ANALYSIS OF PROJECT-BASED BLENDED LEARNING IN STATISTICS LEARNING IN HIGHER EDUCATION

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Abstract. The purpose of this study is to analyze the results of the application of Blended Learning which refers to the Project-Based Learning (PjBL) model. Blended Learning and PjBL can be packaged as a learning model, namely Project-Based Blended Learning (PjB2L). The design of learning activities with the help of Bina Sarana Informatika University elearning online media (MyBest) is used to measure its impact on student learning outcomes in Statistics courses. The focus of this study describes two main things, namely the description of the application of statistics lectures with the PjB2L model and the results of statistical tests regarding differences in learning outcomes obtained. Quasi-experimental research was designed to measure the comparison of student learning outcomes in experimental classes (with the PjB2L model) and control classes (conventional/blended direct learning). The 100 students involved in this study were divided into two classes, namely the control class which included 50 students and the experimental class which involved 50 students. In addition, in the data analysis technique, analysis of covariance (ANACOVA) was used to compare the results of the control group and the experimental group, with the Covariance variable being the pre-test result (initial knowledge). The results showed significant differences. The difference shown in this study leads to the support of better learning outcomes of the experimental group.

Keywords: Project-Based Blended Learning, Learning Outcomes, Statistics


Kata Kunci: Project-Based Blended Learning, Hasil Belajar, Statistika

INTRODUCTION

Learning in the digital era is different from previous eras. In the digital era, human life cannot be separated from electronic devices. The use of electronics extends to all aspects of humanity, including education. Education must be the most important medium for understanding, mastering, and using technology appropriately and correctly. Learning can now be done without always having to meet face to face. This allows students to learn without knowing the limits of time and place. Students are expected to be competent, creative and independent, in accordance with the goals of higher education. The goals of higher education include developing the potential of students to become competent, creative and independent humans, mastering the fields of science and technology. These four possibilities form the unity that students must have (Rohaeti, T., & Lusiyana, 2020). Lecturers are no longer the only source of learning. The limitations of conventional systems should no longer be found. The most prominent educational innovation is the teacher-centered concept which becomes student-centered in learning (Fadul, 2022). The student-centered concept is seen as the foundation of constructive education (Li, 2021). There are many learning models that are in accordance with this concept, one of which is the emphasis on collaborative activities (Lu & Smiles, 2022).

Educational innovation through learning based on collaboration is also carried out in Indonesia. The Ministry of Education has proposed a curriculum concept that can answer the challenges of the need for collaboration through an independent curriculum (Hasanah & Haryadi, 2022). The independent curriculum emphasizes the use of learning models that can liberate students through student-centered learning activities (Pertiwi et al., 2022; Fahlevi, 2022). The learning model in question is a project-based learning model or known as Project-Based Learning (PjBL). With developments over time and the acceleration of digitalization due to the pandemic, currently the implementation of PjBL can be combined with Blended Learning. PjBL and Blended Learning can be packaged as a learning model, namely Project-Based Blended Learning (PjB2L).

The aim of combining face-to-face learning with online-based learning in the PjBL learning model is to increase student activity. Educators and students can communicate and interact directly anytime and anywhere. Students can also search for project materials from various sources without any restrictions. Research Objectives: To see the application of the PjB2L model to learning statistics in the FEB Management study program at BSI University, to determine the effectiveness of the PjB2L model and the effect of using control variables (covariance), namely a test of students' initial understanding of the statistics learning outcomes of those studied through the PjB2L model.
METHOD

This study uses a quantitative approach. The research design applied is a quasi-experimental design with a pre-test to reveal students' initial knowledge and a post-test to reveal statistics learning outcomes through learning methods which are applied to the experimental class and control class respectively. Hypothesis testing uses covariate analysis of variance (Ancova). All hypothesis tests were carried out using a statistical application, namely IBM SPSS Statistics 27 at a significance level of 5 percent. The application of the PjB2L model and prior knowledge of statistics are the two main factors considered in this research. It is believed that the inclusion of these two factors can influence student learning outcomes in statistics courses.

Table 1. Treatment design view (ANCOVA)

<table>
<thead>
<tr>
<th>Group (R)</th>
<th>Pretest</th>
<th>Treatment</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>Y1</td>
<td>X</td>
<td>Y2</td>
</tr>
<tr>
<td>Control</td>
<td>Y1</td>
<td>Yx</td>
<td></td>
</tr>
</tbody>
</table>

The population of this study was 112 students spread across four classes in the Management study program, Faculty of Economics and Business, Bina Sarana Informatics University in the Odd Semester 2022-2023 and were recorded as having programmed statistics courses in their study plans. The sample in this study consisted of two parallel classes (100 students) selected using group random sampling techniques. Management Class 3A, which consists of 50 students and studies by applying the PjB2L model, is designated as an experimental class. Meanwhile, the Management 3B class consisting of 50 students was designated as the control class.

RESULTS AND DISCUSSION

Effectiveness of the PjB2L Model and Effect of Initial Test of Understanding (Covariance)

First, the results of descriptive statistics from learning in the experimental class (with the PjB2L model) and the control class will be presented. A description of each class is presented in Table 1 below.

Table 2. Description of pre-test and post-test in Statistics learning

<table>
<thead>
<tr>
<th>Class</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Class</td>
<td>78.68</td>
<td>14,138</td>
<td>50</td>
</tr>
<tr>
<td>Experiment Class</td>
<td>90.16</td>
<td>9,392</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td>84.42</td>
<td>13,262</td>
<td>100</td>
</tr>
</tbody>
</table>

Descriptive Statistics
Dependent Variable: Posttest Value
Based on Table 1, it appears that the results of learning statistics between before and after treatment in the experimental class and control class have both increased. This can be investigated from the average pre-test and post-test scores in both classes. Even though both have increased, the average in the experimental class (with the PjB2L model) has a higher value. This can be used as a reference that the results of learning statistics in the experimental class are superior to those in the control class.

**Normality test**

The normality test was carried out according to theory using the Kolmogorov-Smirnov test (Santoso, 2018) with a significance level of 0.05.

**H0**: Residual student statistical scores are normally distributed

**H1**: Student statistical score results are not normally distributed

The decision criteria is if the significance level is > 0.05 then H0 is accepted, if the significance level is < 0.05 then H0 is rejected.

**Table 3. Test of Normality**

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Kolmogorov-Smirnov</th>
<th>Shapiro-Wilk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Statistics</td>
<td>df</td>
</tr>
<tr>
<td>Residual for POSTTEST</td>
<td>.106</td>
<td>100</td>
</tr>
</tbody>
</table>

a. Lilliefors Significance Correction

Source: SPSS data processing, 2023

It can be seen in the table that the significance value is 0.07 > 0.05, so accept H0, meaning the residual student statistical scores are normally distributed.

**Homogeneity Test**

**H0**: Group variances are not different (same or homogeneous)

**H1**: Different group variances (not the same or not homogeneous)

Significance level 0.05

Decision criteria if the significance value is > 0.05 then accept H0 (homogeneous). If the significance value is < 0.05 then reject H0 or accept H1 (not homogeneous)

**Table 4. Levene's test of equality of error variances**

<table>
<thead>
<tr>
<th>F</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>14,162</td>
<td>1</td>
<td>98</td>
<td>.0052</td>
</tr>
</tbody>
</table>

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + CLASS
It can be seen in the table above, the data variance is stated to come from a homogeneous population, with a sig value. The Levene's Test output is 0.052 and this value is more than 0.05 (Rothwell, 2022). The final prerequisite is that linearity between the dependent variable and the control variable (covariance) can be tolerated, this is tracked through the sig value. 0.241 in the Deviation from Linearity output which also has a value of more than 0.05 (Matondang & Nasution, 2021).

**Covariate Linearity Test**

![Figure 3.6. Q Plot of residuals](image)

After the prerequisite tests are fulfilled, the Ancova statistical test is then carried out. Through the Ancova test, there are three hypotheses that can be answered as stated in the introduction. The statistical analysis carried out to answer the three hypotheses can be traced through three output results, namely the tests of between-subjects effects table, Anova table, and correlation table. Based on the Ancova test results, interpretations can be drawn by referring to statistical values in the form of sig values. interaction between learning methods and initial understanding tests, then the sig value, on the learning method (without looking at the interaction with the covariance variable), as well as the sig value in the correlation table between learning methods and initial understanding tests.

**Interaction of Learning Method and Initial Test (as Covariance Variable)**

The interaction between the learning approach used and the results of the statistical understanding test is discussed in the first section.
According to the results, the calculated F value is 22.87, and the sig. the interaction between learning method and initial comprehension test is 0.558. Therefore, the initial ability test results were not significantly affected by the learning method ($p > 0.05$), indicating that the regression homogeneity assumption was met. The conclusion that there is no interaction in this test is very important because it can show that the Ancova test has been used correctly because it suits the characteristics of the data collected and that the research conclusions will not be biased. The theory that data variables from students' initial comprehension test results are considered as covariance variables also makes sense (Sari & Prihatnani, 2021).

### Effect of Pretest as Covariance in Implementing the PjB2L Model

In the second part, differences in average student learning outcomes are reviewed from the application of the PjB2L learning model, which controls and controls the results of students' initial knowledge tests on statistical material. The correlation table shows the results of the analysis to reach a conclusion. The significance value is 0.000 ($p < 0.05$), which indicates that the student's prior knowledge test is positioned as a covariance variable which has had a significant influence on the differences in student learning outcomes in the two research classes.

### Table 6. Parameter Estimates

<table>
<thead>
<tr>
<th>Parameter</th>
<th>B</th>
<th>Std. Error</th>
<th>t</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>Intercept</td>
<td>91.822</td>
<td>6.342</td>
<td>14.478</td>
<td>.000</td>
<td>79.235</td>
</tr>
<tr>
<td>PRETEST</td>
<td>-.022</td>
<td>.081</td>
<td>-.272</td>
<td>.786</td>
<td>-.184</td>
</tr>
<tr>
<td>[CLASS=2]</td>
<td>0.1</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>

a. This parameter is set to zero because it is redundant.

Source: SPSS 2023 data processing
Based on the table above, the following regression equation is obtained:

\[ Y = 91.822 + 0.1X - 0.022z_1 - 11.714z_2, \]

Indicating that the higher the initial comprehension test results (the higher the \( x \) value), the higher the student's statistics score (\( Y \) value). Initial knowledge can show the student's level of readiness in accepting the learning that will be provided. By knowing the student's initial abilities, the lecturer can determine where learning should start. Initial knowledge of statistics is very necessary to facilitate the subsequent learning process (Ririen, 2019). Initial knowledge is a bridge to final understanding of learning material. Each learning process has its own starting point or stems from the initial abilities of certain students to be developed into new abilities, each of which is the goal in the learning process (Suseno, 2017). The link between prior knowledge and the project-based learning model has been expressed by Bayer (2016) who found that once students have adequate prior knowledge, the use of guided problem-based learning can improve conceptual understanding of statistics and increase students' understanding of the value of statistical learning.

Project-based blended learning can improve student learning outcomes. Other research also supports this statement. Learning outcomes for knowledge aspects in the Network Design course can be improved by implementing project-based learning (Adinata, 2015). An additional study conducted by Tureni & Dhafir (2020) found that the pass rate for the experimental class reached 100%, while the pass rate for the control class was only 23.33%. In addition, learning outcomes were significantly different between the experimental class taught with a project-based learning model and the control class taught with a conventional learning model. The result is that student learning outcomes with the PjB2L model have increased significantly. This is because the implementation of the project shows that the PjB2L learning model fits the characteristics of students at the student level.

**CONCLUSION**

Students who use the PjB2L model and those who use the conventional or blended learning model are very different in learning statistics. Despite the differences, student learning outcomes in both research classes improved. Student learning outcomes are also influenced by covariance variables through initial tests. Simultaneously, the research dependent variable will produce different results because there are differences in the learning models applied. These findings are very useful for improving the quality of statistics learning in higher education institutions. The PjB2L model can actually give students more opportunities to participate in education.
If students can connect what they know from the real world (such as field data from secondary sources) with what they learn in class, their learning will be more effective. Statistical results show that students in both research classes showed significant learning outcomes. Thus, it can be concluded that students who study statistics using the PjB2L model learn better than students who study using the conventional or direct blended model. The conclusion of this research shows that student learning outcomes in Statistics courses are better.

RECOMMENDATIONS

Similar research needs to be carried out in other courses and in expanded classes, both in terms of study program and semester level.

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