 2016; Suarjana et al., 2017; Zakiah, 2017). A contextual approach assisted by project assessment allows students to develop their ideas involving all their senses (Ariyanto et al., 2020; Sulistyawati, 2021; Sarmi et al., 2015). Conventional learning places more emphasis on the teacher's ability to provide extrinsic motivation to students so that students are passive. Thus, it can be concluded that for students who have high numerical abilities, performance students who take lessons with a contextual approach based on project assessment are better than students who take lessons with a conventional learning model.

Secondly, a contextual approach assisted by project assessment can improve numerical abilities. The application of a contextual approach assisted by project assessment for students who have high numerical abilities provides opportunities for students to be able to explore their abilities so that when the learning process occurs students can develop their abilities optimally. In the learning process with a contextual approach assisted by project assessments, they are actively involved in discovering and understanding the concepts of the subject matter being studied and are allowed to assess what they have done (Amri & Tharihk, 2018; Uslan et al., 2018; Widiana, 2016). In this way, learning will feel more meaningful because it involves students as a whole in the learning process. Based on the explanation above, it is clear that the contextual approach assisted by project assessment is better applied to students than conventional learning because with the contextual approach assisted by project assessment all students' senses are involved in the learning process. The application of a contextual approach assisted by project assessment for students who have high numerical abilities provides opportunities for students to be able to explore their abilities so that when the learning process occurs students can develop their abilities optimally. In the learning process with a contextual approach assisted by project assessments, they are actively involved in discovering and understanding the concepts of the subject matter being studied (Agung et al., 2020; Suarjana et al., 2017; Zakiah, 2017). Students are

allowed to assess what they have done (WP Rahayu et al., 2020; Widiana et al., 2022). In this way, learning will feel more meaningful because it involves students as a whole in the learning process.

Third, a contextual approach assisted by project assessment can increase student activity. When compared with conventional learning models, the contextual approach assisted by project assessment seems to place more emphasis on student involvement in learning. This makes students actively involved in the learning and assessment process for decision-making (Rahayu & El Hakim, 2021; Suryawati & Osman, 2017). This is following the curriculum guide which states that student learning experiences occupy an important position in efforts to improve the quality of graduates (Andrianingrum & Suparman, 2019; Hanik et al., 2018; Evi Suryawati & Osman, 2018). Therefore, teachers are required to be able to design and implement the learning process appropriately (Fu et al., 2019; Musriliani & Anshari, 2015). Every student needs knowledge and skills to be able to live in society and this provision is expected to be obtained through learning experiences at school. Learning that links students with their everyday experiences will clearly show the benefits of mathematics in children's lives so that children learning mathematics is connected to children's everyday experiences.

This research implies that a contextual approach assisted by project assessment has a better impact than students who take part in conventional learning. Opportunities for students to develop their ideas involving all their senses (Anugraheni et al., 2018; Tapingkae et al., 2020). Thus, it can be concluded that for students who have high numerical abilities, the performance of mathematics learning of students who take lessons with a project assessment-based contextual approach is better than conventional learning. Students are oriented to problems related to everyday life, and based on these problems can develop concepts related to the problems being faced. Students are required to be actively involved in discovering and understanding the concepts of the subject matter they are studying and being able to assess what they have done (Agung et al., 2020; Suarjana et al., 2017; Zakiah, 2017). In this way, learning becomes student-centered. So for students who have low numerical abilities, this will be very difficult to do because they will tend to just accept what the teacher gives them without any desire to criticize the problems given.

4. CONCLUSION

The results of data analysis show that first, there are differences in mathematics learning outcomes between students who take a contextual approach based on project assessment in class V. Second, there is an interaction effect between the contextual approach and numerical ability on mathematics learning outcomes. Third, for students who have high numbers, the mathematics learning outcomes of students who follow the contextual approach are higher than students who study using conventional learning. Fourth, for students who have low numerical abilities, the learning outcomes of students who take conventional learning are higher than students who take a contextual approach based on project assessment. It was concluded that a contextual approach assisted by project assessment can improve students' learning achievement and numerical abilities.

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