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BOOSTING STUDENT UNDERSTANDING USING THE INTEGRATION OF ETHNOMATHEMATICS AND WORKED EXAMPLES IN A PROJECT-BASED LEARNING MODEL

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ABSTRACT

This study investigates the effectiveness of integrating ethnomathematics and worked examples within a Project-Based Learning (PjBL) model to enhance students' mathematical understanding in a Package B equivalent junior high school program. The integration of PjBL with ethnomathematics provides a culturally responsive and contextual learning environment, while worked examples support students' conceptual clarity before engaging in project-based tasks. A pre-experimental design employing a One-Group Pretest–Posttest approach was used. The population consisted of all Package B students at SKB Magetan in the 2024/2025 academic year, with a purposive sample of 63 Grade IX students assigned to control (n = 31) and experimental (n = 32) groups. Data were collected through mathematics pretests and posttests and analyzed using descriptive and inferential statistics. The experimental group demonstrated an improvement from a mean score of 65.00 (pretest) to 71.25 (posttest), whereas the control group showed a slight decline from 64.35 to 63.39. Normality testing using the Kolmogorov–Smirnov method confirmed that the residual data were normally distributed (p = 0.200). The paired sample t-test showed a significant difference between pretest and posttest results (t = –2.632, p = 0.011), indicating measurable learning gains. Additionally, the Independent Samples

Test confirmed initial equivalence between groups (p = 0.954) and revealed a significant difference in posttest performance (t = –3.284, p = 0.002), with the experimental group outperforming the control group. These findings suggest that the integration of ethnomathematics and worked examples within a PjBL model effectively improves students' mathematical understanding.

KEYWORDS: PjBL; Ethnomathematic; Worked Xamples; Package B Equivalency Education; Student Understanding.

1. INTRODUCTION

Equivalency education is one of the important solutions in providing learning opportunities for individuals who cannot access formal schooling. The Package B Program, which is equivalent to junior high school education, provides a second chance for learners to obtain an academic qualification. In this context, learning mathematics becomes particularly challenging due to the complexity of mathematical concepts and the diversity of students' backgrounds (Saputra, 2024). Students in equivalency programs vary widely in age, prior learning experiences, and learning needs, which strongly influences their motivation and engagement in mathematics learning (Nugraha et al., 2020). Such differences are significant because students' mindsets and beliefs have a substantial impact on how they approach and understand mathematics (Boaler, 2016).

Learning methods that can be used by teachers based on the 2013 Curriculum include Discovery Learning, PBL, and PjBL. This curriculum emphasizes student-centered learning, in which the effectiveness of instructional methods is determined by the teacher's ability to select and apply pedagogical approaches aligned with the content and learning context. This aligns with the view that the quality of mathematics instruction significantly influences student learning outcomes (Yang & Kaiser, 2022; Cheng et al., 2023; Cerezci, 2020; Pauli et al., 2024). Selecting an appropriate learning model also requires consideration of cognitive processes that students use to understand mathematical ideas (Sun et al., 2023).

Based on the Pancasila Student Profile, the government recommends learning models that encourage independence, collaboration, and creativity, one of which is Project-Based Learning (PjBL). PjBL enables students to explore real-life problems, engage in inquiry, and manage information collaboratively an approach consistent with international findings that inquiry-based tasks can enhance students' mathematical thinking (Chhabra & Gawande, 2025; Ndiung & Menggo, 2024; Almulla, 2020; Rehman et al., 2024). According to the Ministry of Education and Culture (2013), the project-based education model has the following features: students choose a framework; students pose problems or challenges; students work together to obtain and manage information to solve problems; and evaluations are carried out periodically. PjBL structure is also in line with design-based research principles that emphasize authentic, culturally relevant tasks (Svihla et al., 2019; Q. Zhang & Ramli, 2025; Akharraz, 2021).

The rationale for this research is rooted in students' perceptions that mathematics has no connection to culture. This disconnect often leads to anxiety, rote memorization, and a belief that mathematics offers little relevance to daily life. Cultural perspectives, however, play an important role in shaping students' mathematical identities and engagement (Amit & Fouze, 2017; Moller et al., 2014; Khilji & Xenofontos, 2023).

Students' fear of mathematics and their reliance on memorizing formulas are manifestations of mathematics anxiety, a well-documented phenomenon that negatively affects working memory, problem-solving ability, and conceptual understanding (Klados et al., 2019; Dowker & Sheridan, 2022; Pelegrina et al., 2020; Siaw et al., 2020). As a result, learners often fail to see the relevance of mathematics in daily life and community contexts, reducing perceived usefulness and motivation (Dowker et al., 2016). This situation leads many families and segments of society to view mathematics as a difficult and abstract discipline, reinforcing long-standing negative attitudes toward the subject (Luttenberger et al., 2018). Such misconceptions highlight the need to develop meaningful, contextual, and culturally grounded approaches to mathematics education to reduce anxiety and promote mathematical literacy (Oladejo et al., 2023; Moustafa et al., 2021; Verdeflor et al., 2025).

Ethnomathematics is considered the best way to show the reciprocal relationship between mathematics and culture. Alangui (2010) said that "transformation" in mathematics must occur from a historical, cultural, social, political, and educational perspective. If examined further, this transformation leads to the creation of the term ethnomathematics (Alangui, 2010). Urbiratan D'Ambrosio said that there are two main reasons why ethnomathematics is used in education. The first is because ethnomathematics shows the intellectual development of various cultures, professions, genders, and others. The second reason is because ethnomathematics reduces the idea that mathematics is final, permanent, absolute (certain), and unique (certain).

The ethnomathematics perspective in the mathematics curriculum helps all participants to understand and appreciate alternative perspectives, cultural diversity, natural language, mathematics, and visual representations that form a unique system for meaning-making. In this context, reorienting teaching and learning to include ethnomathematics can engage and excite students in learning and encourage them to see themselves as capable of doing mathematics by validating their own cultural experiences, which serve as important components in understanding and celebrating learning, This perspective aligns with the Realistic Mathematics Education (RME) approach, which emphasizes the importance of grounding mathematics in real-world contexts (Soleha et al., 2024; Susanti, 2025; Hakim et al., 2024). Studies also show that embodied and cultural mathematical activities can strengthen students' conceptual understanding (Naufal et al., 2024; Ashabulabib & Arfinanti, 2024; Healy & Fernandes, 2011; Fenyvesi et al., 2019). In mathematics learning, ethnomathematics elements can be used to help students construct concepts as part of mathematical literacy. Ethnomathematics helps students appreciate diverse ways of reasoning and supports meaningful mathematical learning experiences (Shahbari & Daher, 2020; Machaba & Dhlamini, 2021; Batiibwe, 2024; Pathuddin et al., 2021). In addition, ethnomathematics can make the learning environment more exciting and interesting so that students become very interested in mathematics lessons, which is expected to have an impact on their mathematical abilities, especially mathematical literacy (Saironi, 2022).

Human Cognitive Architecture (HCA) is an important concept in education, especially in the context of learning mathematics at the junior high school level. HCA focuses on understanding how the human brain processes, stores, and retrieves information, which has great relevance in efforts to improve the quality of mathematics learning (Money-Nolan & Shelley-Tremblay, 2023). This has important implications for mathematics learning at the junior high school level, because students are often confronted with complex mathematical concepts (Kalyuga, 2009). To increase the effectiveness of learning, it is important to present the material in a way that does not burden the students' working memory. In other words, teachers must ensure that explanations and learning materials are presented briefly and clearly so that students can process the information well, making it essential for teachers to design instruction that minimizes unnecessary cognitive load. This is supported by Cognitive Load Theory (Van Merriënboer & Sweller, 2005). The concept of repetition and practice is a key factor in moving information from working memory to long-term memory (Paas et al., 2003). In the context of junior high school mathematics, this means that students need to do regular practice to strengthen their understanding of concepts such as algebra, geometry, and statistics. This practice helps students internalize mathematical knowledge and skills, so that the information can be more easily accessed and applied in the future (Sholihah, 2022).

In the context of junior high school mathematics learning, the application of HCA suggests that teachers should consider ways to facilitate schema development, reduce cognitive load, and utilize students' working and long-term memory capacity. One approach that can be used is to adopt a diverse learning approach, including the use of concrete examples to illustrate concepts, conducting group activities to allow students to collaborate in solving problems, and utilizing learning technology to provide interactive learning experiences (Apriyani, 2018).

The application of Cognitive Load Theory in mathematics teaching is very important in an effort to reduce non-essential cognitive load that can hinder students' understanding and learning. Cognitive Load Theory is an important concept in Human Cognitive Architecture (HCA) which emphasizes that the human brain has a limited capacity to process information. Therefore, in the context of mathematics learning, the use of Cognitive Load Theory can play a key role in ensuring that students can assimilate mathematical concepts more efficiently.

Asmara et al. (2020) explains that one important aspect in implementing Cognitive Load Theory is breaking down mathematics learning materials into smaller, more accessible parts for students. For example, when teaching complex mathematical concepts such as algebraic equations, teachers can start with simpler steps and then gradually introduce more complex concepts. This helps students not to feel too overwhelmed by the large amount of information they have to process at once.

The use of concrete examples and real-world situations is also an effective strategy in reducing non-essential cognitive load. In teaching mathematics, teachers can illustrate mathematical concepts with examples that are relevant to everyday life. For example, when teaching the concept of comparison in mathematics, teachers can provide examples that are easy for students to understand. In practical classroom implementation, strategies that incorporate concrete examples, collaborative tasks, and technology-based supports can help reduce extraneous cognitive load (Bolkan & Goodboy, 2019; Sands, 2019).

Worked Example is a teaching strategy that provides step-by-step examples of solving a problem before students try it themselves (Irwansyah & Retnowati, 2019; Booth et al., 2015). In the context of

PjBL and ethnomathematics, worked examples are used to reduce cognitive load, i.e. students see examples before working on a project, making it easier to understand the concept, increase learning effectiveness, i.e. concrete examples help students build understanding before they apply concepts in a project, show the application of mathematics in culture, i.e. worked examples can show how people from a particular culture use mathematics in everyday life.

The PjBL model integrated with Ethnomathematics and Worked Example is an innovative and contextual learning approach. Students not only learn mathematics in the abstract, but also understand how mathematical concepts are applied in their own culture through interesting projects. Worked examples help them understand the concept better before applying the knowledge in real projects. This approach is very suitable for use in culture-based learning and can be applied at various levels of education to improve students' critical, collaborative, and creative thinking skills.

Student understanding refers to the extent to which a student can process, interpret, and apply information or concepts that have been learned in various contexts. This understanding includes cognitive aspects such as factual knowledge, concepts, procedures, and metacognition that enable students to use their knowledge in different situations (Renkl, 2005).

Worked examples are a very effective method in improving students' understanding because they help them reduce cognitive load, understand the structure of the problem, and develop systematic thinking patterns. With proper application, this method can help students become more confident in solving problems and applying concepts in various situations.

From the explanation above, the author wants to research the Project Based Learning Model integrated with ethnomathematics and worked examples to improve the understanding of Package B students equivalent to junior high school.

2. RESEARCH METHODS

2.1. Research Design

This study employed a quasi-experimental design using a non-equivalent control group pretest–posttest approach. Two intact groups of Package B students were involved: an experimental group and a control group. The experimental group received mathematics instruction through the integration of ethnomathematics and worked examples within a Project-Based Learning (PjBL) model, while the control group was taught using conventional mathematics instruction. Both groups were administered a pretest prior to the intervention and a posttest after the intervention to examine changes in students' mathematical understanding. This design allows for the evaluation of learning gains within each group as well as comparisons of post-intervention outcomes between the experimental and control groups. Quasi-experimental designs are commonly used in educational research when random assignment is not feasible (Johnson, 1986; Knapp, 2016; Stratton, 2019).

2.2. Population and Sample

The population in this study includes all Package B students at SKB Magetan who are registered in the odd semester of the 2024/2025 academic year. From this population, the research sample was selected using a purposive sampling technique by considering the number of classes at PKBM Raharjo which only consists of 1 class IX.

2.3. Research Instruments

This study uses several types of instruments to collect data. First, data on students' initial mathematics scores obtained from the results of the 2023/2024 academic year semester 2 exams. This data will be used as a pretest to determine students' initial abilities before implementing the learning model. Second, worked examples for classroom learning activities. Third, a mathematics learning achievement test that will be given as a posttest at the end of the implementation of the learning model, precisely in the fourth week of October 2024. This test was prepared by the researcher with reference to the material that had been taught.

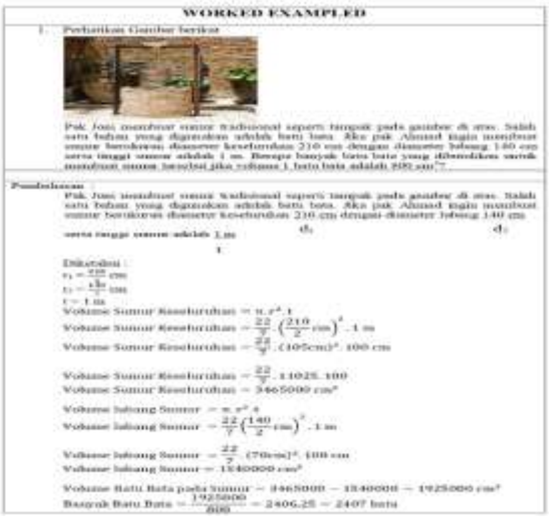
WORKED EXAMPLED

Figure 1: Worked Examples Of Curved Side Geometric Shapes

2.4. Research Procedures

This research consists of three main stages: preparation stage, implementation stage, and data analysis stage. In the preparation stage, the researcher will prepare a research instrument in the form of worked examples, validate the instrument, and collect data on students' initial mathematics scores. The implementation stage includes the application of the ethnomathematic integrated PjBL model with Worked Examples of mathematics learning on the research sample and the implementation of the posttest in the fourth week of October 2024. Finally, in the data analysis stage, the researcher will process and analyze the initial and posttest data, conduct appropriate statistical tests, and interpret the results of the data analysis.

Table 1: The Learning Syntax is as Follows.

Stage	Teacher Activities	Student Activities
1. Orientation and Identification of Culture-Based Problems (Project Definition)	– The teacher introduces a project related to local culture (ethnomathematics). – Provides an initial worked example to show the relationship between mathematical concepts and culture.	– Students observe and understand the examples given. – Identify mathematical problems in the context of local culture.
2. Project Planning (Designing Culture-Based Solutions)	– Teachers guide students in designing projects by considering cultural aspects and relevant mathematical concepts. – Provide additional worked examples with increasing levels of complexity.	– Students design culture-based solutions, for example analyzing batik motifs, traditional houses, or weaving patterns.
3. Investigation and Data Collection (Concept Exploration & Worked Example Implementation)	– The teacher facilitates further exploration of mathematical concepts in local culture. – Asks students to work on similar problems with initial guidance from worked examples.	– Students collect data from observations, interviews, or literature. – Use worked examples as a guide in analyzing data.
4. Project Development and Completion (Solution Implementation & Understanding Evaluation)	– The teacher monitors the progress of the project and provides feedback based on worked examples. – Faded worked examples are removed to encourage independent problem solving.	– Students complete projects and test the mathematical concepts they learn in a cultural context. – Attempt to solve problems without the aid of full worked examples.
5. Project Results Presentation (Communication & Learning Reflection)	– The teacher asks students to present the results of the project and explain the mathematical concepts used. – Provides trigger questions to reflect on the application of ethnomathematics and worked examples.	– Students present project results and explain their thinking process. – Reflect on how worked examples helped their understanding.
6. Final Evaluation and Reflection (Assessment & Feedback)	– Teachers provide project-based assessments and conceptual understanding tests. – Reflective discussions about how these approaches help mathematical understanding.	– Students take formative tests to see how far they understand the concepts. – Discuss their learning experiences through ethnomathematics and worked examples.

2.5. Data Analysis Techniques

Data analysis in this study consists of two parts: descriptive analysis and inferential analysis. In descriptive analysis, researchers will calculate the mean value, standard deviation, minimum value, and maximum value of the initial and posttest data. The results of descriptive analysis will be presented in the form of tables and graphs to provide a clear picture of the data distribution. Meanwhile, inferential analysis involves testing the normality of the data to determine the type of statistical test to be used. If the data is normally distributed, then the paired sample t-test will be applied to compare the average initial and posttest values. However, if the data is not normally distributed, the Wilcoxon test will be used as an alternative. In addition, researchers will also calculate the effect size to determine how effective the learning model is applied.

Through this study, it is expected to obtain valid and reliable information regarding the effectiveness of implementing the PjBL model of differentiated mathematics learning in improving the mathematics learning achievement of Package C students at PKBM Raharjo. The results of this study are expected to provide a positive contribution to the development of more effective and innovative mathematics learning strategies in equivalency education.

3.RESULTS

3.1. Descriptive Analysis Results

Descriptive statistics is a method used to describe and summarize the main characteristics of a data set. In the context of this study, descriptive statistics are used to describe the distribution of pretest and posttest scores in the control and experimental classes. Table 1 presents various descriptive statistical measures, such as the number of students, minimum score, maximum score, mean, median, mode, standard deviation, variance, skewness, and kurtosis. These measures provide important information about the central tendency, dispersion, and shape of the distribution of student score data before and after the treatment is given.

Table 2: Descriptive Statistics of Pretest and Posttest Scores.

	Control Class		**Experimental Class**	
	Pretest	*Posttest*	*Pretest*	*Posttest*
Number of Students	31	31	32	32
Minimum Value	40	45	50	55
Maximum Value	83	80	83	90
Average	64.35	63.39	65.00	71.25
Median	65.00	65.00	63.00	70.00
Mode	65	60	63	70
Standard Deviation	9.47	8.44	9.87	10.53
Variance	89.77	71.31	97.42	110.81
Skewness	0.17	-0.28	0.44	0.17
Kurtosis	-0.28	-0.62	-0.71	-0.55

Based on the descriptive statistics table, it can be seen that the number of students in the control class is 31, while in the experimental class it is 32. The minimum and maximum values provide information about the range of values obtained by students. The mean, median, and mode indicate the measure of central tendency of the data, where the mean is the arithmetic mean, the median is the middle value after the data is sorted, and the mode is the value that appears most frequently. In the control class, the mean value decreased from pretest to posttest, while in the experimental class, the mean value increased. The standard deviation and variance measure the variability or spread of the data around the mean. The greater the standard deviation and variance values, the more varied the students' scores in the group.

Skewnessand kurtosis provide information about the shape of the data distribution. Skewness measures the asymmetry of the distribution, where positive values indicate a distribution that is skewed to the right (long tail on the right side) and negative values indicate a distribution that is skewed to the left (long tail on the left side). Kurtosis measures the sharpness or flatness of the distribution, where positive values indicate a distribution that is more pointed (leptokurtic) and negative values indicate a distribution that is flatter (platykurtic) compared to the normal distribution. In this study, the skewness and kurtosis values in both classes tended to approach zero, indicating that the distribution of student scores tended to be symmetrical and not too pointed or too flat.

3.2. Normality Analysis Results

Based on the One-Sample Kolmogorov-Smirnov Test output presented, with the number of observations or data samples (N) of 63, the mean value of the standardized residual is 0, and the standard deviation is 6.96140896.

Table 3: Normality Test Results.

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		63
Normal Parametersa,b	Mean	.0000000
	Std. Deviation	6.96140896
Most Extreme Differences	Absolute	.082
	Positive	.078
	Negative	-.082
Test Statistics		.082
Asymp. Sig. (2-tailed)		.200c,d
a. Test distribution is Normal.		
b. Calculated from data.		
c. Lilliefors Significance Correction.		
d. This is a lower bound of the true significance.		

The statistical value of the Kolmogorov-Smirnov test obtained is 0.082, while the asymptotic significance value (Asymp. Sig. 2-tailed) is 0.200. Because the significance value (0.200) is greater than the commonly used significance level (0.05), we fail to reject the null hypothesis, which means that the residual data is not statistically significant to be said to be not normally distributed. Thus, based on the results of the Kolmogorov-Smirnov test, it can be concluded that the residual data is normally distributed, so that the normality assumption is met, and researchers can continue with the t-test or other parametric analysis that requires the normality assumption.

3.3. Paired t-Test Results

Table 4 presents the results of the paired sample t-test conducted to examine changes in students' mathematical understanding within the experimental group.

Table 4: Paired t-Test Results.

Item	Value
Mean	-244.444
Std. Deviation	737.209
Std. Error Mean	0.92880
95% Confidence	Lower: -4.30108
Interval of the	Upper: -0.58781
Difference	
t	-2.632
df	62
Sig. (2-tailed)	0.011

The analysis yielded a t-value of –2.632 with 62 degrees of freedom and a significance value of p = 0.011. Since the p-value is smaller than the conventional significance level of 0.05, the results indicate a statistically significant difference between pretest and posttest scores. The negative t-value and mean difference result from the calculation order used in the analysis (pretest minus posttest). Therefore, the negative mean difference (–2.44) indicates that posttest scores were higher than pretest scores, reflecting an improvement in students' mathematical understanding following the implementation of the Project-Based Learning model integrated with ethnomathematics and worked examples. Furthermore, the 95% confidence interval of the mean difference (–4.30 to –0.59) does not include zero, providing additional evidence that the observed improvement is statistically meaningful. These findings confirm that the instructional intervention had a significant positive effect on students' learning outcomes.

3.4. Independent t-Test Results

Levene's Testused to test the assumption of equality of variance between two groups of data. A significance value (Sig.) that is greater than the specified significance level (usually 0.05) indicates that the assumption of equality of variance is met. For the pretest variable, the Sig. value in Levene's Test is 0.611 (greater than 0.05), which means that the assumption of equality of variance is met. While for the posttest variable, the Sig. value is 0.617 (greater than 0.05), which also indicates that the assumption of equality of variance is met.

Table 5: Independent t-Test Results.

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
pretest	Equal variances assumed	.261	.611	-.059	61	.954	-.13911	2.37690	-4.89202	4.61380
	Equal variances not assumed			-.059	60,884	.954	-.13911	2.37734	-4.89308	4.61486
posttest	Equal variances assumed	.252	.617	-3.284	61	.002	-7.55544	2.30041	-12.1553	-2.95549
	Equal variances not assumed			-3.290	60,656	.002	-7.55544	2.29643	-12.1479	-2.96293

The t-test for Equality of Means section shows the results of the t-test to test the equality of means between two groups of data. There are two output rows, namely Equal variances assumed and Equal variances not assumed. The Sig. (2-tailed) value in the Equal variances assumed row for the pretest variable is 0.954 (greater than 0.05). This indicates that there is no statistically significant difference between the pretest mean scores in the two groups. In other words, before the treatment, there was no significant difference in initial ability between the two groups.

For the posttest variable, the Sig. (2-tailed) value in the "Equal variances assumed" row is 0.002 (less than 0.05). This indicates that there is a statistically significant difference between the average posttest scores in the two groups. The Mean Difference value of -7.55544 indicates that the average posttest score in the experimental group is higher than the control group.

Based on these results, it can be concluded that after the treatment (in this case, the application of the Project Based Learning Model integrated with ethnomathematics and worked examples), there is a significant difference in the achievement of learning outcomes between the experimental group and the control group, where the experimental group showed a greater increase than the control group. This finding indicates that the Project Based Learning Model integrated with ethnomathematics and worked examples can improve students' understanding in the equivalent education Package B equivalent to junior high school.

4. DISCUSSION

This study aims to evaluate the effectiveness of the implementation of Project Based Learning Model integrated with ethnomathematics and worked examples. The PjBL model integrated with Ethnomathematics and Worked Examples is an innovative and contextual learning approach. Students not only learn mathematics abstractly, but also understand how mathematical concepts are applied in their own culture through interesting projects. Worked examples help them understand the concept better before applying the knowledge in real projects. This approach is very suitable for use in culture-based learning and can be applied at various levels of education to improve students' critical, collaborative, and creative thinking skills.

Data analysis in this study involved two main stages, namely descriptive analysis and inferential analysis. Descriptive analysis provides an overview of the distribution of pretest and posttest scores in the control group and the experimental group, including measures of data central tendency such as mean, median, and mode, as well as measures of data dispersion such as standard deviation and variance. Furthermore, inferential analysis was conducted to test the assumption of data normality and compare the average pretest and posttest scores between the two groups.

The results of the Kolmogorov-Smirnov normality test indicate that the residual data are normally distributed, so the assumption of normality is met. Thus, the researcher can continue with the paired sample t-test to compare the average pretest and posttest scores in the same group. The results of the paired t-test revealed that there was a statistically significant difference between the pretest and posttest scores, although the average posttest score was lower than the average pretest score. This finding indicates that there are other factors that may influence the decrease in the average posttest score, such as the level of test difficulty or other factors that need further investigation.

Next, Independent Samples Test analysis was conducted to compare the average pretest and posttest scores between the control group and the experimental group. The results of Levene's test showed that the assumption of equality of variance was met, both for the pretest and posttest variables. The t-test for equality of means showed that there was no significant difference between the average pretest scores in the two groups, indicating that the initial abilities of students in the two groups were relatively the same. However, for the posttest variable, there was a statistically significant difference between the average scores in the experimental group and the control group, with the average posttest score being higher in the experimental group.

The research conducted has similarities with the research conducted by Rahmawati and Hidayati (2022) in terms of using technology-based multimedia in mathematics learning. However, Rahmawati and Hidayati's research focuses on the use of website-based multimedia and its influence on elementary school students' learning motivation, while this study uses the PjBL Model integrated with Ethnomathematics and Worked Example is an innovative and contextual learning approach. Students not only learn mathematics abstractly, but also understand how mathematical concepts are applied in their own culture through interesting projects. Worked examples help them understand concepts better before applying that knowledge in real projects. This approach is very suitable for use in culture-based learning and can be applied at various levels of education to improve students' critical, collaborative, and creative thinking skills.

Both the research conducted by Claudia et al. (2020) are experimental studies with a One-Group Pretest-Posttest Design. However, Claudia et al. (2020) 's research focuses on the effect of a realistic mathematics approach on the learning outcomes of grade II elementary school students on the material of multiplication of whole numbers, while this study examines the effectiveness of a hybrid model of differentiated mathematics learning in Package C equivalency education.

In addition, this study involves more complex statistical analysis, such as data normality test, paired t-test, and Independent Samples Test, to evaluate the effectiveness of the learning model as a whole. The findings of this study also provide important contributions to the development of innovative learning strategies in equivalency education, which is different from the focus of Rahmawati and Hidayati's (2022) research on elementary school students' learning motivation, as well as Claudia et al. (2020) on the learning outcomes of grade II elementary school students in the material of multiplication of whole numbers.

Thus, although there are similarities in the use of experimental research methods and involving technology in mathematics learning, this study has its own uniqueness in terms of the research context, the variables studied, and the statistical analysis used to evaluate the effectiveness of the applied learning model.

This finding implies that the implementation of Project Based Learning Model integrated ethnomathematic with worked examples to improve students' understanding. Although there was a decrease in the average posttest score compared to the pretest in the experimental group, a significant increase compared to the control group showed that the Project Based Learning Model integrated ethnomathematic with worked examples had a positive impact. The results of this study provide an important contribution to the development of more effective and innovative learning strategies in equivalency education, as well as being the basis for further research to explore other factors that may influence the effectiveness of this learning model.

5. CONCLUSION

This study demonstrates that integrating ethnomathematics and worked examples within a Project-Based Learning (PjBL) model effectively enhances students' mathematical understanding in Package B equivalency education. By embedding mathematical concepts within culturally meaningful contexts and supporting cognitive processing through worked examples, the instructional approach promotes deeper conceptual engagement and active learning. The findings highlight the importance of culturally responsive and cognitively informed learning models in non-formal and equivalency education settings. This approach not only supports students' academic understanding but also strengthens the connection between mathematics learning and local cultural knowledge. Future research is recommended to explore the implementation of this integrated model in different cultural contexts, to examine its long-term effects through longitudinal designs, and to investigate additional variables that may further optimize learning outcomes.

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