

Effectiveness of Collaborative Problem Based Learning Model of Learning Computer Network Courses

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Abstract—This study is based on the need analysis that finds the phenomenon that conventional learning model has not been effective enough in developing students learning potential optimally. This study aims to know the effectiveness and difference learning result of using Collaborative-Problem Based Learning (CPBL) model on computer network subjects compared with conventional learning method. The subject of this research is the 4th semester students of Information Technology Study Program of Universitas Dharma Indonesia as much as 42 students. Students are divided into groups of controls and experimental groups. This research uses Quasi-Experiment approach, with non-equivalent control group design. The results showed that learning model collaborative-problem based learning in computer network course is effective in imparting learning skill and more motivated in learning, more confident and able to solve problems given, responsible and able to work together in teams, there is difference learning result of learning model of Collaborative-Problem Based Learning with conventional learning methods on cognitive and psychomotor aspects.

Keywords—*problem based learning; collaborative learning; computer network; effectiveness*

I. INTRODUCTION

Technological developments and advancements enable automation in almost all fields. New technologies and approaches that combine the physical, digital and biological worlds will fundamentally change human life patterns and interactions (1). The Industrial Age 4.0 as part of the technological revolution will change the way people engage in scale, scope, complexity and transformation from previous life experiences. Various opportunities and challenges will arise as a result of the Industrial Revolution 4.0 (2), the paradigm in 21st century learning is a constructivist paradigm. who believe that knowledge about something is a construction (formed by a subject who is in the process) understanding something [1]. The paradigm emphasizes that in the 21st century learning process lecturers are no longer as learning resources, but as facilitators to teach students with the pedagogical abilities of lecturers who have.

The learning model continues to experience development and change over time. Conventional learning models are now starting to be abandoned to change to a more modern model that is adapted to the classroom situation and learning objectives to be achieved. In line with the constructivism approach in learning, there are several learning models that are feasible to be applied in 21st century learning. Learning models that are quite popular are implemented and developed are learning models of collaborative learning and problem based learning. The learning model that is currently getting a lot of response is a collaborative learning model [2] Collaboration has become a 21st century learning trend. The need for people to think and work together on issues of critical concern has increased, shifting the emphasis from individual efforts to group work [3].

The learning model innovation that is now becoming a lot of concern is Problem Based Learning (PBL). PBL is learning that is designed so that students do more autonomous learning processes. Teachers function more as facilitators. However, learning design is needed which output gets real results. Problem Based Learning is an innovative learning model that emphasizes contextual learning through complex activities. Presents a variety of authentic and meaningful problematic situations to students, which can serve as a springboard for investigation and investigation [4]. Learning focus is designed on the concepts and core principles of a study discipline, involving students in investigating problem solving and other meaningful tasks, giving students the opportunity to work autonomously to build student knowledge and culminate in producing real products. The role of the lecturer in learning using the Problem Based Learning model is as a facilitator and guide [5].

The application of Problem Based Learning in professional learning and training has been extensively studied in the last 20 years [6–12]. The development of Problem Based Learning (PBL) models is important to be used to overcome the problem of low student achievement. In collaborative learning, it is applied a learning strategy with a number of students as group members and each member of the group must cooperate actively to achieve the goals that have been determined in an

activity with a certain structure resulting in a meaningful learning process [13]. Collaborative Problem Based Learning (CPBL) has been developed to improve student activity and learning outcomes. The CPBL model has been specially designed to increase the self-confidence students in computer network problems solving. CPBL model has 6 phases, namely: (1) formulation of learning outcomes; (2) identification of problem; (3) divide students into Jigsaw groups; (4) scaffolding collaborative leaning; (5) Presentation of The best solution and (6) evaluation. The CPBL model and learning tools developed by researchers have fill the needs and demands of the curriculum in Indonesia and 21st Century skills. Therefore, it is hoped that the implementation of the CPBL model that have been developed are expected to contribute to improving student's quality. Implementation of CPBL shown in figure 1.



Fig. 1. Implementation of CPBL.

Based on the problem and general description about " Effectiveness of collaborative problem based learning model of learning computer network courses"

II. METHOD

This research uses descriptive qualitative method which aims to describe or describe the actual conditions of a situation. Qualitative approach is used to get a clear picture of the process of implementing learning that is applied in the classroom and student learning outcomes as a result of the application of collaborative-problem-based learning models in the learning of computer networks. This research is a Classroom Action Research, as long as the learning process takes place every event that occurs is observed by researchers and observers to see the effectiveness of the learning model applied in improving learning activities, learning outcomes, and student responses, especially in computer network courses.

The procedures and steps in this classroom action research follow the basic principles of classroom action research. This study consisted of two cycles, namely cycle I and cycle II. The subjects in this study were fourth semester students of Informatics Engineering Study Program, Dharmas Indonesia University, in computer networking courses totaling 42 students, with 25 female students and 17 male students. The instruments used are: Observation Sheets, Tests conducted to measure student learning outcomes namely cognitive aspects in cycles I and II, Questionnaire, Interviews, Field Notes, Documentation.

Assessment of cognitive aspects of learning outcomes is done by steps: Provide test posts; Assess student test results; Comparing students' cognitive learning outcomes in cycle I

with cycle II. To find out the improvement of cognitive aspects; Describe to explain the improvement in learning outcomes of cognitive aspects of cycle I and cycle II. Learning Outcomes Affective Aspects are carried out by steps: Provide an assessment for each aspect observed; Looking for the average affective aspects observed in each cycle. Furthermore, comparing the percentage of affective aspects in cycle I to cycle II; Describe the improvement of learning outcomes of the affective aspects of cycle I and cycle II. For learning outcomes of psychomotor aspects, data analysis is carried out by steps: Provide an assessment of each psychomotor aspect; Look for the average psychomotor aspects observed in each cycle; Score; Comparing psychomotor aspects in cycle I with cycle II;

III. RESULTS AND DISCUSSION

During the observation of the first cycle of the implementation of Collaborative-problem based learning, it was found that all aspects listed in the observation sheet of learning stages were observed during the learning process. Some aspects of the learning stage are still less than optimal by the lecturer, as at the stage of orienting students to the problem of lecturers in explaining the learning objectives are still not optimal. At this stage, the lecturer only repeats and reminds students of the previous material. In addition, the lecturer also did not explain the detailed and comprehensive problem-solving and jigsaw cooperative learning procedures to students, so that many students still did not understand the steps that must be done in problem-based learning and many students did not understand the tasks to be done. especially in making problem formulations and hypotheses in making group reports. Besides that, what appears in the first cycle is student cooperation that is not optimal. This is because students are not used to doing cooperative learning methods.

In the cycle II, it was found that the aspects listed in the observation sheet of jigsaw type problem-based learning and cooperative learning were carried out by the lecturer, because in the second cycle was a refinement of cycle I by observing the results of reflection in cycle I. Therefore, learning on cycle II is better than cycle I. In the first cycle the problems given are related to wireless LAN policy and in cycle II the problems are related to the wireless network. As for cooperative learning students discuss materials that have been determined by lecturers about wireless LAN and wireless networks.

The Collaborative problem based learning model in the second cycle have increased, students have begun to be able to share tasks with their group friends so that students have their own responsibilities. The purpose of the application of collaborative-problem based learning is to help students improve student learning activities. Through problem solving activities, in the end students are accustomed to solving problems faced in everyday life so that students have responsibility for themselves and later responsibility to the community Student learning activities as a whole have increased in each cycle. This increase occurs because of the factors that include: (1) a more detailed explanation from the researcher regarding the procedure for implementing collaborative-problem-based learning models, (2) more students actively participating in learning activities, (3) students already understand a problems and can formulate their

own hypotheses, (4) students are happy and accustomed to discussing, (5) students have understood their responsibilities, (6) students have begun to be trained in case solving activities, (7) students have begun to express opinions through questions, (8) students have started to be happy with this learning model so that students want to answer a problem, (9) there is a hand out that helps students, as well as motivation and assistance from researchers about concluding a problem. It can be seen that all aspects of the criteria for learning activities of student's experience sufficient improvement.

Student learning activities are continuously related to learning outcomes. Student learning activities are a series of activities carried out by students which generally consist of students' attention in participating in learning, notes of assignments, seriousness in learning participation, level of mistakes made, and students' responses in responding to the learning carried out. Improved learning outcomes shown in table 1

TABLE I. ASSESSMENT OF STUDENT LEARNING ACTIVITIES

Indicator	Cycle I	Cycle II	Cycle Development
Gather information	58.60	71.49	12.89
Make observations	60.56	73.44	12.88
Identification of problems	59.76	65.66	5.90
Analyze the problem	59.36	72.42	13.06
Solution Search Discussion	56.88	68.50	11.62
Students' thinking skills	60.40	73.69	13.29
Students' skills to argue	54.50	66.49	11.99
Student skills answer	57.70	70.39	12.69
Make the problem solving	59.50	72.59	13.09
Average Percentage	58.58	70.60	12.03

In this study, learning outcomes observed consisted of three aspects, cognitive, affective and psychomotor. Student learning outcomes in cognitive aspects are used to measure students' increased understanding of the material. These results are obtained by giving test questions to students before and after doing learning using a collaborative problem-based learning model. Tests conducted in the form of multiple choice tests that are valid and reliable. The cognitive aspects of learning outcomes are measured by the students' post-test scores at the end of each cycle. The results of the post-test at the end of each cycle are made average and seen the number of students who are complete and not yet completed, then compared each cycle to find out the improvement of cognitive aspects of learning outcomes. The level of completeness in the second cycle has increased by 28.54%.

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TABLE II. STUDENT AFFECTIVE LEARNING OUTCOMES

Indicator	Cycle I	Cycle II	Cycle Development
Attitude	85.6	94.2	8.6
Interest	84.2	95.5	11.3
Self Concept	78.4	88.6	10.2
Tolerance	76.8	89.6	12.8
Confidence	80.5	90.5	10.73
	81.1	91.68	10.72

Psychomotor aspects of learning outcomes obtained from the results of the observation of the implementation of the preparation of the paper given. Based on the case given, students will make observations to the business world and make reports in the form of papers and present them in the presence of assessors and friends. The assessment category and learning outcomes by using collaborative-problem based learning models shown in in Table 3.

TABLE III. STUDENT PSICOMOTORIC LEARNING OUTCOMES

Indicator	Cycle I	Cycle II	Cycle Development
Planning	80.6	94.5	13.9
Data Collection Process	82.4	95.3	12.9
Data Processing / Reports	74.56	85.4	10.84
Presentation	80	95.2	15.2
Average	79.39	92.6	13.21

Overall student learning outcomes can be improved through the application of collaborative-problem based learning models in computer network learning. It can be seen that the three aspects of learning outcomes have increased significantly. Factors that cause an increase in student learning outcomes on cognitive aspects include: (1) students are already getting used to the collaborative-problem based learning model of computer networks (2) researchers are more motivating and accompanying students, and (3) researchers are always reminded of there is a test post at the end of the meeting every time you start the lesson.

Increased learning outcomes affective aspects of increasing student learning outcomes are caused by factors such as: (1) students are happy with collaborative-problem based learning models, (2) students begin to enjoy computer network material so that students are active in learning. While the student learning outcomes of psychomotor aspects also increased. The influencing factors include: (1) students begin to be aware of responsibility in completing tasks, (2) material in cycle II about wireless LAN is very close to everyday life so students are more understanding. Basically the three learning outcomes above cannot stand alone, but are related to each other. A person who changes his cognitive level actually at a certain level has also experienced changes in his attitude and behavior. So that each group member can improve their learning outcomes, then during the learning process takes place all group members must be present, so that they can gain knowledge when learning takes place because learning outcomes are the results that students have obtained from experiences and exercises that followed during learning.

IV. CONCLUSION

The conclusion of this study is the academic achievement and creativity of students in general has increased. Thus, the CPBL model effectively improves capabilities. Based on the results achieved, suggestions can be made as follows. (1) CPBL can be used as an alternative learning model by lecturers to improve learning skills. (2) the use of the CPBL model is applied to higher learning. (3) the CPBL model is an independent learning model. (4) CPBL implementation in learning receives good responses from students.

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