

## The effect of project based learning (PJBL) on student economics and business mathematics learning outcomes: analysis on the topic of taxes and subsidies

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### Abstract

This research aims to investigate the influence of the integrated Project Based Learning (PBL) Model of Science, Technology, Engineering, and Mathematics (STEM) on students' learning outcomes in economic and business mathematics, specifically on the concept of tax and subsidy analysis in the Development Economics Study Program, Faculty of Economics and Business. Economics and business mathematics courses are crucial in developing student competencies in understanding basic concepts and applications, including taxes and subsidies. The research method used is an experimental design with a control group. Eight groups of students studying tax and subsidy material were chosen to receive experimental questions. The method used is classroom action research. The aspects of students' scientific work skills observed included skills in asking questions, planning experiments, making observations, using tools/materials, analyzing experimental results, drawing conclusions, compiling experimental reports, and presentation skills. Analysis of critical thinking skills is around 50% and analysis of student enthusiasm level is around 82 which is quite high in cycle II. In addition to scientific work skills, students' conceptual knowledge and relative creativity also increased by 62.5%. The conclusion of this research is that the application of the STEM-integrated Project Based Learning model with tax and material subsidies can improve students' scientific skills. This integrated model can be used as an alternative learning approach to enhance students' scientific skills in mathematics, economics, and business courses.

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**Keywords:** STEM-integrated Project Based Learning, Tax and Subsidies Analysis, Student Scientific Skills Development

### INTRODUCTION

Based Learning Projects or *Project Based Learn* ( PBL) have studied in a way wide in variety context education to assess impact to results Study student . PBL is a learning approach that contextualizes learning by presenting it to participants educate problems that must be to be solved or a product to be developed , emphasizing learning through student- centered , interdisciplinary , and integrated activities in real -world situations (Sadeghi et al., 2016).

Study Han et al., (2015) show that PBL can impact positive to performance students in the eyes Science, Technology , Engineering, and Mathematics (STEM) lessons , with impact observed differences between outstanding students high , middle , and low (Han et al., 2015) . The PBL model incorporates video elements are evident increase Skills think critical student in a way significant (Anggito et al., 2021)

Paradigm related to Based Learning Project ( PjBL ) can increase results Study student in a way significant in various ways eye studying including eye studying economic math . Ningsih (2020) shows that application PjBL increase capacity thinking

original in economics. PBL is looked at both by economics students at both university and university levels school intermediate on (Chmelárová & Čonková, 2021) .

Apart from that, (Winarno & Maulana, 2020) emphasize benefit application of the PjBL model STEM -based to improve results Study students in the field administration business . By collective results the show that the PjBL model is very good at improving results Study students ' eyes lesson mathematics and economics especially in context taxes and subsidies .

Within the realm education mathematics , PBL has linked with enhancement ability solution problem student (Fisher et al., 2021) . Research also highlights effectiveness of PBL in increase ability mathematics student (Supriadi et al., 2019), encouraging effective learning in eye studying biotechnology (Movahedzadeh et al., 2012), and improve creativity among student (Siagian et al., 2022), apart from the , integration of PBL with Other proven methodologies such as Brain-Based Learning give influence positive to results Study mathematics student (Siagian et al., 2022).

Various literature show that PBL can be very beneficial in increase interest student in learn , create learning more meaningful , and helpful solution problems in life real , which is Skills important For 21st (Hakim et al., 2019). Apart from that , the use of PBL in education mathematics has linked with development Skills 21st century and supports student in future career they (Hakim et al., 2019)

Study about PBL in the field education is very helpful For increase results Study students , skills think critical , ability solution problems , creativity , and interests Study (Hodijah et al., 2022) ,(Hodijah & Hastuti, 2022), (Suryanti et al., 2023). Findings This support idea that insert PBL into in education economics and mathematics business, especially on the topic taxes and subsidies , yes become promising approach For increase learning students in these fields the .

Classroom learning outcomes will have a positive impact from project-based learning methodology. Apart from benefiting from interesting and relevant learning experiences through project-based learning (Ningsih et al., 2020), PBL can also improve understanding, creativity and critical thinking (Kamarni, 2022). Therefore Therefore , using case studies as a teaching and learning tool can help students perform better academically in economics. (Habasisa & Hlalele, 2014). There is strong student motivation to study basic mathematical research topics. (Sauri et al., 2022). Technology is also used when classroom learning activities are combined with expert learning in the field (Łobacz & Matuska, 2020)

However, the use of project-based learning in the classroom is still quite low. (Łobacz & Matuska, 2020) so that teacher conducting research on a variety of effective learning approaches in order to solve common difficulties in what is taught in the curriculum (Xiang, 2017). In research This studies case taxes and subsidies which has been created and incorporated into the Global Economics and Business course. According to (Donndelinger, 2021) Mathematics education economics and business is part important in formation competence student in understand concepts fundamental economics and business. Because that 's one Very relevant concept in context This is taxes and subsidies . Good understanding to draft taxes and subsidies become key for student For develop thinking analytical in face situation complex economy .

However, in practice , teaching mathematics economics and business often limited in approach just traditional depend on lectures and training question . Approach the tend not enough capable build in -depth understanding and application draft in context real . Therefore that is necessary approach innovative and effective learning For increase understanding and results Study student in mathematics economics and business , especially in concepts taxes and subsidies . One of promising approach is *the Project Based Learning* (PjBL) Model .

The PJBL model integrates learning based project with understanding draft mathematics economics and business . In this model , students will involved in project real involving analysis , planning , and solving problem related with draft taxes and subsidies . Through experience practical This is expected student can develop more understanding good and capable apply concepts the in situation real .

However , even though the PJBL model offers great potential , not yet Lots research that is special discuss its influence to results Study mathematics economics and business students on the concept taxes and subsidies . Therefore, that is necessary in -depth study For investigate the influence of the PJBL model on results Study students on the concept it in the environment college tall .

This study aim For fill in gap study that and give more understanding comprehensive about effectiveness of the PPA model in increase results Study mathematics economics and business students on the concept taxes and subsidies. Research result This expected can give recommendation for development approach more learning Good in context this, as well give contribution to understanding theoretical and practical in field education mathematics economics and business.

Economics and business courses students are expected to be able understand, apply, analyze knowledge and evaluate knowledge factual, conceptual, procedural, and metacognitive based on desire know about phenomena and events, as well apply knowledge procedural in the field specific study according to his talent and interest in solving problem. Apart from that, ability others obtained by capable students processing, reasoning, and presenting in relation to development from what he learned at school in a way independent as well as Act in a way effective and creative , and capable use method in accordance rule science on concepts taxes and subsidies. This is because students tend to interested There is phenomenon that is occurring.

Findings this research is expected can give a more comprehensive understanding of the effectiveness of the PPA Model in improving results Study mathematics economics and business students on the concept taxes and subsidies. Results this research is expected can give recommendation for development better learning approaches in this context, as well give contribution to understanding theoretical and practical in the field education economics and business mathematics. Thus , this research is expected can increase understanding and application concepts taxes and subsidies in context real for students.

By seeing problems that occur, then solution to make it happen success activity Study teaching through choice the right method is the project based learning model ( Rusman , 2017). Based on formulation problem the so researcher interested in analyzing topic about " The Influence of the Project Based Learning ( PjBL ) Model on Learning Outcomes ." Student Economics and Business Mathematics on the Concept of Taxes and Subsidies ".

## **METHOD**

### **Research design**

This research uses design study experiment with groups control . In this case , it will Two groups of students were formed , namely group experiment to be applying the Project Based Learning (PJBL) Model in learning mathematics, economics and business concepts taxes and subsidies , and groups control that will receive conventional learning use method lectures and exercises question .

Sugiono (2017:15) stated that study learning This use methodology qualitative . Additionally, research qualitative according to Creswell (2016) is something type research that investigates and understands significance behavior, concept or phenomenon , problem social , etc. to various people or group.

Study studies case like This appropriate For answer question study that is what is the study model case applied For increase creativity students in the eyes studying theory projection business. Study action is methodology research used. For maximizing results Study student in a way cognitive , affective , and psychomotor , research action class on the eye studying mathematics business and economics with studies case taxes and subsidies This will support lectures For increase creativity Study student in teach self in environment supportive learning.

Study This use design quasi-experimental research with matching only pretest-posttest control group design (Fraenkel & Wallen, 2009: 271). eight group Then carried out 2 cycles in design research : group experiments and groups control . Group experiment accept therapy before data is collected . With use approach learning based project , research This done For collect data on student STEM literacy /I. Matching only pretest- posttest control group design used in quasi- experimental research can explained as following :

**Table 1.** Research Design

<b>Class</b>	<b>Pretest</b>	<b>Variable Free</b>	<b>Post Test</b>	<b>Enhancement</b>
Experiment	T1	X1 (with treatment )	T2	Y
Control	T3	X2 ( without treatment)	T4	Y1

Information :

- X1 = P learning mathematics economics and business with a learning model based project
- X2 = Learning mathematics economics and business conventional
- T1 = Instrument For see ability beginning students' STEM literacy
- T2 = Instrument For see ability beginning students' STEM literacy
- T3 = Instrument For see ability end students' STEM literacy after get a learning model based project
- T4 = Instrument For see ability end students' STEM literacy after get learning conventional

**Subject study**

Population study This is students at Development Economics Study Program , Faculty of Economics and Business . Retrieval technique sample in study This is a Purposive Sampling technique (Fraenkel & Wallen. 2009: 99) , namely sample chosen with objective certain . Researcher choose sample For class experiment that is Class A is 35 people and for class control that is Class B consists of 40 people, where each class is divided into 8 groups .

**Table 2.** Research design

<b>Class</b>	<b>Pretest</b>	<b>Variable Free</b>	<b>Post Test</b>	<b>Enhancement</b>
Experiment	T1	X1 (with treatment )	T2	Y
Control	T3	X2 ( without treatment )	T4	Y1

*Source : Processed data , 2023*

**Data collection technique**

Test and non- test is method assessment used in this research. Test STEM literacy works as instrument tests , and reactions student to based learning paradigm project works as non- test instruments.

**Table 3.** Data collection techniques

Data source	Data Type	Collection Techniques data	Information
Student	STEM Literacy	Test choice double (pretest and posttest)	Done in beginning and at the end process learning
Lecturer	Lecturer activities in managing learning	Internal teacher observations managing learning	During learning
Student	Frequency student activities during the learning process	Observation activity student during the process learning	During learning
Student	Student response to the learning model	Tight response student	After all over learning process finished

Source : Processed data , 2023

Prepare , plan , implement , and observe is step beginning in method study action class. Planning the done in accordance with the steps that will be change attitudes and behavior student To use overcome problems that arise when they Study become more creative . This matter illustrated in Figure 1 below :



**Figure 1.** Cycle study action class ( McNIff & Whitehead, 2002)

Source : Rusdi , 2020

A number of influencing indicators ability think creative when finish problems (Windasari et al ., 2021). As for indicators Originality , smoothness , and flexibility will be the future entered at 5 levels ability think creative (Umami et al., 2021)

**Table 4.** Indicator ability think creative in solving problem

Aspect	Indicator
Student Originality / i	Student/ i own ability to explain known things as well as asked To use give answer in different ways
Student Fluency / i	Student/ i own ability to implement established method To use obtain various answer
Student Flexibility / i	Student / i have ability explained results calculation use established method from corner look different

Source : Abdullah et al , in Windasari et al , 2021( processed )

**RESULTS AND DISCUSSION**

Data obtained from results This research is presented in the form table illustrating student activity in responding studies the case . Use The solution learning method using the Project Based Learning Model (PJBL) is highly preferred form of bound learning provision estimation time student learning which is then expressed with weights credits . Forms of offline, online and/or mixed learning designed according to characteristics eye lectures and written clearly to make it easier identification appropriate materials and media . A very valuable key in designing RPS is through the formulation of CPMK and Sub CPMK that are appropriate to the verb operational (KKO) from bloom's taxonomy , arrangement eventual learning indicators influential in the preparation learning activities . By doing activity *Focus Group Discussions* (FGD) can be initial capital for lecturers to develop dynamic lectures through the Project Based Learning (PJBL) Model.

**Table 5.** Analysis ability think critical cycle of students in cycles I and II

No	Aspect Observation	Cycle 1			Cycle 2		
		B	C	K	B	C	K
1.	Student/ i capable identify / formulate question		✓		✓		
2.	Able to search clear answer from every question		✓		✓		
3.	Accept suggestions from others to develop new ideas		✓		✓		
4.	Student/ i capable give argument that is different from the existing one		✓		✓		
5.	Student/ i can analyze something problem		✓			✓	
6.	Student/ i can put forward his opinion up front class	✓				✓	
7.	Able to accept exists difference pendo	✓			✓		
8.	Able to provide real examples		✓		✓		
9.	Able to face challenges with strong fundamentals		✓			✓	
10.	Identify stated reasons		✓			✓	
11.	Look for connection between problems / experiences		✓			✓	
12.	Identify conclusion		✓			✓	

Information : B = Good C = Sufficient K = Poor

Based on Table 4 shows titles studies cases discussed by students. Based on this data, students already understand what was said by the lecturer. This learning innovation is more leads to thinking be critical with studies selected case.

Based on Table 4, there are Implementation where is the third cycle research , cases analyzed by students are taken from the article is then analyzed accompanied by relevant and realistic explanations in line with the material and RPS (Semester Learning Plan ). The cases observed are varied and up to date with current events . Profit method studies case where students are more trained in analyzing something problem and capable think be critical of the problems that occur and find them solution from various perspective .

Duties and responsibilities answer a lecturer in carrying out tridharma college One of them is teaching. Learning in the lecture process naturally contain a series of processes carried out by lecturers and students in a reciprocal , educative manner to achieve objective certain .

**Table 6.** Analysis level enthusiasm of cycle I and II students

No	Aspect Observation	CYCLE 1			CYCLE 2		
		B	C	K	B	C	K
1.	Student response to material Trading between countries	✓			✓		
2.	Student interest in material connection international		✓		✓		
3.	Ability to ask students questions about the material connection Trading between countries		✓		✓		
4.	Students' ability to express opinion		✓		✓		
5.	ability to answer , refute and respond question Good from lecturers or other students		✓		✓		
6.	Students' ability to collaborate in discussions group		✓		✓		
7.	Students' ability to formulate problem related to material connection international		✓			✓	
8.	Students' ability to collect sources related to the material		✓			✓	
9.	Student's ability to express solution or alternative solution problems with the material connection Trading between countries		✓		✓		
10.	Student's ability to present material ahead class		✓		✓	✓	
11.	Interesting student abilities conclusion	✓					

Information : B = Good C = Sufficient K = Poor

Based on Table 5 shows that level enthusiasm students in the teaching process experience significant improvements were seen from student response to assigned tasks, abilities interesting conclusion where in cycle II level student enthusiasm increases

significant. Therefore , in a way Overall , it happened enhancement significant in various ways aspect observation from cycle I to cycle II. Students demonstrate increase in capabilities think critical , cooperation , communication , and skills presentation . This improvement shows effectiveness treatment given in improving student enthusiasm and involvement in the learning process. Thus , the approach used in cycle II can be considered successful and worthy of application in further learning activities .

**Table 7.** Recapitulation charging sheet Class A student work without treat

No	Group Code	Indicator			Tikat Ability think creative
		Originality	Smoothness	Flexibility	
1.	R1	✓	✓	✓	Creative
2.	R2	–	✓	–	Less Creative
3.	R3	✓	–	–	Less Creative
4.	R4	✓	✓	–	Enough
5.	R5	✓	✓	–	Creative Enough
6.	R6	✓	–	✓	Creative Enough
7.	R7	✓	–	✓	Creative
8.	R8	–	–	✓	Less Creative

Source : Processed data , 2023

Based on Table 6 shows in a way whole of eight analyzed groups , two groups (R1 and R7) were assessed creative , three groups (R4, R5, and R6) were assessed Enough creative , and three group others (R2, R3, and R8) were assessed not enough creative. These results show that without treatment special, ability think creative students Class A varies, with some big group is on level Enough creative until not enough creative. This can be the basis for implementing more effective learning strategies, such as the Project Based Learning (PjBL) model, to improve ability think creative students. Next, students are grouped into 8 (eight) group A in one class to see level originality , fluency and flexibility is classified creative about 25%, enough creative about 37.5% and less creative around 37.5% of whole group .

**Table 8.** Recapitulation charging sheet Class B student work with treatment

No	Group Code	Indicator			Tikat Ability think creative
		Originality	Smoothness	Flexibility	
1.	R1	✓	✓	✓	Creative
2.	R2	–	✓	✓	Enough Creative
3.	R3	✓	✓	–	Enough Creative
4.	R4	✓	✓	✓	Creative
5.	R5	✓	✓	✓	Creative
6.	R6	✓	✓	✓	Creative
7.	R7	✓	✓	✓	Creative
8.	R8	–	✓	✓	Enough Creative

Source : Processed data , 2023



Overall, of the eight groups analyzed in Class B with treatment, six groups (R1, R4, R5, R6, and R7) were rated as creative, two groups (R2 and R3) were rated as quite creative, and one group (R8) was rated as less creative. This shows that with certain treatments, the majority of student groups show high creative thinking abilities. The presence of treatment seems to increase the level of creativity of students compared to the group that did not receive treatment, as can be seen from the majority of groups in the creative category. This supports the use of this treatment method in an effort to improve students' creative thinking abilities.

Next, students are grouped into 8 (eight) group in one class to see level originality, fluency and flexibility is classified creative about 62.5%, enough creative about 37.5% and less creative about 0% of whole group the .

**Table 9.** Comparison of Pretest and Posttest Results for Experimental and Control Classes

No	Data	Class Experiment		Class Control	
		Pre Test	Post Test	Pre Test	Post Test
1.	Lowest Value (min)	50	70	55	45
2.	Highest Value (Max)	70	85	75	72
3.	Average (mean)	60	77.5	65	58.5
4.	Middle value	60	65	77.5	58.5

Source : *Processed data , 2023*

Based on Table 8 shows analysis percentage change pre-test and post-test scores for class experiments and classes control, can concluded that Class Experiment show significant improvement in all the aspect being measured (value lowest, value highest, average, and value middle). Enhancement biggest seen in the average value of 29.17% and value Lowest by 40%. On the other hand, Class Control show decline in all the aspect being measured, with decline largest in value middle of -24.52% and value Lowest of -18.18%. This shows that treatment (intervention) provided to Class Experiment effective in increase performance students, temporary Class Controls that don't get treatment show decline in performance.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusion

The results of this study support idea that application of appropriate learning strategies can increase results learning and skills think creative students. Implementation PjBL in class can be a solution to overcome limitations traditional learning approaches, as well help students develop the skills needed to deal with it challenges in the real world.

Next to class Experiment show significant improvement in a way statistics in all assessed areas, especially on scores Lowest based on analysis percentage change score before and after test. On the other hand, Class Control experience decline mark. This shows that intervention Class Experiment succeed increase performance students, meanwhile performance Class Control decrease if it doesn't exist intervention the.

## Recommendations

Use method treatment, such as the Project Based Learning (PjBL) model, is proven effective in improving ability think creative students. Therefore, the implementation of innovative and project - centered learning strategies recommended for wider implementation in the curriculum education, especially in the eyes necessary lessons thinking analytical such as economics and business mathematics. Proven learning methods effective, as applied to the Classroom Experiment, extended throughout class to improve performance student in a way whole. Evaluation periodically need carried out for monitoring effectiveness method and identify areas of need repair. Training for teachers regarding Effective learning techniques and strategies are very important, so they can implement this method is better.

Additionally, improve involvement students in the learning process through discussions, projects groups, and activities interactive other can help increase interest and motivation they. Provision source adequate and quality learning high too support learning methods applied. Lastly, an individual approach to help students who experience difficulty learning, such as guidance additions or sessions Study special, necessary considered to ensure all students can follow study well. By implementing these suggestions, it is hoped the quality of learning can be improved and results Study student can Keep going experience enhancement.

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