The Effectiveness of Problem-Based Learning Model to Improve Critical Thinking Skills for High School Students

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Abstract: ***This study aims to analyze the factors that influence the effectiveness of the application of the Problem Based Learning (PBL) model to improve the critical thinking skills of high school students in Economics. This study involved 140 high school students at 4 high schools in the Special Region of Yogyakarta. Data is processed using descriptive analysis techniques and multiple linear regression techniques. The results showed that the design of the problem-based learning model had succeeded in helping students improve critical thinking skills as evidenced by the increase in the mean value from 1.92 to 4.26 and the value of t arithmetic 18.157 with a probability value of 0.000 <0.05. Students are encouraged to develop critical thinking skills through the dynamics of learning activities, including posters, video clips, role playing methods, tabloids, talk shows, news reader models, and variety show models. The effectiveness of applying the PBL model is influenced by student enthusiasm, the attractiveness of the case and the desemination of output, but the availability of facilities does not have a significant effect on the effectiveness of implementing PBL with a R^2 value of 0.568. This means that 56.8% of the effectiveness of PBL is determined by variations in student enthusiasm, case attractiveness, facility availability and output desemination, while the remaining 43.2% is determined by variables outside of this study such as intake, material difficulty, teaching style teacher, and others. So, it can be concluded that the problem-based learning model is effective for improving students' critical thinking skills in economics.***

Keywords: effectiveness, PBL model, critical thinking skills, economic lessons

1. Introduction

Critical thinking skills and scientific attitudes are very important to be developed in schools because they have become one of the competencies of educational goals in many countries. The teacher is expected to be able to design learning that activates students and develops critical thinking skills and scientific attitudes of students. The teacher is expected to be a dynamic facilitator who is able to explore the potential of critical thinking skills and scientific attitudes among students through the learning process in the classroom.

Students' critical and creative thinking skills can be trained and developed through learning that encourages students to explore, inquiry, find and solve problems through learning activities in small groups (Sunaryo, 2014: 42). Critical thinking skills and scientific attitudes are the characteristics of high-order thinking skills (Anderson and Krathwohl, 2010)

One learning model that can be used to improve critical thinking skills and scientific attitude is a problem-based learning model. The problem-based learning model facilitates students to acquire essential knowledge from learning material combined with concrete problems from real life. Problem-based learning helps students think analytically and develop alternative solutions to problems (Lissa, et al 2012).

The assumption that the problem-based learning model is able to improve critical thinking skills and the scientific attitude of students is supported by the opinions of experts. According to Sanjaya (2007: 214), the problem-based learning model contains a series of learning activities that emphasize the process of solving problems faced scientifically. Students work in groups to solve problems by relying on the ability to think scientifically. Sutawidjaja and Jarnawi (2011: 7-9) revealed that problem solving would be more optimal if presented in instructional materials in the form of complex and reasonably complex problems. According to Arends (2012), the problem-based learning model has 5 phases namely: 1) the phase of student orientation to the problem, 2) arranging students to learn, 3) helping group investigation, 4) developing and procuring models or drawings, and 5) analyzing the process solution to problem. According to Seng (2000), the application of problem-based learning models can improve students' critical thinking skills.

This research is a continuation of previous years' research. In the previous year, researchers have conducted a study of the extent of learning planning, learning and assessment processes of learning in high school economics subjects that have accommodated the development of scientific attitudes and critical thinking skills. The research team has also drafted a problem-based learning model design and has conducted a limited tryout for the implementation of problem-based learning models to improve scientific attitudes and critical thinking skills in Economics subjects in class X Stella Duce High School 1 and 2. The results of the first year study are as follows. First, basic competencies, indicators, learning objectives in learning devices are dominant at the level of understanding (C2). Second, the learning process on economic subjects in Stella Duce 1 and 2 High Schools has reached a higher level, namely the level of analysis (C4) and evaluating (C5). Third, thinking skills demanded in the daily test questions and midterm Economics subjects are dominant at level C2. Fourth, the results of a limited tryout for Stella Duce High School students 1 and 2 show that the implementation of a problem-based learning model has been proven to be able to improve critical thinking skills among high school students.

This study focuses on evaluating the results of the implementation of the problem-based learning model design on economic subjects in four schools namely Stella Duce 1 High School, Stella Duce 2 High School, Pangudi Luhur 1 High School 1 Yogyakarta, and SMAN 7 Yogyakarta. In addition, the research team also analyzed the influence of student enthusiasm, teacher understanding, facilities, and output desemination on the effectiveness of the implementation of problem-based learning models in developing critical thinking skills. Thus, this study focuses on examining the effectiveness of the problem-based learning model for improving critical thinking skills for high school students.

The problems examined in this study are: 1) How are the results of the implementation of a problem-based learning model that has been revised to improve critical thinking skills in economic learning at high school students ?; 2) How is the influence of student enthusiasm, attractiveness of cases, facilities, and output desemination on the effectiveness of the implementation of problem-based learning models in developing scientific attitudes and critical thinking skills?

Problem based learning model is one of the learning models that involve student activity predominantly. Educators act as facilitators and dynamists. Seng (2000) states that problem-based learning applied in the classroom can improve students' critical thinking skills. According to Chang (2016), the application of a problem-based learning model is believed to be able to facilitate students to think critically and build scientific attitudes according to the current context. Interaction between students in peer mediated instruction provides opportunities for students to solve complex problems that may not be solved if students work individually (Putu, 2005). The dominant problem based learning model involves students so that they are believed to be able to improve students' thinking skills (Carriger, 2016). This problem-based learning begins with a problem that must be solved with the ability to think critically and be creative.

The steps for implementing Problem Based Learning can be described as follows (Winataputra, 2001): a) Educators explain the competencies to be achieved; b) Educators motivate students to engage in problem solving activities; c) Educators help students define and organize learning tasks; d) Educators encourage students to gather appropriate information, experiments, data collection, hypotheses, problem solving; e) Educators help students in planning reports, and f) Educators help students reflect or evaluate the learning process. Problem-based learning models involve students predominantly in learning activities (Phungsuk, Chantana, Thanin, 2017).

This problem-based learning activity is designed to improve critical thinking skills for students. Critical thinking activities have been studied for almost a hundred years. Socrates had begun a critical thinking approach in learning activities for more than 2000 years ago, but John Dewey, a philosopher of psychologists and American educators, was widely seen as the "father" of the tradition of modern critical thinking. John Dewey, named the activity of critical thinking as "reflective thinking". Reflective thinking is an active, persistent, and careful consideration of a belief or form of knowledge that is taken for granted, viewed from the point of reason that supports it and other conclusions that become its tendency (Dewey, 1909: 9 in Fisher, 2009: 2).

Furthermore, Edward Glaser (in Fisher, 2009: 3), develops Dewey's ideas and formulates critical thinking activities as: a) An attitude of willingness to think deeply about problems and things that are within reach of one's experience; b) Knowledge of methods of examination and logical reasoning; c) A kind of skill to apply these methods. Thinking and recognition skills must be transformed through the educational process that is through the learning process (Gao, Li, Zhu, Wang, Zhang, 2017). The results of Alrahlah's study (2016: 159) show that students' critical thinking skills will increase if the steps of problem-based learning are applied systematically.

In the 1950s Benjamin Bloom led a team of psychologists to analyze academic learning behavior. Bloom's taxonomy for the cognitive aspects of the original version of Benjamin Bloom and his team are as follows (Yulaelawati, 2004): 1) Knowledge, 2) Understand, 3) Application, 4) Analysis, 5) Synthesis, and 6) Evaluation.

Bloom's taxonomy was later revised by Lorin Anderson, and his team in the 1990s. The revised version of Bloom becomes as follows: 1) Remembering; 2) Understanding; 3) Applying; 4) Analyzing; 5) Evaluating; 6) Creating. In this study, the operational word at the fourth level is analyzing, the fifth level is evaluating, and the sixth level is creating an indicator of the development of critical thinking skills.

This study aims to: 1) find out the results of implementing a problem-based learning model that has been refined to improve critical thinking skills in economic learning among high school students; 2) analyze the influence of student enthusiasm, attractiveness of cases, facilities, and output desemination on the effectiveness of the implementation of problem based learning models in developing scientific attitudes and critical thinking skills of students.

This study is useful as a reaserch and development pilot project in the field of education so that it can improve students' critical thinking skills. This research is very useful to do to solve strategic issues, especially those related to increasing the nation's competitiveness in the form of critical thinking skills. Critical thinking skills are also needed so that students are able to be the successors of a quality and competitiveness nation.

2. Methods

The research approach used in this study is research and development approach which refers to the theory of Borg and Gall (1979). This research and development begins with a preliminary study to find the learning design then developed in certain situations, tested, revised and re-tested until the final product is deemed perfect.

This development research was conducted in March to May 2019 at Stella Duce 1 High School, Stella Duce 2 High School, Pangudi Luhur High School Yogyakarta and State Senior High School 7th Yogyakarta involving 140 students. These schools have a high commitment to become a place as well as research partners. The involvement of partner schools in this study is in the form of preparing students who are the subjects of research for the implementation of problem-based learning models in order to improve students' critical thinking skills and scientific attitudes. The Principals and Economic Teachers in the four schools are committed to providing places, learning facilities and lesson hours needed for the implementation of problem-based learning models. The Economics teachers are also ready to be invited to discuss each time after implementing this problem-based learning model.

This research uses development research design, namely ADDIE Model (Analyze, Design, Development, Implementation, Evaluation Model) (Sugiyono, 2010). ADDIE Model which is one of the systematic learning design models. The choice of this model is based on the consideration that this model is developed systematically and rests on the theoretical foundation of learning design. This model consists of five steps, namely: (1) analyze, (2) design, (3) development (4) implementation, and (5) evaluation. Visually the ADDIE Model stages can be seen in the following chart.

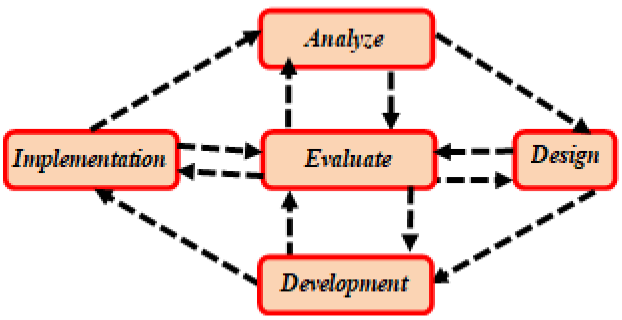

Chart 1: ADDIE Model Stage (adapted from Tegeh and Kirna, 2010)

The stages of this research development are as follows: 1) The preliminary study phase was undertaken by applying a qualitative descriptive approach at Stella Duce High School 2; 2) Stages of Silabus and SAP analyzing the subjects of High School Senior High School XI because the class material characteristics are most relevant to developing critical thinking skills and scientific attitudes; 3) Stages of observing how far the implementation of the learning has developed critical thinking skills and scientific attitudes; 4) Stages analyzing the extent to which the questions in semester evaluation and final assessment of the semester have developed critical thinking skills and scientific attitudes; 5) Designing appropriate problem-based learning models to develop critical thinking skills and scientific attitudes.

Data analysis uses descriptive analysis techniques, paired sample t-test and multiple linear regression techniques. Descriptive analysis techniques are used to provide a description of the extent of planning, process, and evaluation undertaken in the Senior Economics subject to accommodate the development of scientific attitudes and critical thinking skills. Paired sample t-test is used to analyze the extent to which problem-based learning design effectively improves critical thinking skills and scientific attitudes. For that reason, critical intelligence and critical thinking data is needed before and after the implementation of a problem-based learning model. Multiple regression analysis is used to analyze the influence of student enthusiasm, case appeal, facility support, and output desemination to the effectiveness of applying problem-based learning models in developing scientific attitudes and critical thinking skills. The multiple regression model in this study is as follows:

$$Yi = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_3 X_3 + e_t$$

Description: Y = Effectiveness of application of Problem Based Learning Model; X_1 = Student enthusiasm level; X_2 = The appeal of the case; X_3 = Facility support; X_4 = Accuracy of output desemination; e_t = error term. This regression analysis requires prerequisite test in the form of normality test and linearity test. In addition, classical assumptions are also needed in the form of multicollinearity test, heteroscedasticity test, and autocorrelation test.

3. Findings and Discussion

This study was conducted to answer two problems, namely: 1) How the implementation of problem-based learning model has been refined to improve critical thinking skills in economic learning among high school students; 2) How does student enthusiasm, appeal, facilities, and output desemination influence the effectiveness of applying problem-based learning models in developing scientific attitudes and critical thinking skills?

The level of knowledge and thinking skills required in the learning planning prior to the implementation of the PBL model in the economy class X grade economy can be observed in the following table:

Table 1: Levels of Thinking Thinking Abilities in Summary of Basic Competencies and Indicators

No	Thinking Ability	Level of Cognitive in Basic Competencies and Indicators					
		C1	C2	C3	C4	C5	C6
1.	In the formulation of Basic Competence	5	8	0	0	0	0
	Sub-total & Percentage (%)	5 (38.5%)	8 (61.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
2.	In the Formulation of Indicators	6	17	9	0	0	0
	Sub-total & Percentage (%)	6 (18.8%)	17 53.13%)	9 (28.1%)	0 (0%)	0 (0%)	0 (0%)
	Total Operational Verbs in Basic Competencies and Indicators (%)	11 (24.4%)	25 (55.56%)	9 (20%)	0 (0%)	0 (0%)	0 (0%)

Source: secondary data processing, 2019

From the table above, it is known that 61.5% basic competence formulas use the verbs at level of understanding (C2), while the remaining 38.5% use the verbs at the level of remembering (C1). None of the operational verbs on Basic

Competence is above C2 level. For the operational verbs in the 53.13% indicator is at the level of understanding (C2), 28.1% is at the applying level (C3) and the rest 18.8% is at the level of remembering (C1). Thus, it can be concluded that learning planning in the class X economy focuses only on lower order thinking skills and has not been directed at the development of critical thinking skills and scientific attitudes.

This fact is of concern because at the high school level, what should be developed is critical thinking skills and scientific attitudes, namely levels C4 to C6. There are several underlying causes of this phenomenon. First, the lack of educator's understanding of critical thinking skills and scientific attitudes. Educators rarely reflect in greater depth about the importance of developing critical thinking skills and scientific attitudes. Second, learning tools are often arranged to meet administrative requirements so that they are not thought through in depth. Third, the operational verbs formulated in Basic Competencies and Indicators in learning devices often use operational verbs that are considered easy to teach, namely at levels C1 and C2. Fourth, educators often tend to underestimate the intellectual abilities of students so they do not dare to demand critical thinking skills and develop scientific attitudes.

If it refers to the category of knowledge dimension in Bloom's taxonomy, it can be argued that learning planning in the subjects of High School Economics is included in the factual knowledge category, conceptual knowledge, but yet to the knowledge of produral and metacognitive knowledge.

The results of the structured evaluation when the tryout design of the problem-based learning model shows that the problem-based learning model shows that the problem-based learning model has succeeded in helping students develop scientific attitudes and critical thinking skills. However, the design of this problem-based learning model needs to be varied by the design of other contructivistic learning models. This needs to be done so that the teaching and learning process is not dominated by a single learning design model that can lead to boredom in students.

In the whole series of teaching and learning processes, the design of a problem-based learning model needs to be varied with the implementation of other learning models such as project based learning, inquiry learning and discovery learning models. The design of varied learning activities but still focusing on developing high-level thinking skills will enhance critical thinking skills and scientific attitudes of students. Variety, creative and fun learning activities will create a happy mood for students to be actively involved in learning activities.

Based on the results of an evaluation of the tryout of the implementation of reflections on field findings, the authors believe that the design of problem-based learning is suitable for improving critical thinking skills and scientific attitudes of students in economics. Beliefs of researchers are also based on the characteristics of high school economics subject matter that are potentially directed at concrete problems, including human needs, production, production costs, economic systems, consumer behavior, producer behavior, economic actors, demand, supply, balance prices, and markets production factor.

Arends (2012) revealed that Problem-Based Learning is learning that uses real-life everyday problems that are open-ended to develop critical thinking skills and scientific attitudes. The design of the Problem-Based Learning learning model implemented to improve critical thinking skills and scientific attitudes in the economic learning process follows the following stages.

According to Arends (2012), there are 5 stages in the implementation of the Problem Based Learning model, namely: First, the orientation stage towards the problem. At this stage, the teacher presents real problems related to economic learning material to students. Second, the organizational learning stage. At this stage, the teacher facilitates students to understand the real problems related to selected economic learning. Students share the role to solve the problem. Third, the stages of individual and group investigations. At this stage, the teacher guides students to collect data or information related to economic cases through various ways to find alternative solutions to problems. Fourth, the stage of developing and presenting the results of problem solving. At this stage, the teacher guides students to determine the most appropriate problem solving from various alternative solutions to problems found. Students compile reports on the results of problem solving, for example in the form of ideas, models, charts, or power point slides. Fifth, the stage of analysis and evaluation of the problem solving process. At this stage, the teacher facilitates students to reflect or evaluate the process of solving problems related to the economic learning material that is carried out.

The implementation of this problem-based learning model encourages the growth of creativity, independence, responsibility, confidence, and critical and analytical thinking in students. Students gain more meaningful learning experiences because they are facilitated to think critically and be scientific. Through this process, students are prepared to enter the real school of life (Yew and Goh, 2016).

However, in the context of the overall learning activities, the design of a problem-based learning model needs to be varied with the design of a project-based learning model, inquiry and discovery. Various learning designs are believed to be able to improve critical thinking skills and scientific attitudes among high school students. This belief is supported by the steps of project based learning learning activities, inquiry learning and discovery learning that are oriented towards developing thinking skills as seen in the steps of learning activities.

First, Project-Based Learning is learning that emphasizes activities that produce products by applying the skills of researching, analyzing, making, and presenting real products. The product in question can be in the form of design, scheme, paper, artwork, technology or craft work, and others. Projects can be carried out independently or in groups. Usually PBP is designed to be applied to complex problems. Project-based learning activities are carried out with the following steps: 1) Project determination; 2)

Designing steps for project completion; 3) Preparation of the project implementation schedule; 4) Project completion with facilitation and monitoring of teachers; 5) Preparation of reports and presentations or publications on project results; 6) Evaluate project processes and results.

The activity of determining the project begins by beginning with the emergence of a guiding question that directs students to determine a collaborative project that integrates a series of basic competencies in one subject. In the design plan for the steps to complete the project, the teacher facilitates students to design the steps for project completion activities and their management. In the activity of preparing the project implementation schedule, the teacher provides assistance to students scheduling all activities that have been designed.

In project completion activities with facilitation and monitoring, the teacher facilitates and monitors students in implementing the project designs that have been made. In the activity of preparing reports and presentations or publications on the results of the project, the teacher facilitates students to present and publish their work. Furthermore, at the evaluation stage of the process and the results of the project, the teacher and students at the end of the learning process reflect on the activities and results of the project tasks that have been done.

Second, inquiry is a learning process that is based on search and discovery through a process of systematic thinking. Knowledge is not a pile of facts resulting from remembering, but the result of the process of finding or constructing. The main task of the teacher is to facilitate discovery activities so that students gain knowledge and skills through their own findings and not the results of remembering a number of facts. Inquiry inquiry activities follow the steps as follows: 1) Formulating problems; 2) Formulating hypotheses; 3) Collect data; 4) Test the hypothesis; 5) Formulate conclusions.

At the stage of formulating the problem, the teacher guides and facilitates students to formulate and understand the real problems that have been presented. At the stage of formulating the hypothesis, the teacher guides students to form hypotheses by asking various questions to provoke answers while students or can formulate various estimates of the possible answers to a problem under study. At the stage of collecting data, the teacher directs students to find the facts or data needed to answer the temporary questions (hypotheses) that have been formulated previously. The method can be through in-depth interviews, reading, and surveys.

At the stage of testing the hypothesis, the teacher directs the students to match the temporary answers with answers that are built from the data that has been collected through various ways. The expected final result is to receive answers based on data. At the stage of formulating conclusions, the teacher guides the students to describe the findings obtained based on the results of hypothesis testing. To reach accurate conclusions, the teacher can show students which data is relevant.

Third, finding learning activities, is learning to find concepts, meanings, and causal relationships through organizing learning carried out by students. The steps of discovery activities are as follows: 1) stimulation; 2) problem statement; 3) Data collection; 4) Data Processing; 5) Verification.

In the stage of stimulation, the teacher starts PBM activities by asking questions to students, asking students to read books, observing phenomena through video clips or images, and other learning activities that lead to a problem. In other words students are faced with a problem or question so that the desire arises to investigate. Example: News or video or TV shows about the many community groups who oppose the establishment or opening of a minimarket.

In the stage of problem statement the teacher gives the opportunity to students to identify as many problems as possible relevant to the basic competencies or indicators, then choose one or several and formulated in the form of hypotheses. Example: The existence of a mini market near traditional markets will push or defeat traditional traders or shops.

In the data collection stage the teacher asks students to gather as much relevant information or data as possible to answer questions. The technique or method of collecting data can vary. For example, by reading or interviewing sources, conducting experiments, observations, and so on.

At the stage of data processing, all information originating from the results of reading, interviewing, observing, etc., is processed, selected, sorted, classified, tabulated, if necessary calculated in a certain way, and interpreted or interpreted. Furthermore, in the verification phase, the results of processing the data above are linked to the questions that have been formulated before or carried out a careful examination of the results of data processing to prove whether or not the hypotheses that were previously set were correct. Various kinds of learning models above are based on science so that they need to be carried out varied so that students experience a creative and enjoyable learning process. A happy and joyful mood during learning activities will encourage students to develop critical thinking skills and scientific attitudes.

4. Results of the implementation of the PBL Model that has been improved

In the next stage, the researcher drew up a draft design of a problem-based learning model that focused on developing high-level thinking skills reflected in the formulation of basic competency operational verbs and indicators at levels C4 to C6. The complete design of the problem-based learning model can be observed in the appendix section of this research report. Next, the researchers conducted a tryout on class X high school students at Stella Duce I High School, Stella Duce II High School, Pangudi Luhur 1 High School Yogyakarta and State High School 7th Yogyakarta involving 140 students.

The results of the implementation of the Problem Based Learning (PBL) model that focuses on developing higher order thinking skills (HOTS) shows that there is an increase in critical thinking skills and scientific attitudes among students. Students work together seriously in groups and are actively involved in the economic learning process related to the resolution of a given case. Students can choose the way of presentation for example by using posters, video clips, role playing methods, tabloids, talk shows, news reader models, and variety show models. Through presentation activities in various ways, students are facilitated to develop thinking skills (Assen, Meijers, Otting, & Poell, 2016).

After testing statistically using descriptive analysis and different test paired sample t-test, the level of thinking skills before and after a limited tryout of the implementation of problem-based learning models can be observed in the following table.

Table 2: Thinking skills before and after PBL implementation

No	Level Thinking Skills	Before PBL	After PBL
1	Remembering (C1)	23.8%	0%
2	Understanding (C2)	57.2%	0%
3	Applying (C3)	19%	11.3%
4	Analysing (C4)	0%	66.1%
5	Evaluating (C5)	0%	22.7%
6	Creating (C6)	0%	0%
	Mean	1.92	4.26
	t value	18.157	
	Probability	0.000	

Source: secondary data processing, 2019

The results of the implementation of the PBL model oriented to HOTS showed that there was an increase in the level of thinking skills before and after the implementation of the PBL learning model. Before PBL implementation, the dominant level of thinking skills was understanding (C2), 57.2%, whereas after PBL implementation, the dominant level of thinking skills was analyzing (C4) of 66.1%. Judging from the mean value, there was an increase from 1.92 to 4.26. Thus, it can be concluded that there is an increase in thinking skills significantly as indicated by the value of t arithmetic 18.157 and probability values of 0.000 <0.05.

The students were happy because their creativity in delivering ideas during presentations was highly valued. The students were given the opportunity to present a critical review of presentation material from the presenter group. The presenters were also given the opportunity to respond to questions and statements from the discussion group. Thus, the implementation of a limited tryout of the learning process using a problem-based learning model has developed critical thinking skills and scientific attitudes.

2. Effect of student enthusiasm, attractiveness of cases, facilities, and output desemination on the effectiveness of PBL implementation

There are many factors that influence the effectiveness of implementing PBL. Data analysis of the factors that influence the effectiveness of PBL implementation involved 140 high school students in 4 schools namely Stella Duce 1 High School, Stella Duce 2 High School, Pangudi Luhur Sedayu High School, and SMAN 7 Yogyakarta. In this study, the effectiveness of applying PBL is thought to be influenced by student enthusiasm, case attractiveness, learning facilities and output desemination. The influence of various variants can be observed in the following table:

Table 3: Effect of student enthusiasm, case attractiveness, facility availability, and output desemination on the effectiveness of PBL implementation

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.42	0.263		1.565	0.123
	Student Enthusiasm	0.347	0.109	0.25	3.164	0.003
	Case Attractiveness	0.232	0.099	0.178	2.239	0.022
	Facility Availability	0.001	0.145	0.001	0.006	0.994
	Output Desemination	0.613	0.135	0.546	4.544	0
a. Dependent Variable: the effectiveness of PBL implementation						

Source: primary data processing, 2019

From the regression results table above, the regression equation can be arranged as follows:

$Y = 0.420 + 0.347X_1 + 0.232X_2 + 0.001X_3 + 0.613X_4 + e$

$R^2 = 0.568$

Description: Y = Effectiveness of application of Problem Based Learning Model; X_1 = Student enthusiasm level; X_2 = The appeal of the case; X_3 = Facility support; X_4 = Accuracy of output desemination; e_t = error term.

From the table above, it can be seen that the beta coefficient for constants is 0.420 and the asymptote of significance is 0.123. The significance of asymptot value is 0.123> alpha 0.05 so that it can be concluded that the constants do not have a significant effect on the effectiveness of PBL implementation.

The enthusiasm of students has a beta coefficient of 0.347, asymptote significance is 0.003. The beta coefficient of student enthusiasm is positive and the asymptote of significance is 0.003 <alpha 0.05 so it can be concluded that student enthusiasm has a positive and significant effect on the effectiveness of PBL implementation. The enthusiasm of the students was made graded which was very unenthusiastic, not enthusiastic, quite enthusiastic, enthusiastic and very enthusiastic so that it could be said that the level of enthusiasm of the students had a positive and significant effect on the effectiveness of PBL implementation. Student enthusiasm beta coefficient of 0.347 means that if student enthusiasm increases by one unit, the effectiveness of PBL implementation will increase by 0.347 units.

The attractiveness of the case has a beta coefficient of 0.232, the asymptote of the significance is 0.022. The attractiveness coefficient of the case is positive and the asymptote of significance is 0.022 <alpha 0.05 so that it can be concluded that the attractiveness of the case has a positive and

significant effect on the effectiveness of the application of PBL. The appeal of the case is made graded, which is very unattractive, unattractive, quite interesting, interesting and very interesting so that it can be said that the attractiveness of the case has a positive and significant effect on the effectiveness of PBL implementation. The beta coefficient of attractiveness of a case of 0.232 means that if the attractiveness of a case increases by one unit, then the effectiveness of the application of PBL will increase by 0.232 units.

Availability of facilities has a beta coefficient of 0.001, the asymptot significance is 0.994. The facility availability coefficient is positive and the asymptot significance is 0.994> alpha 0.05 so it can be concluded that the availability of facilities does not significantly influence the effectiveness of PBL implementation. The availability of learning facilities made graded is very inadequate, inadequate, adequate, adequate and very adequate so that it can be said that the availability of facilities does not significantly influence the effectiveness of PBL implementation.

Output desemination has a beta coefficient of 0.613, the asymptote of its significance is 0,000. The output desemination coefficient has a positive and significant asymptote 0,000 <alpha 0.05 so that it can be concluded that output desemination has a positive and significant effect on the effectiveness of PBL implementation. Output desemination is made graded which is very not intensive, not intensive, quite intensive, intensive and very intensive so that it can be said that output desemination has a positive and significant effect on the effectiveness of PBL implementation. The beta desemination coefficient of output of 0.613 means that if the output desemination increases by one unit, the effectiveness of the PBL application will increase by 0.613 units.

R^2 value of 0.568 means that 56.8% of the variation in the effectiveness of PBL is determined by variations in student enthusiasm, case attractiveness, facility availability and output desemination, while the remaining 43.2% is determined by variables outside of this study such as intakes material difficulty level, teacher teaching style, and others.

This multiple regression analysis model has passed the multicollinearity test and heteroscedasticity test. From the results of the multicollinearity test it can be seen that the tolerance value of all the dependent variables is less than 1 and the VIF value of the dependent variable is less than 10, so it can be concluded that the regression model does not contain multicollinearity problems. Furthermore, based on the results of heteroscedasticity test, it can be seen that the asymptot significance of all dependent variables> alpha 0.05 so that it can be concluded that the model does not contain the problem of heteroscedasticity.

The results of the study indicate that student enthusiasm has a positive and significant effect on the effectiveness of PBL implementation. This means that the more enthusiastic students are actively involved in the learning process, the more effective the application of PBL. The enthusiasm of students becomes a very valuable capital to develop students' thinking skills and scientific attitudes. The more enthusiastic the students are, the easier it will be to develop students' thinking skills and scientific attitudes. The development of thinking skills and scientific attitudes is the goal of the application of problem-based learning models.

Output dissemination has a positive and significant effect on the effectiveness of PBL implementation. Ouput desemination relates to the intensity and seriousness of students compiling group work reports and the intensity of students preparing interesting presentations. The more intensive and interesting the way students present the results of group work, the more effective the application of PBL will be. This happens because the application of PBL is directed at increasing the intensity of student involvement in learning activities. The higher the involvement of students in learning activities, the higher the effectiveness of the application of PBL.

The results of this study are in line with the opinion of Kek and Huijser (2011), which explains that PBL is a strong pedagogical approach to teaching critical thinking skills. Elder and Paul (2010), explain that advanced thinking is characterized by the ability to analyze deeply. The results of this study are in line with the results of the study of Nugraha, Suyitno and Susilaningsih (2017: 39-40) which show that the problem-based learning model can empower students' critical thinking skills which ultimately can improve student learning outcomes.

5. Conclusions and Recommendations

The problem-based learning model has succeeded in helping students develop scientific attitudes and critical thinking skills. Students can be actively involved in the learning process and are encouraged to develop critical thinking skills through the dynamics of learning activities. Students can choose the way of presentation for example by using posters, video clips, role playing methods, tabloids, talk shows, news reader models, and variety show models.

Implementation of problem-based learning models needs to be varied with other learning models for example project based learning, inquiry learning and discovery learning models. The results of the implementation of the problem-based learning model showed that there was an increase in the level of thinking skills before and after the implementation of the PBL learning model. Before PBL implementation, the dominant level of thinking skills was understanding (C2), 57.2%, whereas after PBL implementation, the dominant level of thinking skills was analyzing (C4) of 66.1%.

The effectiveness of applying the PBL model is influenced by student enthusiasm, attractiveness of cases and output desemination, but the availability of facilities has no significant effect on the effectiveness of PBL implementation. R^2 value of 0.568 means that 56.8% of the variation in the effectiveness of PBL is determined by variations in student enthusiasm, case attractiveness, facility availability and output desemination, while the remaining 43.2% is determined by variables outside of this study such as intakes material difficulty level, teacher teaching style, and others.

Here are some suggestions that can be conveyed: First, economic subject teachers should be more courageous in designing learning tools that focus on developing higher order thinking skills. Operational verbs in indicators and basic competencies should be dominated by thinking skills at level C4 (analysis), C5 (evaluating), and C6 (creating).

Secondly, economics teachers should be more courageous in carrying out the learning process in a variety of ways and focus on developing high-level thinking skills, especially levels C4, C5, and C6. Implementation of a problem-based learning model needs to be varied with the implementation of other scientific-based learning models, for example project based learning, inquiry learning, and discovery learning. Learning should be packaged in an interesting, contextual, and varied manner, for example with varied presentation methods.

Third, teachers of economic subjects should be more courageous in applying learning design using the Problem Based Learning Learning Model. Thus, students get more opportunities to develop critical thinking skills and scientific attitudes.

Fourth, subject teachers need to continually strive to increase student enthusiasm, the attractiveness of the cases discussed, and the desemination of output from group work. Students need to be given the widest possible opportunity to choose the way of presentation, for example by using posters, video clips, role playing methods, tabloids, talk shows, news reader models, and variety show models. Thus, the teaching and learning process can take place in a very pleasant and scientific atmosphere. The fun and scientific-based learning process will improve students' critical thinking skills and scientific attitudes more optimally.

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