The Implementation of Problem-Based and Jigsaw Model Learning to Improve Basic Programming Learning Outcome

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ABSTRACT

Basic Programming Learning in class X RPL1 on semester 1 has implemented the Problem Based Learning model and run effectively to achieve 90% in KKM percentage. Problems occur when there are changes in students of semester 2 because of the industrial class. This study is aimed to measure the feasibility of the learning model and improve the learning outcomes of Class X RPL1 students on Basic Programming subjects by providing innovative learning models that combine the Problem Based Learning and JIGSAW models. The study was conducted in class X RPL 1 of Turen Vocational High School which has 34 students for three (3) cycles. Each cycle consists of planning, implementing actions, observing, and reflecting. The results which is obtained, the feasibility of learning model in the first cycle, reaches 64%. While on the second cycle it reaches 76%, and third cycle is 92%. The learning outcome in the first cycle of knowledge states that the average score of students is 62.94 with a percentage of completeness of 44.12%. In cycle II, it has increased, the average score of students is 73.52 with a percentage of mastery learning by 70.59%, while in cycle III the average value of students is 79.71 with a percentage of completeness of 91.18%. Based on the results of the study, it is concluded that the implementation of the Problem Based Learning method and the JIGSAW model are able to improve the learning outcomes of Grade X RPL1 of students in the Basic Programming of Turen Vocational High School.

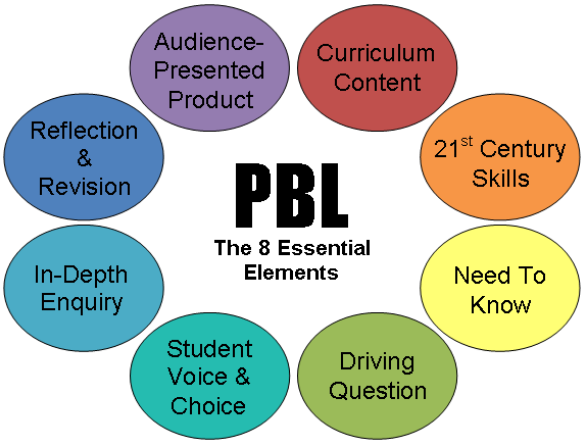
1. Introduction

Problem-based approaches to learning have a long history of advocating experience-based education. Psychological research and theory suggests that by having students learn through the experience of solving problems, they can learn both content and thinking strategies. Problem-based learning (PBL) is an instructional method in which students learn through facilitated problem solving [1][2][3]. Problem-based learning is an important approach to learning, which is based on a tradition of experiential learning, and how students solve problems [4][5]. The problem base learning approach can use game [6], technology [7], and the integration of the learning process[8], with the same goal of training students to be able to solve their problems[9].

Jigsaw-based cooperative learning strategies can be a variety of ways, for example using Google+ to support cooperative learning through social networking services [10]. The Jigsaw model

can be used to build empathy, compassion, and achievement. this is because students learn from the experience they do. So it needs to be designed learning process that will be carried out in class. Jigsaw is a type of special group learning experience where each student must work together with his friends to achieve his individual goals [11]. Before implementing the jigsaw learning model, it is necessary to prepare a mature learning plan that is adjusted to the curriculum, and evaluation of learning. so the results will be maximal [12]. Figure 1. explains that the Implementation of Problem Based Learning has eight important elements that must be considered [13].

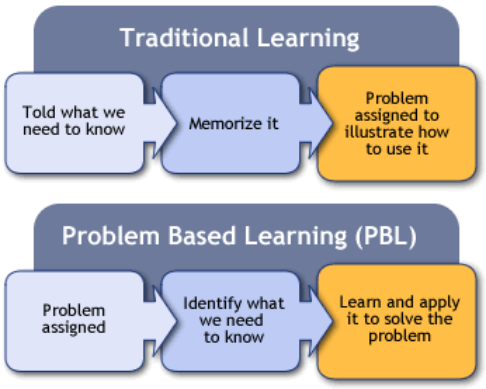
Fig. 1. The eight Problem Based Learning Essential Elements



The experience of thousands of teachers at all grade levels and fields of study, supported by research, confirms that PBL is an effective and fun way to learn - and develop deeper learning competencies needed for success in college, career, and community life. Figure 1 explains that problem based learning has eight essential elements. In another opinion, Larry K. Michaelsen explained that there were four essential elements in the successful implementation of problem based learning; properly formed and managed groups, Student Accountability for Individual and GroupWork, Frequent Immediate Student Feedback, and Assignments That Promote Both Learning and TeamDevelopment [14]

Other research results explain that learning knowledge and facilities contributed to the success of the learning process. However, the internalism typology instrument recommends for the teacher to select and choose appropriate knowledge. Particularly in specific student experience and scaffolding in constructivism through identification and screening system. Another instrument is externalism typology, found that the absorbs of knowledge depends on the developmental age and group compositions, primarily, in first-third grade students [15]. The question now is, why should implement PBL?

Fig. 2. Difference between traditional and PBL



PBL is a student-driven process that uses a bottom up approach to bring the students from a problem to the theory, while classic learning approaches usually go from theory to problems. As

shown in Figure. 2, in the classic learning approaches which are referred to traditional learning approaches in this paper, students learn a new theory, memo-rise it and later some problems or scenarios are assigned in order to illustrate on how to use the learnt theory. In PBL, however, before a theory is introduced, a problem is first assigned, then the theory is introduced and later the students will learn how to apply the theory to solve the given problem [16].

The basic programming learning process in class X RPL1 on semester 1 has implemented the Problem Based Learning model which runs effectively by showing significant results on the achievement of learning outcomes during semester 1, which is 90% and reaching KKM. The achievement of learning outcomes is a benchmark of learning. However, the success of semester 1 cannot be the success benchmark of the learning process of class X RPL1. Turen Vocational High School has Samsung industrial class for RPL major. The implementation of Samsung Class students' selection is performed in the end of semester 1.

The outcome of semester 1 learning and the implementation of psychological tests in the end of the semester determine students who join Samsung Class. Students group who has high grade and pass the psychological test will be placed in Class X RPL2 (Samsung Class) and they who have lower grade and do not pass the psychological test will be placed in Class X RPL1 (Regular Class).

Problems arise in the beginning of semester 2 of class X RPL1. The implementation of Problem-Based Learning model has not been able to provide learning outcome according to the specified KKM standards. It is proven by no student who obtains KD 3.8 and KD 3.9 learning outcome as KKM. The learning process which was carried out was classified as passive because they were less active in asking questions or discussing. The problem is allegedly due to group change of Class X RPL 1 students which was very influential on the learning process. Therefore, there should be learning model innovation which can improve the learning outcome of Class X RPL 1 students on Basic Programming subject.

According to Nawawi he states that planning means compiling steps to solve a problem or the implementation of a job which directed on certain goal achievement. While learning has a nature of planning or designing as the effort to educate students. So, they do not only interact with teachers as the source of learning but also all learning sources which are utilized to reach the desired learning goal [17].

According to Schmidt [18], Savery and Duffy [19], Hendry and Murphy [20], Problem-Based Learning model is based on constructivism learning theory which has understanding characteristics obtained from interactions with problem scenarios and learning environment, problem solving and inquiry processes to create knowledge dissonance that stimulates learning, and knowledge which occur through the process of social negotiation collaboration and evaluation of the existence of a point of view.

The JIGSAW Model is one of active learning types consisting of heterogeneous learning teams of 4-5 members the material is presented by students in form of text and each student is responsible for mastering the learning material section and able to teach the section to other members. JIGSAW model had been developed and tested by Elliot Aronson and his colleagues at the University of Texas, and John Hopkins University in 1978 [21].

The assessment of learning outcome is one of ways to find out the learning outcome obtained by students. This is an evaluation stage of the learning process on a subject. Based on Ministerial Regulation No. 20 Year 2007 on Educational Assessment Standards, which is article 1 paragraph 1, the assessment of student learning outcome at the level of primary and secondary education is carried out based on education assessment standards which are applied nationally. In other words, evaluation tools / techniques can be classified into 2 types, such as tests and non-test [22].

Based on the thoughts that have been described previously, it is expected that the implementation of the Problem-Based Learning (PBL) model combined with the JIGSAW model can improve the students' learning outcome. The scope of problem of this research is: 1. The Learning model which is utilized is Problem-Based Learning model combined with JIGSAW model. 2. The Implementation of learning model is performed on Class X RPL 1 on Semester 2 in Basic Programming subject at Turen Vocational High School. 3. The learning outcome aspects which are measured are realm of knowledge with 80% of total numbers of students X RPL 1 as the targets who obtain the outcome as KKM on Basic Programming subject. 4. The learning outcome which is

obtained is through learning evaluation in form of test. 5. The research is performed from KD 3.10 accompanied with initial learning outcome of KD 3.8 and 3.9 of Basic Programming subject. 6. If 80% of the students have reached the KKM, the class action research cycle is declared as completed.

2. Method

The performed type of research was Classroom Action Research (CAR) or Classroom Action Research (CAR). The research is a collaborative study because of the collaboration between researchers and teachers of the Basic Programming Class X RPL1 at Turen Vocational High School. This research is a practical research which is aimed to improve weaknesses of classroom learning by taking actions in order to improve or develop the quality of the learning process and outcome, overcome learning problems, and grow academic culture (Arikunto, Suhardjono, and Supardi, 2009). The planned action is in the form of the implementation of Problem-Based Learning (PBL) and the JIGSAW model to improve Basic Programming learning outcome of students of Class X RPL 1 at Turen Vocational High School. The data analysis techniques which are used in this study are: Qualitative data analysis. Qualitative data analysis is performed based on the following order: Data reduction involves selecting data through a description or a brief description and grouping the data into qualifications that have been determined. Conclusions are drawn based on the results of all data that has been obtained from data reduction. Concluding the increase or change that occurred is summarized in the reflection of cycle I, cycle II, and the final conclusion in the end of cycle III.

Quantitative data analysis is used to provide an overview of improving understanding of Basic Programming material. The analysis result will be presented in form of percentage. In this study, the analysis of quantitative data is obtained from the analysis of the result of the cycle I to III which is determined as follows:

Data Analysis of Result of Learnin Model Implementation of Problem Based Learning and JIGSAW Model. The success rate of applying the Problem Based Learning model and the JIGSAW Model were analyzed using the formula:

$$Percentage\ of\ Model\ Workability = \frac{score\ obtained}{maximum\ number\ of\ scores}\ x\ 100\% \quad (1)$$

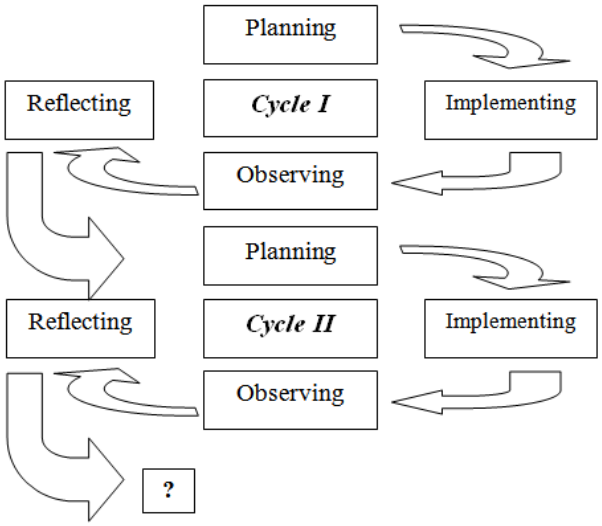
Analysis of Students' Learning Outcomes Data

In addition to be reviewed from the implementation of the Problem-Based Learning and JIGSAW Model, the success level of an action is determined by students' learning outcome. It is observed and measured by the following formula:

$$Percentage\ of\ overall\ learning\ outcomes = \frac{\sum the\ total\ score\ obtained\ by\ all\ students}{\sum maximum\ score}\ x\ 100\% \quad (2)$$

The classroom action research model which was utilized in this study was the spiral model. In the spiral model, the research stages are divided into four stages, which were the planning, action, observation, and reflection stages, and so on until the expected improvement or development is achieved. The design of the class action research round was quoted from Arikunto and explained as follows figure 3.

Fig. 3. Classroom Action Research (CAR design)



This study was conducted within two cycles. Each cycle consists of four stages: (1) planning, (2) implementing, (3) observing, and (4) reflecting [22]. The fourth stage is the research cycle. The each stage was presented in Figure. 3. The study was conducted in several cycles which will end when the outcome has been relevant with the research success indicator. In detail, the description of the activities carried out in the classroom action research are as follows:

Cycle I

Action Planning

After finding the problems that exist at school through observation of learning activities in the beginning of semester 2 as found in Basic Competence of 3.8 (KD 3.8) and Basic Competence of 3.9 (KD 3.9), the initial action plan in the classroom action research process could be determined.

The planning activities covered the preparation of the Learning Implementation Plan (RPP), learning materials, observation sheets, test questions and answers compiling to measure knowledge, behavioral observation sheets, and camera for documentation.

Action Implementation

The activities which are performed on the action implementation stage is the planning implementation which has been organized by previous researches during the stage. The teachers performed the learning stage as the Lesson Plan which is organized using Problem-Based Learning and the JIGSAW model. While the observer (colleague) would observe the learning activities. The actions which were taken are flexible and open to classroom change. These changes were noted in the observation sheet.

Observation

During the implementation of the action, record in accordance with the observation sheet was performed. Observations were made to see the implementation of the learning process which was relevant with the stages of the application of the Problem-Based Learning model and the JIGSAW model that would improve students' learning outcomes in Basic Programming Class X RPL1 subject at Turen Vocational High School. Some matters which were observed during the observation were the implementation of the stages of the Problem-Based Learning model and the JIGSAW model which included: students' activity, group learning, class presentations, and individual test assessments.

Reflection

Reflection was performed after actions and observations were made. In reflection, the analysis was carried out whether the learning process was in accordance with the stages of the Problem Based Learning model and JIGSAW model or not, how much the success and level of success of the Problem-Based Learning model and JIGSAW model were, and the improvement of learning outcomes of Class X RPL1 Basic Network subject at Turen Vocational High School If it has not been relevant as expected, learning improvement plan which includes: lesson plans, learning media, field notes, and learning implementation for the next cycle were made.

Cycle II

Of the result of reflection on cycle I, the researcher and observer revised the learning process to make the learning process in the second cycle better. Cycle II was carried out by following the stages of cycle I, which meant that cycle II was prepared based on the result of cycle I reflection. Cycle II was intended to be the improvement or perfecting of the implementation of learning in cycle I in order to achieve predetermined indicators of success. The process which was carried out started from the action planning, action implementation, observation, and reflection, was broadly similar to cycle I.

Cycle III

Of the results of cycle II reflection, the researcher and observer revised the learning processto make the learning process in cycle III better. Cycle III was carried out by following the stages in cycle II. In other words, cycle III was prepared based on the result of reflection obtained from cycle II. Cycle III was intended to be the improvement or refinement of the learning implementation in cycle II in order to achieve the indicators of success that have been set. The process which was carried out started from action planning, action implementation, observation, and reflection was broadly similar to cycle II.

This class action research is considered as successful if the percentage of successful action has reached 80% or in a very good predicate. While students' learning outcome is considered as successful if the percentage of students who have completed class study has reached the specified criteria or equal to 80%.

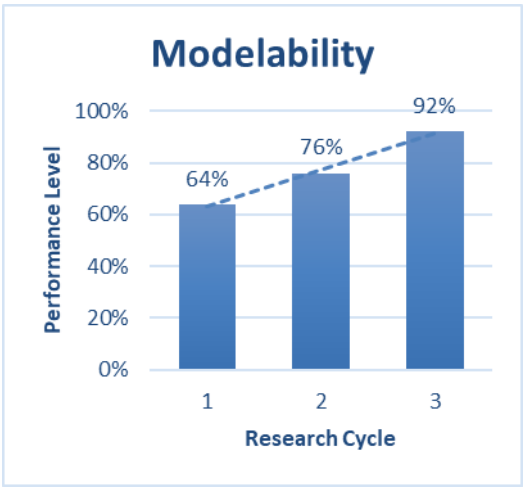
3. Results and Discussion

The research which is performed obtains a significant result with the analysis result as follows:

1) The Implementation of Problem-Based Learning and JIGSAW Models

Data of the learning model implementation is obtained through observation while the learning activities takes place. This observation is performed by both tutor and observer. The details of students' learning activity data on cycle I, cycle II, and cycle III can be fully seen in the appendix.

Fig. 4. Comparative Graph of Learning Model Implementation



It has been found that the implementation of the Problem-Based Learning model and the JIGSAW Model in the learning process of Basic Programming Class X RPL 1 at Turen Vocational School experiences a significant increase. Literacy in the first cycle reaches 64%, in other words, the qualification of the learning model based on Arikunto & West Java (2014) is less. In cycle II, the level of performance reaches 76%, in other words, the qualification is quite good. In cycle III, a significant change is shown by the result of the learning model implementation which reaches 92%, in other words, the implementation was said to be in very good qualifications.

2) Students' Learning Outcomes on the Implementation of Problem-Based Learning and JIGSAW Model

Students' Learning Outcomes on the Implementation of Problem-Based Learning and JIGSAW The model in this study can be seen in table 1-4

Table 1. Descriptive statistics of the initial data

Initial Data	
Mean	42.35294118
Standard Error	1.937472835
Median	45
Mode	45
Standard Deviation	11.2973109
Sample Variance	127.6292335
Kurtosis	-0.389077526
Skewness	-0.54536712
Range	45
Minimum	15
Maximum	60
Sum	1440
Count	34

Table 2. Descriptive statistics of Cycle I

Cycle II	
Mean	62.94117647
Standard Error	2.205139507
Median	65
Mode	50
Standard Deviation	12.85806238
Sample Variance	165.3297683
Kurtosis	-1.349929805
Skewness	-0.113671116
Range	45
Minimum	40
Maximum	85
Sum	2140
Count	34

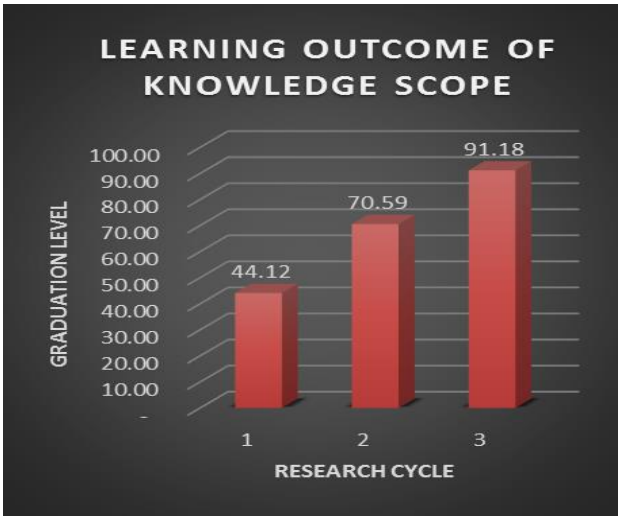
Table 3. Descriptive statistics of Cycle II

Cycle II	
Mean	62.94117647
Standard Error	2.205139507
Median	65
Mode	50
Standard Deviation	12.85806238
Sample Variance	165.3297683
Kurtosis	-1.349929805
Skewness	-0.113671116
Range	45
Minimum	40
Maximum	85
Sum	2140
Count	34

Table 4. Descriptive statistics of Cycle III

Cycle III	
Mean	79.70588235
Standard Error	1.283051045
Median	80
Mode	80
Standard Deviation	7.481408925
Sample Variance	55.9714795
Kurtosis	-0.51188612
Skewness	-0.528180278
Range	25
Minimum	65
Maximum	90
Sum	2710
Count	34

Table 1. Students' Learning Outcome Graph



3) The Implementation of Problem-Based Learning and JIGSAW Model

The implementation result of Problem-Based Learning and JIGSAW model on the learning process of Basic Programming of Class X RPL 1 at Turen Vocational High School experiences significant improvement. The implementation on Cycle I reaches 64%, so the qualification of learning model implementation based on Arikunto & Jabar (2014) is less. On Cycle II, the implementation level reaches 76%, so it is categorized as good qualification. On cycle III, significant change is shown with the implementation result of learning model which reaches 92%, so it can be said as very good qualification.

4) Students' Learning Outcome on the Implementation of Problem-Based Learning and JIGSAW Model

The study was conducted based on students' learning outcome in the beginning of semester 2 that does not achieve KKM. After Class Action Research was performed, there was students' learning outcome change. On Cycle I, the mean of students' learning outcome reached 42.35 with 44.12% as the graduation level. It is mentioned in detail that 15 students are relevant with KKM and the other 19 students are not. Therefore, the qualification of students' learning outcome is categorized as less (Arikunto, 2014).

The obstacle of cycle I is the lack of apperception and motivation towards students so that learning is not optimal. Improvements were made in the second cycle where preliminary activities were played on the video for a real picture of the application of the theory. This is proven to improve student learning outcomes, namely the percentage of students who reach KKM as much as 70.59%. In Cycle II the average value which was obtained by students reached 73.53 or 24 students.

The study was continued on cycle III because in cycle II it had not reached the 80% target. The reflection of cycle II is utilized as a reference of cycle III, in which not only video playing but also ice breaking were performed on the preliminary activities. The learning uses syntax that has been made by applying Problem-Based Learning model which is combined with the JIGSAW Model.

This innovation is able to improve student learning outcome and provide success in classroom action research which is conducted because the student graduation rate reaches 91.18% or 31 students are declared to have met the KKM that has been set. Therefore, in the third cycle, the success rate is stated in the excellent category.

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4. Conclusion

The implementation of Problem-Based Learning and JIGSAW learning model in Basic Programming subject for class X RPL1 at Turen Vocational School reached 92%. The increasing students' learning outcome which was obtained by applying the Problem-Based Learning and JIGSAW Model in Basic Programming subject of class X RPL1 at Turen Vocational High School reached 91.18%. The results shows that the implementation of the Problem-Based Learning and the JIGSAW Model is able to improve students' learning outcome in Basic Programming class X RPL1 at Turen Vocational High School. It can be a reference of using learning models which are relevant with other subject by taking the characteristics of students and subject into account. In addition, it is expected to more deeply prepare the preliminary activities.

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