



# Application of Project Based Learning and STEAM in Higher Education

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## ABSTRACT

The aim of this articles provides views on the application of PBL in several courses in the Accounting Department. Application of the PBL model can be combined with the STEAM approach. The application of this approach integrates each component of STEAM into project-based learning. This research design uses a quantitative approach with experimental research methods. The research design used is a quasi-experimental design in the form of None-equivalent Control Group Design. This research design uses two classes to be compared. The purpose of this study is to apply a model project-based learning with a STEAM approach to accounting learning. The results showed that the application of the project-based learning model with the STEAM approach could improve students' critical thinking skills. Students are more active in participating in the learning process.

**Keywords:** *Higher Education; PBL; STEAM*

## 1. INTRODUCTION

Education is a journey of all techniques and methods of teaching and learning in the context of transferring knowledge from one individual to another based on the criteria that have been formulated [1]. Education in the 4.0 era requires individuals who have noble character, are able to think critically and creatively, have good social skills including being able to work together and communicate socially and are skilled in the field of information technology. These demands can be achieved by applying the learning process centred on the learner (student centre learning). Learning student learning centre is a model of learning in which the student has a part to activity important lecture planning, learning, interaction between lecturers and students research, and evaluation of the learning that has been done [2]. By implementing student centre learning, students will have a meaningful learning experience that will maximize the ability of students to compete and distribute in every aspect of life.

The phenomenon of accounting learning in universities shows that student involvement in learning activities is still low. Students tend to inactive in learning process besides the lower of students' critical thinking skills. When the lecturer gives an issue for students to respond to, most of the students are passive. The thinking process of students is only based on memorization. When

the lecturer gives questions that are not in accordance with the material they have memorized, students are immediately confused and cannot work on the problem. Students do not feel they have a responsibility in learning activities.

Learning should guide students to gain the ability and skills to know, work on, and take into account various information critically. The learning model that teaches students actively involved in the learning is the model Project Based Learning. Project based learning is an instructional model that implementing project or activity as a learning tool for shaping the attitude of competence, knowledge and skills. Model-based learning project done with the ultimate goal is to produce a work or contextual product. Project-based learning emphasizes the activities of students in order to carry out investigation, evaluation, understanding, synthesis, and information use activities create various forms of learning [3]. Students are invited to explore through project activities so that students participate directly during its manufacture [4]. The application of the method project-based learning can optimize students' thinking skills, develop students' creativity, and encourage students to work together in a team [5].

The application of PBL model can be combined with STEAM approach. The application of this approach combines every part of the STEAM component into the

syntax of the PBL model that is applied to accounting learning. The STEAM approach maximizes students creating their understanding of learning process by combining some aspects of the field of study in the industrial [6]. Through this learning model project-based learning and STEAM, students are expected to be able to think critically during learning activities because they are directly involved the learning process in order to complete a project on a product that is produced independently. Project based learning with a STEM approach can increase meaningful learning, interest in learning, and help students solve a problem [7]. Project based learning teaches students to understand a concept through product creation, with STEM students will try to make the best product through the design and re-design process [8]. Implementation of project-based learning approach STEAM can foster interest learners, learning to be more meaningful, helping learners to solve problems in real life as well as supporting the work of the future [9]. PBL Models is a model of learner-centred learning which links a problem with everyday life [10]. PBL is a creative learning model where students are required to think critically, creatively, and innovative ways of producing products for projects that have been implemented at the end of the lesson. Projects implemented can be in the form of individually or individually and in groups.

The stages of project-based learning are (i) Beginning with an essential question (start with the essential question). Initial knowledge of students is assessed through a question and giving assignments in carrying out an activity; (ii) Designing a project plan (design a plan for the project). Educators and students ensure the provisions of the project implementation rules; (iii) Establish a schedule (create a schedule). Students and educators by jointly organizing the activity agenda in implementing the project; (iv) Supervise students and monitor project progress. Educators are responsible for carrying out monitoring and supervision during student activities; (v) Assess the outcome (assess the outcome). Evaluation is carried out to assist educators in measuring

the achievement of benchmarks and learning objectives; (vi) Evaluating the experience (evaluating the experience). Educators and students carry out evaluations on activities and the final results of projects that have been implemented [11]. In project-based learning, educators play the role of facilitator, collaborating with students in making useful questions and meaningful assignments, it will be able to develop knowledge and social skills and assess students from their learning experiences [12].

STEAM approach combines two or more parts of the STEAM component with several other disciplines in everyday life. STEAM is an extension of STEM education by adding Arts [13]. Educators can encourage students to be actively involved by integrating the components of STEAM in learning in order to know the dependence of one another on a problem in real life. The application of learning with STEAM can strengthen and increase meaningfulness and solve science and technology problems in everyday life [14]. STEAM encourages curiosity and motivation of students about higher-order thinking skills which include problem-solving, collaboration, independent learning, project-based learning, challenge-based learning, and research [13].

## 2. METHOD

This study was designed using a quasi-experimental approach with the form of a Non-equivalent Control Group design. This research design uses two classes to be compared. One experimental class and one control class. Where educators give an initial test (pre-test) to both classes to assess their initial abilities, then are given a treatment (treatment), which then ends with giving a final test (post-test). It can be concluded that the effect of the treatment is known to be more accurate because the results are compared between conditions before and after being given treatment. The experimental design of the Non-equivalent Control Group Design has been presented in table 1.

**Table 1** Research Plan

Class	Pre-Test	Action	Post-Test
Control	$O_1$	$X_1$	$O_2$
Experiment	$O_3$	$X_2$	$O_4$

source : Dywan & Airlanda [15]

Notes:

$O_1$ : Giving a pre-test in the control class

$O_3$ : Giving a pre-test in the experimental class

$O_2$ : Giving a final test after being given treatment in the control class

$O_4$ : Giving a final test after being treated in the experimental class

$X_1$ : Application of PBL

$X_2$ : Application of PBL + STEAM

The population involved are all students of FE UM Accounting Education Class of 2020. The sampling technique uses the purposive sampling technique. Based on this technique, the cost accounting class was selected as the research sample. The procedure in research is divided into 3 stages, namely planning, implementation,

and completion. Planning stage doing the RPS (Semester Lecture Plan) and research instruments in the form of test sheets (pre-test and post-test). The implementation stage is by providing learning treatments project-based learning and STEAM as well as tests pre-test and post-test before and after being given treatment. While the final stage is to analyse data, discuss and draw conclusions. The data in this study are primary data, namely essay test sheets. The essay test contains cases in the course of cost accounting. Before the instrument is given, it is first tested on the instrument. The calculation of the data analysis of the test results includes validity tests, reliability tests, levels of difficulty, and discriminatory power of questions.

The data obtained were processed using the independent sample t-test technique which was carried out on the data gain score (the difference between the scores pre-test and post-test). Before carrying out the hypothesis test using the t-test, the data analysis prerequisite test was carried out first by carrying out the data normality test and homogeneity test. To test the

normality test of the data is carried out using the technique One-Sample Kolmogorov-Smirnov which will be carried out with the help of SPSS. While the homogeneity test was conducted using test Levene's.

### 3. RESULT AND DISCUSSION

#### 3.1. Normality Test

Data calculated in the normality test used N-gain of pre-test and post-test in the both of groups using a significance level of 5% ( $\alpha = 0.05$ ) for critical thinking skills. Based on the calculation of normality test carried out using SPSS, it shows that the N-gain value of the experimental class's critical thinking ability data has a significance value of 0.190 while the control class has an N-gain value with a significance of 0.177. This indicates that the data is normally distributed. Where the significance value for the gain score in the experimental and control classes is greater than 0.005 so that the data is normally distributed.

**Table 2** Normality Test Result

Group	N	Kolmogorov Smirnov (sig)	Note
Experiment Class	36	,190	Normal
Control Class	36	,177	Normal

#### 3.2. Homogeneity Test

Based on homogeneity test in table 4.7, shows that Levene show a significance value of 0.804 which is greater than the 0.05 significance level, which means that

the data in the experimental class and the control class are homogeneous. Based on the results of the test Levene, the test was continued using an independent t-test by looking at the line equal variance assumed (assumed both variants were the same).

**Table 3** Homogeneity Test Result

Data	Asymp. Sig.	Note
Gain Score	0,804	Homogen

#### 3.3. Hypothesis Testing

The data used to test this hypothesis is data from the results gained score during learning online. The data used have gone through normality and homogeneity tests

which are prerequisite tests carried out before testing the hypothesis. The results of the two tests indicate that the data are normal distribution and homogeneous. Therefore, to test the hypothesis of this study using an independent t-test.

**Table 4** Hypothesis Test Result

Parameter	t-test for Equality of Means Sig. (2-tailed)
gain score	0,006

Based on table 4 shows that the significance value of 0.006 is less than the 0.05 significance level, so it can be concluded that  $H_0$  rejected and  $H_a$  is accepted and it can be said that the application of project-based learning with the STEAM approach influential in improving students' critical thinking skills. This is indicated by the difference

in gain scores between the experimental class and the control class.

### 3.4. Application of PBL and STEAM in Accounting Learning.

The results show that the application of the model project-based learning with the STEAM approach can improve students' critical thinking skills. This is because students are actively involved in the learning process so that students more easily understand the material being studied. Students' critical thinking skills in cost behaviour analysis have increased. Students carry out each stage of learning by using a model project-based learning with a STEAM approach. In the stage start with the essential question, students are given problems related to material analysis of cost behaviour in MSMEs. At this stage, students make observations in MSMEs about how the behaviour of costs in MSMEs. In the stage design of a plan for the project, students design instruments for observation in SMEs. In the stage to create a schedule, students prepare an observation schedule at MSMEs. In the stage of monitoring the students and the progress of the project, the lecturer monitors the progress of projects carried out by students. At this stage, it will be known the obstacles faced by students when carrying out the project. In the assess the outcome stage, evaluation of project results is carried out with learning objectives. In the stage evaluation of the experience, lecturers and students evaluate the learning experience carried out.

The integration of STEAM in learning cost accounting courses is (i) Science refers to students' understanding of the concept of cost behaviour analysis in MSMEs; (ii) Technology refers to the use of media such as laptops, androids to complete project assignments and the use of the internet to support the learning process; (iii) Engineering refers to the implementation of research and development to work on projects cost behaviour analysis in MSMEs; (iv) Art refers to the stage of recording calculations carried out by students in solving problems using the basis of judgment internal accountant; (v) Mathematics refers to calculations in determining cost behaviour in SMEs.

The application of the model project-based learning with the STEAM approach makes students have a meaningful experience in the learning process they are doing. This is because during the learning process students are directly involved with real (contextual) cases in MSMEs. At the time of project preparation students are involved in problem-solving, decision making, or investigative activities, so that students have the opportunity to independently produce a product [16] [17].

## 4. CONCLUSION

The results of the study indicate that the application of the model project-based learning with the STEAM approach can improve students' critical thinking skills in accounting learning. Students' critical thinking skills

have increased before and after being given treatment. The application of model's project-based learning and STEAM in the learning process has also succeeded in making students more active in the learning process.

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