The Influence of The PjBL Model Based on Local Gorontalo Cultural Values to The Learning Outcomes in Simple Aircraft Concepts

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Abstract: This research aims to determine the influence of the Project Based Learning (PjBL) model based on local Gorontalo cultural values on the learning outcomes of simple aircraft concepts. This research is experimental, with the research design being a one-group pretest-posttest design. The population in this study was all class VIII of SMP Negeri 8 Paguyaman for the 2023/2024 academic year. Research data was collected using test techniques. Then, the data was analyzed using descriptive and inferential statistics, including normality tests, hypothesis tests, and n-gain analysis. The average score for all sample classes for class VIII students is greater than the minimum completion criteria (MCC), as shown by the average score for the experimental class of 81.97, replication class 1 of 80.91, and replication class 2 of 80.15, compared to the MCC of 75. Based on the course results, the average normalized gain obtained by the experimental class was 0.69, replication class 1 was 0.68, and replication class 2 was 0.68, meaning that all sample classes are in the medium category. Thus, the PjBL model based on local Gorontalo cultural values has a significant effect on student learning outcomes in simple aircraft concepts.

Keywords: Gorontalo cultural; Learning outcomes; PjBL model; Simple aircraft

Introduction

Education is an effort to grow potential within students in a learning environment during the learning process, and students can also develop the potential within themselves in terms of knowledge, skills and talent (Pristiwanti et al., 2022; Doyle, 2023). Education also plays an essential role in the learning, abilities and habits of someone who receives instruction through teaching. Education also comes from something other than other people's or teachers' direction. However, the nature of autodidactic individuals provides everyone with experience in thinking, acting, and behaving. According to (Wayan, 2019; Harding, 2010), Education is an effort to help students' souls physically and mentally, from their nature towards a humane and better civilization (Agus et al., 2021; Bassar & Hasanah, 2020).

Learning began to be combined with a learning model based on local Gorontalo cultural values. So that during learning, the teacher can provide students with mastery of the subject matter. In the current era of globalization, there are many advances and increasingly sophisticated times, such as the use of learning media, so cultural values are lost and need to be preserved. The local cultural values of Gorontalo that are applied to learning, namely the culture of discipline or discipline, the culture of discipline in Gorontalo society, is reflected in the value of discipline in *tuja'i* oral literature, which is the basis for the birth of a disciplined nature in work, consistent with time, obedience and compliance (Husain & Walangadi, 2020). Secondly, *mohuyula* is also the value

of cooperation or mutual help between members of society to fulfil common interests and interests which are based on social solidarity, so when doing something, it is good to apply this *mohuyula* (Hasan et al., 2023).

Concerning learning that integrates local Gorontalo cultural values, in reality, there are still many teachers who have not implemented Gorontalo local cultural values when teaching. Even though using the teachers and students can continue to instil cultural values that should be preserved, they can also instil a sense of love for diversity in lessons (Jumriani et al., 2021; Adawiyah et al., 2023; Widodo, 2018). Local in the environment. In this case, improving student learning outcomes in the future, implementing a learning model based on local Gorontalo cultural values. During the implementation of learning, the teacher must provide apperception, meaning linking theoretical subjects with everyday life. After that, the teacher motivates students to connect the knowledge they have and be able to apply their knowledge to everyday life. Implementing learning requires various teacher preparations in the form of assigning various learning models that will be used in class (Ally, 2004; Gani et al., 2023; Pintrich, 2002).

Based on the results of observations from class VIII of SMP Negeri 8 Paguyaman, during learning, conventional learning models were still used, so students felt bored in receiving the concept, there was less interest in learning for students, and learning was still centred on the teacher. There needs to be learning based on Gorontalo's local cultural values in the learning process. Therefore, teachers must implement learning based on Gorontalo's local cultural values so that local culture reflects Gorontalo's identity and will never be lost. So that it is not lost, Gorontalo's local cultural values must be used in the learning process so that Gorontalo's cultural values remain inherent and continue to be preserved.

Based on interviews with science teachers at SMP Negeri 8 Paguyaman, students still need help understanding simple aircraft concepts. In addition, students, when learning takes place, are less active and tend to be passive, and when learning, students pay less attention, resulting in poor student learning outcomes. As educators, teachers have a crucial role in improving the quality of learning outcomes in the classroom. Professional teachers can choose the suitable learning model to use in the learning process (Chi & Wylie, 2014; Deslauriers et al., 2019; Yunus et al., 2021).

Conventional learning models are considered less effective because, during learning, the interaction only goes one way, making students passive in the learning process. Therefore, teachers as moderators or educators must be able to choose learning methods that will be used in the learning process, which are expected to facilitate the delivery of concepts to students (Supartin

et al., 2022; Arinda et al., 2019; Wright, 2011). The learning model is one of the elements of learning that contribute significantly to various learning systems because it helps in teaching and enables teaching and learning activities. This learning model builds a learning atmosphere that does not look monotonous (Kattoua et al., 2016; Cui et al., 2023; Alam, 2023).

The solution to the above problem is using a learning model, namely the Project Based Learning (PjBL) model based on Gorontalo local cultural values, which seeks to increase student knowledge and understanding while creating a love for Gorontalo local culture. In addition, this model can affect the learning outcomes of each student on simple aircraft concepts because some students still need help understanding this concepts. Simple aircraft concept is one of the concepts discussed in the learning process. The learning process of the concepts can use the project-based learning model because, in the learning process, students can interact directly with the learning object, which has only been taught theories but direct practice. So, a medium or instrument is needed to help students understand the information and involve them directly or interestingly. Thus, using the PjBL model based on Gorontalo's local cultural values is very important. So from the project, students more quickly understand the concepts content and not the concepts as well, but students preserve the values as a pillar of national identity. Based on the background described above, we will to determine the influence of the PjBL model based on local Gorontalo cultural values on the learning outcomes of simple aircraft concepts.

Method

This research uses an experimental method to determine the effect of the PjBL model based on local Gorontalo cultural values on the learning outcomes of class VIII students on simple aircraft concepts. Research design: One group pretest-posttest design. This design was chosen because there is an initial test before treatment and a final test after treatment. This research design was applied to three classes, namely 1 experimental class and 2 replication classes. The population in this study were all students in class VIII of SMP Negeri 8 Satu Roof Paguyaman consisting of 2 classes VIII-A with a total of 15 students, class VIII-B with a total of 15 students, and a total of 15 students.

Sugiyono (2015) states that the sample is part of the population's number and characteristics. In this research, researchers used the total sampling technique. Total sampling means the sampling technique is the same as that of the population (Sugiyono, 2015). This research was carried out using total sampling, using the

entire population as the sample, namely some experimental and some replication classes. Determination of the experimental class and replication class was carried out randomly by drawing lots. So, in this case, the researcher prepared three papers according to the number of classes VIII. After that, number them one to three and roll up the paper. Then, the roll of paper

is dropped randomly. The research flow chart from experiment to data analysis can be seen in Figure 1. The names that appeared in the first paper were used as the experimental class and the two replication classes. The selected research samples were VIII A as the experimental class, VIII B as the replication 1, and VIII C as the replication 2.
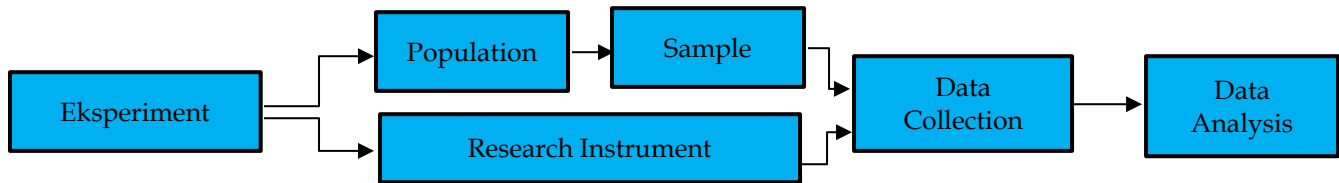
Figure 1. Flow chart of research

The data or information collection technique in this research uses a 10-number essay test validated by the validator lecturer. The aim of giving this test is to determine student learning outcomes. The written test was given twice; the first (pre-test) was carried out at the beginning of the meeting before the learning took place, and then the second test (post-test) was carried out at the end of the meeting after the teaching was carried out.

Normality Test

The first test that will be carried out is the normality test. According to Sheskin (2000), the normality test is carried out to determine whether the research data is usually distributed. The test technique used is a suitability test using a statistical test, namely Kolmogorov Smirnov, with the following in equation (1).

$$Fi = \left| S(Xi) - F0(Xi) \right| \tag{1}$$

In criteria for $Fi \geq k$ is normally distributed data and $Fi \leq k$ is data not normally distributed. In statistical hypothesis for $H0$ = Data is normally distributed and $H1$ = Data is not normally distributed. While in normality testing criteria is accept $H0$ at the significance level a = 0.05 if $Fi \geq k$ obtained from the Kolmogorov Smirnov table.

Hypothesis Testing

Based on the data obtained in the research, associative statistical hypothesis testing was carried out. Statistical hypothesis testing uses the t-test statistic to determine whether local Gorontalo cultural values influenced the PjBL model on student learning outcomes in equation (2).

$$t = \frac{\bar{x} - \mu 0}{\frac{s}{\sqrt{n}}} \tag{2}$$

Information for t is Calculated price t, $\bar{x}$ is Sample average value, $\mu 0$ is Hypothesized value, s is Sample standard deviation, and n is number of samples (Sudjana, 2005).

The test technique used in this research is the mean test with the t-test statistic so that a statistical hypothesis is obtained to determine the effect of the experimental variable on the response variable. For *H0: μ* = 75. The average learning outcomes of Class VIII middle school students taught using the PjBL model in simple aircraft concepts are not different from the minimum completion criteria score (MCC). While for *Ha: μ* > 75. The average learning outcomes of Class VIII middle school students taught using the PjBL model in simple aircraft concepts were greater than the MCC.

The MCC at SMP Negeri 8 Paguyaman is 75. The statistical hypothesis criteria used are when *t-count* < *t-table*, *H0* is rejected, and *H1* is accepted. When *tcount* ≥ *t-table, H1* is rejected, and *Ha* is accepted (Sudjana, 2005). The actual level used is a = 0.5, and this test was carried out on all samples, both experimental and replication classes.

N-Gain Test

To determine the effect of student learning outcomes, the n-gain formula is used. The n-gain (Normality Gain) formula is used to determine the difference between pretest and posttest results, as well as determine the effectiveness of the PjBL learning model based on local Gorontalo cultural values in equation (3) (Hake, 1998).

$$n - Gain = \frac{posttest\ score - pretest\ score}{ideal\ score - pretest\ score} \tag{3}$$

Informatin for high *n-gain* is value (0.70< g < 1.00), medium *n-gain* is value (0.3< g < 0.7), and low *n-gain* = value (g < 0.3).

Result and Discussion

This research was conducted at SMP Negeri 8 Paguyaman, located on the street. Rajawali, Bongo Tua Village, District. Paguyaman, Kab. Boalemo. In this lesson, students are expected to be able to understand concepts regarding simple aircraft from a project based on local Gorontalo cultural values that the students have created. This aims to ensure that students constantly instil the existing local cultural values of Gorontalo.

In the research that has been carried out, student learning outcome scores were obtained from an instrument in the form of a test in the form of an essay description with a total of 10 items, where the test itself is data from research results in the form of a pretest and posttest carried out in the experimental class, replication 1 and replication 2.

This learning outcomes test aims to determine the success of learning in the experimental class, replication 1 and replication 2, and the influence of the PjBL model based on local Gorontalo cultural values, implemented in the odd semester of the 2023/2024 academic year.

Data was obtained after students were given treatment using the PjBL learning model based on local Gorontalo cultural values. Then, the researcher analyzed the data using various statistical techniques known to be based on theory to obtain several conclusions supporting the research hypothesis. The following will describe student learning outcomes and data analysis results in the form of normality tests, hypothesis tests and n-gain tests.

Researchers use the calculated average for each sample group and deviation and variation measures to find out how distributed quantitative data is. The average value, standard deviation, and variance results are calculated using the Excel application program in Table 1.

Table 1. Calculation Results

Class	Average	Deviation Standard	Variant
Experiment	81.97	9.92	98.48
Replication 1	80.91	9.67	93.57
Replication 2	80.15	9.15	83.71

The data normality test aims to determine whether the data is usually distributed. In this study, the Kolmogrof Smirnov normality test formula found in Chapter III was used using Microsoft Excel. For testing the normality of data in the three classes, namely experiment, replication 1 and replication 2, the results obtained from the statistical test can be seen in Table 2 of the data normality test of the following Table 2.

Based on the data normality test results in Table 2, it is known that $Fi \geq K$ for the actual level $a = 0.05$. So, it can be concluded that the research data for the experimental class, replication 1 and replication 2, are typically distributed.

Table 2. Data Normality Test Results

Class	F_i	K	Status
Experiment	0.46	0.38	Normally Distributed
Replication 1	0.46	0.38	Normally Distributed
Replication 2	0.45	0.40	Normally Distributed

Hypothesis testing aims to determine whether there is an effect of the PjBL learning model based on Gorontalo local cultural values on simple aircraft concepts in experimental classes and replication classes given to student learning outcomes. For hypothesis testing in both experimental classes, replication 1 and 2 can be seen in Table 3.

Table 3. Hypothesis Testing Results

Class	t-count	t-table	Status
Experiment	2.71	2.16	H_0 Accepted
Replication 1	2.36	2.16	H_0 Accepted
Replication 2	2.18	2.16	H_0 Accepted

The n-gain analysis of the test results using the course average normalized gain per class can be seen in Table 4.

Table 4. Results of N-gain Testing

Class	N-Gain	Criteria
Experiment	0.69	Currently
Replication 1	0.68	Currently
Replication 2	0.68	Currently

The research was conducted using the PjBL learning model on simple aircraft concepts in class VIII, carried out at SMP Negeri 8 Paguyaman. This study took class VIII as the subject population, and the sample consisted of 3 classes, namely class VIII A as the experimental class, class VIII B as the replication class 1, and class VIII C as the replication class 2. The use of replication classes in experimental research, where replication itself is a repetition of the experiment, is needed to produce better estimates and see the results' consistency (Sudjana, 2005). This research aims to know the effect of the PjBL learning model based on Gorontalo's local cultural values on student learning outcomes. This research contributes significantly to various learning systems because it helps in teaching and enables teaching and learning activities. This learning model builds a learning atmosphere so that it does not look monotonous, and students also look active in the learning process. This research also makes students always apply the value of Gorontalo's local culture in learning.

The learning process lasted for 4 meetings; the first meeting gave a pre-test, then gave simple aircraft concepts and divided groups to make projects. The second meeting directed students to do simple projects by applying Gorontalo local cultural values, namely *Mohuyula* (mutual cooperation) and *Tuja'i* (discipline) in the form of pulleys, levers, inclined aircraft and simple pivoting wheels. The third meeting continued doing projects at the second meeting, after which it continued with a presentation of the project results, and the teacher explained a little about the mechanical advantages of simple aircraft with the help of Mechanics Science tools, According to Abdjul & Uloli (2020), Science tools plays a role in activating interactions between teachers and students and between students and learning. In the fourth meeting, the teacher gave the post-test exam for 40 minutes with completion.

The PjBL model is used to increase student interest in learning, which can be seen from the attention of students centred on the ongoing learning process to affect student learning outcomes. Besides that, with this model, the learning process will feel more meaningful but can give a deep impression to students because learning feels more fun and not monotonous, so students are more active in learning. With the Gorontalo local culture-based PjBL model, students can always apply local cultural values in learning and daily life. The PjBL model emphasizes student-centred teaching through project assignments. In this case, in project activities based on Gorontalo's local cultural values, students make projects related to simple aircraft using pulleys: wells, levers (seesaws), inclined planes, and pivoting wheels (cars). When doing projects based on Gorontalo's local cultural values, such as *mohuyula*, students are very cooperative in making projects and *tuja'i*.

Through project activities, they will understand more about simple aircraft concepts based on the results of the projects they make by doing actual experiments rather than just listening to the teacher's explanation. Learning by using the Gorontalo local cultural value-based PjBL model provides opportunities for students to work more independently and find out for themselves. Students also know that applying Gorontalo's local cultural values is very important in everyday life, so Gorontalo's local cultural values are always preserved. Also, students try to get information, and students build their knowledge by being actively involved in the complex learning process so that the knowledge they gain will be well stored because the "impressions" obtained in the process of achieving knowledge are more meaningful.

Learning activities are conducted four times a meeting for each class, with a time classification of two lesson hours (2x40 Minutes). The first meeting will conduct a pre-test and then discuss simple aircraft concepts. Then, the second meeting directs students to do projects related to simple aircraft in the form of pulleys, levers, inclined planes and pivoting wheels; the third meeting directs students to present the results of the project and continues to discuss the mechanical advantages of simple aircraft and the fourth meeting conducts Postest. In each class, both experiments were replication 1 and replication 2. In each class, both experiments, replication 1 and replication 2, in the learning process using the PjBL model based on Gorontalo local cultural values on simple aircraft concepts; for example, when students make projects from simple aircraft, students must apply existing Gorontalo local cultural values in the form of *Mohuyula* and *Tuja'i*.

Providing guidance and direction for students in understanding simple aircraft concepts through Gorontalo cultural value-based projects can make it easier for students to understand the subject matter provided. Because what is encountered in everyday life is easy to understand and do, it is easy for students to remember what they learn. Making it easier for teachers to explain information to students. And make sure students permanently preserve the local cultural values of Gorontalo. Learning objectives are achieved from the learning outcomes that students can obtain. The existence of success is associated with the high and low scores achieved by students, the absorption of students and student learning outcomes after following the learning process. In other words, the success of education is influenced by many factors (Lagarusu et al., 2023).

PjBL is a learning model that focuses on creativity and needs that are meaningful to students. They then create by utilizing their experiences and abilities to carry out activities and produce work that they consider useful for themselves or others (Kosasih, 2014). The PjBL model also allows teachers to manage classroom learning by involving project work. Through project work learning, students' creativity and motivation increase, and they become independent in completing their tasks (Made, 2012).

Gorontalo's local cultural values are rarely applied among Gorontalo people, so now Gorontalo's local cultural values have become extinct, even though in terms of culture, Gorontalo has its own characteristics as a regional identity. Gorontalo's local cultural wealth results from ancestral heritage passed down from generation to generation (Supriyanto, 2021). However, along with the times marked by the development of technology, Gorontalo's local culture has disappeared by itself. So, using the PjBL model based on Gorontalo's local cultural values is one solution so that learning is student-centred and looks varied. Gorontalo's local cultural values are always preserved and developed and

preserved by every organization. So, the PjBL model based on local cultural values is an alternative to learning so that students look active and always apply and protect the values of Gorontalo's local culture.

Based on data normality testing, it was found that the data for all samples were usually distributed.

Therefore, because the data is normally distributed, statistical testing is continued using the *t-test*.

The hypothesis testing in Table 1 shows that the PjBL model is based on Gorontalo local cultural values on simple aircraft concepts in class VIII. It is also supported by Figure 2, which is a comparison graph of the average and MCC score is > 75.
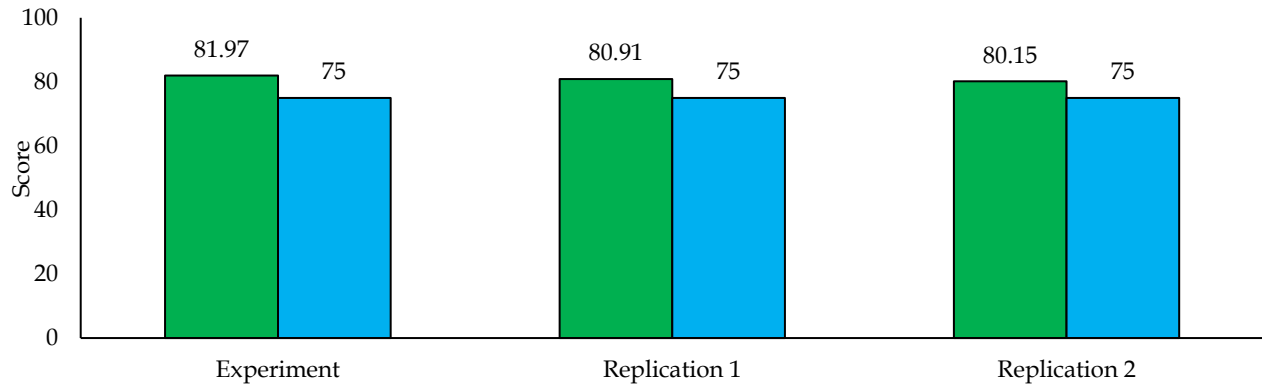

Figure 2. Comparison chart of average score and MCC

Figure 2 shows the quantitative difference between the average and the MCC for each class given the treatment. Student learning outcomes in the experimental and replication classes exceeded the MCC. Thus, the PjBL model based on Gorontalo's local cultural values will determine student learning outcomes in class VIII.

As for seeing the effect on student learning outcomes, the final test is used, namely the N-gain test.

Based on the course average normalized gain analysis per class, Figure 2 shows that the PjBL model can improve student learning outcomes per class. Also, based on the acquisition of a single student normalized gain in the experimental class found in Figure 4, more students are in the high category than students in the medium category.
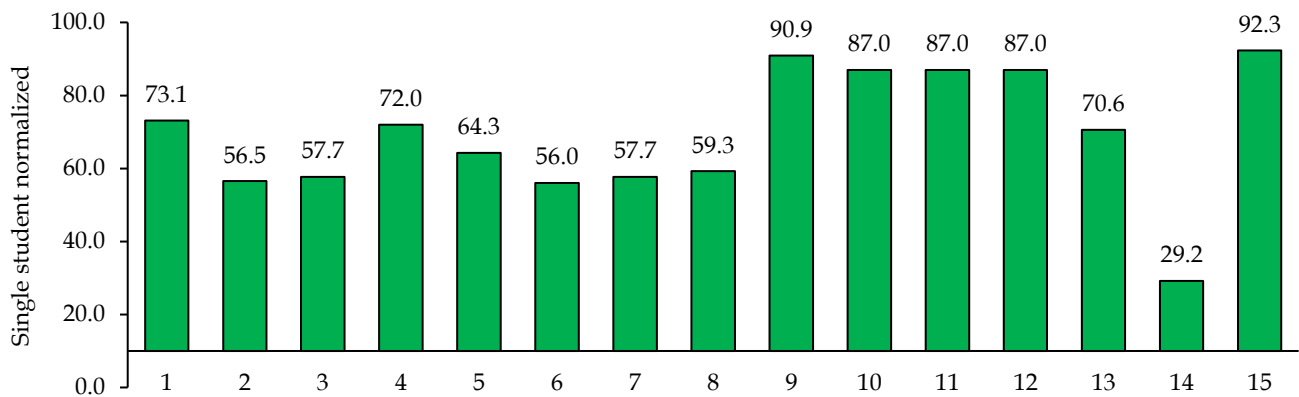

Figure 3. Graph of Single Student Normalized Gain Experimental Class

Figure 3 shows an increase in understanding that can be seen from each student in the experimental class. This means that the PjBL model based on Gorontalo's local cultural values improves the learning outcomes of each student in the experimental class. Analysis of single student normalized gain in the experimental class. Furthermore, judging from the acquisition of single student normalized gain in replication class 1 in Figure

4. It shows that replication class 1 also obtained higher categories than medium categories.

Figure 4. shows an increase in the understanding of each student for replication class 1. After being given treatment, there is an increase in the learning outcomes of each student. Thus, the PjBL model has a quantitative effect in increasing the understanding of each student of replication class 1. Analysis of single student normalized

gain in replication class 1. Then seen from the single student normalized gain of replication class 2 in Figure 5.
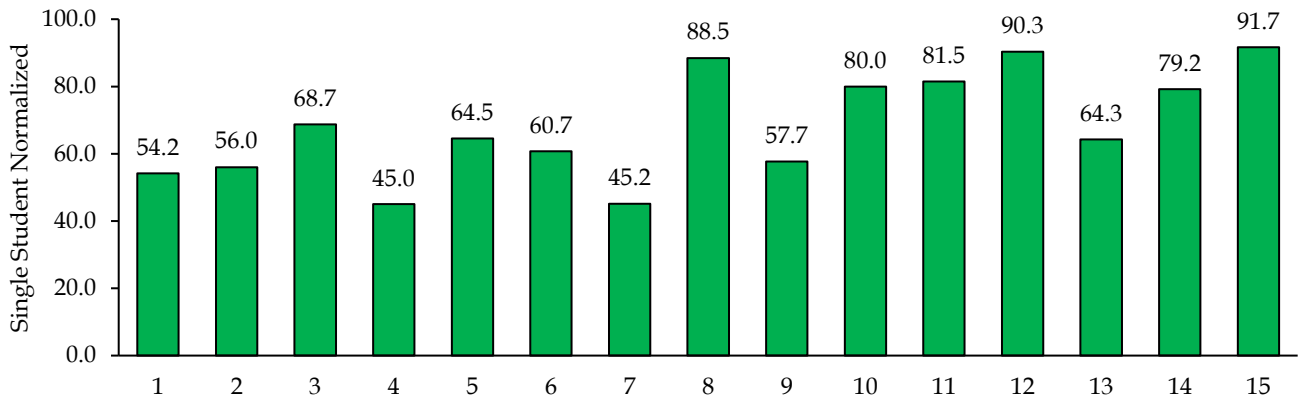

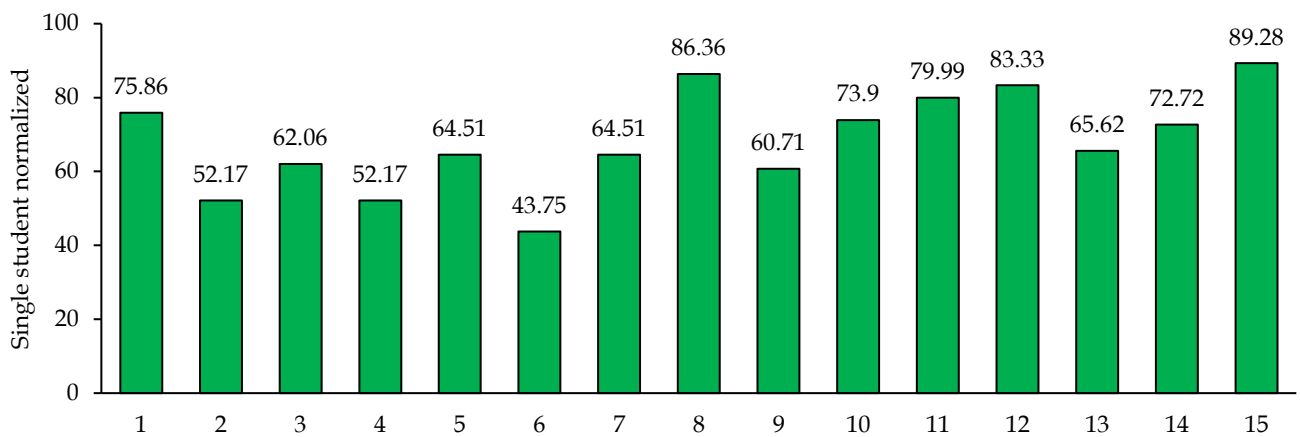**Figure 4.** Single Student Normalized Gain of Replication 1

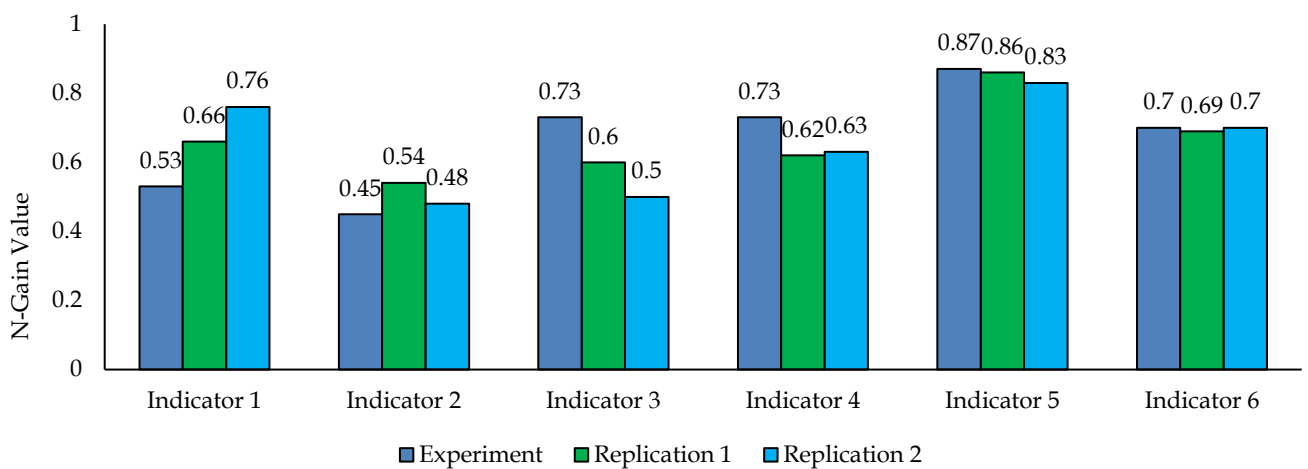**Figure 5.** Single Student Normalized Gain of Replication 2

Figure 6. Analysis of N-Gain Per Indicator

Figure 5 shows an increase in the understanding of each student in replication 2. After being given treatment, there is an increase in the number of individual students. Therefore, the PjBL model based on Gorontalo local cultural values affects increasing

understanding in each student in replication 2. Analysis of single student normalized gain for replication 3.

Figures 3 to 5 show no students in the low category for all sample classes. This shows that the PjBL model based on Gorontalo's local cultural values affects increasing understanding in each student.

Then proceed with analyzing n-gain per indicator. The analysis of n-gain per indicator is carried out to determine the increase in students' concept understanding on each indicator in simple aircraft concepts. The results of the n-gain analysis per indicator can be seen in Figure 6.

Based on Figure 6 shows an increase in understanding per indicator. Where students have gained new understanding or strengthened previous knowledge, this means that the PjBL model based on Gorontalo local cultural values significantly affects the learning outcomes of class VIII students. The magnitude of the effect is shown in the n-gain value per indicator.

Conclusion

Based on the results of the study, it can be concluded that learning using the PjBL model based on Gorontalo local cultural values in class VIII SMP Negeri 8 Paguyaman can improve student learning outcomes on simple aircraft concepts and positively impact learning. The PJBL model based on Gorontalo local cultural values in class VIII SMP Negeri 8 Paguyaman influences the learning outcomes of class VIII students. This is shown through hypothesis testing criteria where for the experimental class, the t-count of 2.71 is greater than the t-table of 2.16, for the replication 1 class, the t-count of 2.36 is greater than the t-table 2.16, and for replication 2, the t-count of 2.180 is greater than the t table 2.16, it can be concluded that testing the hypothesis of each class is the t-count is greater than the t table, this can be interpreted that the PjBL model based on Gorontalo local cultural values has a positive effect on student learning outcomes.

Author Contributions
Dewa Gede Eka Setiawan: Conceptualization, writing—original draft preparation; Nur Rahma Kuengo: Methodology; Supartin: Validation; Asri Arbie: Methodology; Dewi Diana Paramata: Curation, writing—review and editing; Nova Elysia Ntobuo: Formal analysis, validation.

Conflicts of Interest
The authors declare no conflict of interest.

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