Study Effect of Computer-Assisted Cooperative Learning Methods on a Pilot Course For Engineering Economy

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Keywords: Computer-Assisted, Cooperative Learning, Engineering Economy.

Abstract: Cooperative learning is a teaching-learning strategy that emphasizes joint attitudes or behaviors in working or helping among others in a regular group structure of cooperation, consisting of two or more persons. This objective of the research is Study Effect of Computer-Assisted Cooperative Learning Methods on A Pilot Course for Engineering Economy. This research is started by changing the previous method of learning theory to computer-based. Then, at the end of the semester students are asked to fill in questioners to evaluate the implementation of the lecture. The results show that 93% of students stated strongly agree and agree that the learning process computer-based technical techniques currently help increase interest in learning. In conclusion, the application of the computer-based cooperative method to technical economics course can increase student participation of lecture and also show the increased participation of the student due to the dynamic learning situation when compared with previous learning. From the assessment, the result shows the application of this method can increase a student's test score.

1 INTRODUCTION

The learning process is one of the implementations of the development of student knowledge given in the field of education. Education is one of the national development fields that aims to improve human quality. To achieve these goals, education must be carried out systematically and based on science and technology. The approach of Student-Centered Learning (SCL) is a learning model that places students as the center of the learning process (Dewayani, 2006; Had, 2017; Kurdish, 2009). In applying the concept of Student-Centered Learning, students are expected to be active and independent participants in the learning process, who are responsible and initiative to recognize their learning needs, find information sources to be able to answer their needs, build and present their knowledge based on the needs and sources they find (Marioara, 2015; Postareff et.al., 2018; Tyabaev et.al., 2015).

The Engineering Economics course is one of the compulsory subjects in the Agricultural Engineering Study Program in the group of Skills and Skills Ability (MKK) courses. This course weights 3 credits without practicum. This topic studies the understanding and scope of technical economics, the concept of time value of money, compound interest, equivalence, *Present Worth* analysis, *Cash Flow* analysis, *rate of return* analysis, analysis *future worth*, *payback period*, NPV, B / C ratio, *sensitivity*, IRR, economic life, depreciation, analysis of the cost of agricultural equipment and machinery, analysis *break even point*. This course is downstream of a business analysis plan so that it can expect the value of the benefits received. Engineering economics course is one of the fields of science to predict profits, length of time and amount obtained in doing the planning business. Good economic analysis in business planning will result in value benefits that are like and more efficient and effective.

To obtain learning outcomes according to what is expected, the lecturer of this course has teaching materials such as power points and teaching materials. The learning model that has been applied to this course is a conventional learning model or what is known as Teacher Center Learning (TCL) which is carried out by explaining the theory, providing examples of problems and independent assignments. The assessment carried out in measuring student learning outcomes that have been applied is based on UAS and UTS scores 40%, UAS 40%, Quiz 10%, assignments 10%. In even semester 2016/2017 for 2 (two) different classes (grades A, B, and C)

shows that there are students who fail or who get D and E. However, the percentage the number of students who get A as the highest score is 23% of the total students, and the A-score is 31% of the total students of class A, B and C as many as 120 people. These results illustrate that the timber production process has been running well but not optimal. It can be inferred by the presence of D and E values of 3% each.

Besides that, the current learning system is not perfect because the teaching system is still teaching learning and students are not equipped with the ability to make computer application programs to facilitate the completion of cases in the field of Agricultural Engineering. With the expectation that if the learning system into a learning center teaching (cooperative method) and computer-based technology created teaching, students are motivated to follow this course. Moreover, also can increase student's final grades. The purpose of this study is to study the effect of computer-assisted cooperative learning methods on a pilot course of engineering economy.

2 METHODOLOGY

Based on the problems found in the previous teaching system, this study applies a cooperative method with computer-based teaching technology. As previously informed, this lecture is not equipped with practicum, so students do not understand the material presented. For this reason, in this research activity, students were given direct assistance in a computer laboratory. The material presented uses a computer program (software) supporting this subject.

2.1 Methodology or Output Achievement Strategies

Based on the problems found in the previous teaching system, this study applies cooperative methods to computer-based teaching technology. As previously informed, this lecture is not equipped with practicum, so students do not understand the material presented. For this reason, in this research activity, students were given direct assistance in a computer laboratory. The material presented uses a computer program (software) supporting this subject. The expected outcome of the improvement and development of learning methods and student assessments is the new RPKPS and Classroom Action Research (PTK) articles that will be sent as one of the articles in an international seminar that will be held by LP3M. To

achieve these outcomes, a methodology or strategy for achieving the output is needed.

2.2 Learning Plan

Relevance shows the existence of teaching material relations with the needs and conditions of students. Student motivation will be maintained if they consider what is learned is useful. One strategy to show the relevance of lectures is by telling students what they can do after learning lecture material. It means having to explain learning outcomes or by explaining the benefits of knowledge or skills to be learned and how it can be applied in later work. Teaching materials are written in the form of RPS / RPKPS. In the RPS / RPKPS Economics subjects, Previous techniques have explained the learning outcomes of this course. However, the RPS / RPKPS needs to be developed so that it is by the learning method that will be developed, namely the learning method with the SCL approach.

2.3 Development of Learning Methods

TCL learning models that have been implemented so far will be converted into learning models Student Centre Learning (SCL). This is done to support efforts to realize the expected competencies. SCL learning model, currently proposed to be a learning model that should be used because it has several advantages. They are (1) students or students will be able to feel that learning is their own because students are given wide opportunities to participate; (2) students have strong motivation to participate in learning activities; (3) the growth of a democratic atmosphere in learning so that there will be dialogue and discussion to learn from each other - to teach among students; and (4) can add insight into the mind and knowledge for lecturers or educators because something experienced and delivered by students may not be known before by the lecturer (Kurdish, 2009; Postareff et.al., 2018; Sudjana, 2015). The advantages of the SCL learning model will be able to support efforts towards effective and efficient learning.

The learning system that will be applied is centred on students or SCL using methods cooperative learning. Cooperative learning is a teaching and learning strategy that emphasizes shared attitudes or behaviours in work or helps among others in the structure of regular cooperation in groups, consisting of two or more people (Munir et.al., 2018). This model is based on cognitive learning theory and social learning theory. The steps of learning

according to cooperative learning are divided into several stages with the sequence of indicators, namely: conveying goals and motivating students, presenting information, organizing students into learning groups, guiding groups learning, evaluating, and giving awards. For classroom management according to the cooperative learning model, it is translated into grouping, cooperation, and class management. In the cooperative learning model, there are three evaluation models, namely: competition evaluation model, individual evaluation, and cooperative learning evaluation (Tisha et.al., 2016; Saborit et.at., 2016; Navarro-Pablo et.al., 2015; Slavin, 2015).

By applying this element means coordinating student activities in achieving goals, then the things we can build in the teaching and learning process are as follows: 1) know and trust each other, 2) be able to communicate accurately and not ambitiously, 3) accept and mutual support and 4) able to resolve conflicts constructively.

3 RESULT AND DISCUSSION

3.1 Lecture Situation Analysis

The study was carried out on technical economics subjects consisting of 3 parallel classes including Class A, Class B, Class C with the number of students each class respectively as follows; 41 people, 35 people, and 28 people. Figures 1 and 2 below show the atmosphere of computer-based engineering learning systems. In this lecture students get material including: NPV, B/C Ratio, IRR, Economic Age, Depreciation, Analysis of the cost of agricultural equipment and machinery, BEP Analysis, Analysis of the cost of agricultural equipment and machinery and BEP using computers and Analysis of NPV, IRR, B/C ratio BEP using computers for agricultural processing cases. Lectures are held at the computer laboratory of the Department of Agricultural Engineering, Andalas University, Padang. This labor can accommodate 40 students for one lecture.

In the previous year, the learning method used was teaching center learning. With this method, there are several disadvantages, namely that the lecturer teaches in front of the class and students complete the problems using a calculator. Calculations with a calculator (manually) require a long time and require a try and error in the solution. Therefore, lectures become less effective, so that in this study, students have used computers to solve all cases related to agricultural techniques using computers. After being given the material, students are given application questions related to the analysis of the cost of agricultural equipment and machinery. They complete the task directly in labor. Assignments are given in two types, namely personal and group assignments.

3.2 Questionnaire Data Analysis

To evaluate the improvement of the learning, the study was conducted to see the effect of changes in learning methods carried out on student admission. The questionnaire contains ten questions that are easily understood by respondents. A survey was conducted to students at the end of the lecture. Table 1 is a list of items contained in the questionnaire.

Table 1: List of questionnaire questions

| No	Question
1	Learning using media (computer) is more fun than just lecturing.
2	I am better able to follow the learning well about what the lecturer explained when using the media compared to lectures alone.
3	I feel bored quickly when I follow the learning that only records and listens without any direct interaction
4	Learning with conventional methods (lectures) makes me bored quickly and tends to prefer to talk with friends rather than pay attention to the material presented
5	Learning process of Computer-Based Economics currently helping to increase interest in learning
6	Lecturers currently have used interactive learning media
7	Economics of Engineering Lessons Computer-based on material at this time is not boring.
8	Do you think that Computer-Based Economics Engineering Students become easier to understand
9	Current learning media are by the applicable curriculum
10	After lecturing, students have been able to analyze the economic tools and machinery of agriculture quickly and accurately

From the results of questionnaires that have been distributed to students after lectures were conducted, it is found that 52% strongly agree while 42% agreed that learning using media (computer) was more fun than just lecturing. However, there are still 3% students who feel learning to use a computer is not fun.
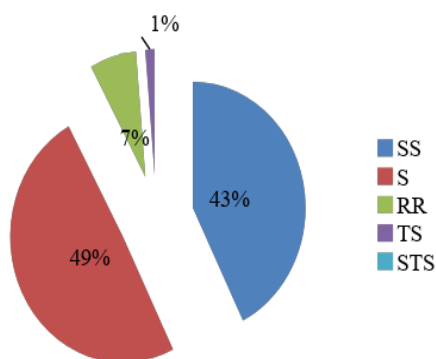
SS = strongly agree, S = agree, RR = hesitation, TS = disagree, STS = strongly disagree

Figure 1: Percentage of Student Satisfaction Levels on Learning Methods

Fig. 1 shows that students are better able to learn well about what the lecturer explained when using the media compared to lectures alone. This can be proven in the percentage of students who strongly agree at 43% and students who agree 49%. However, there are still as many as 1% students who cannot follow the learning well about what the lecturer explained when using the media compared to lectures alone.
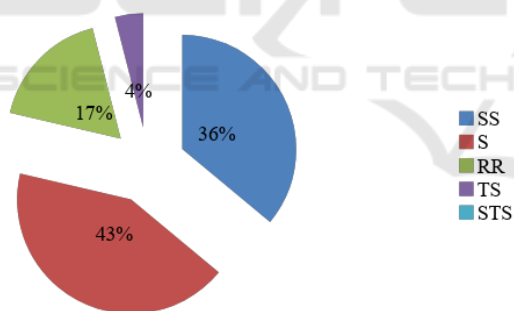
SS = strongly agree, S = agree, RR = hesitation, TS = disagree, STS = strongly disagree

Figure 2: Percentage of Student Bored Level on the Learning Without Interaction Method

Based on the data analysis that has been done, it turns out that students easily feel bored when they only record and listens to the lecturer without any direct interaction. This is apparent from the result, where 36% of students strongly agree, and 43% agree with the statement; only 4% of students do not agree with the statement. The result means that the number of students who like the learning methods is nine times more than those who do not..
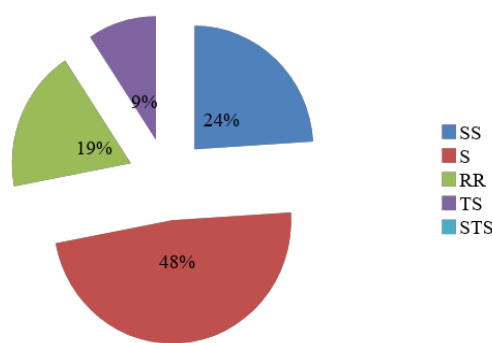
SS = strongly agree, S = agree, RR = hesitation, TS = disagree, STS = strongly disagree

Figure 3: Percentage of Student Bored Levels on Learning with Conventional Methods

The picture shows that 24% strongly agree and 48% agree to the statement that learning using conventional methods (lectures) makes students feel bored. They prefer to talk with friends rather than pay attention to the material presented by the lecturer. However, 9% of the students prefer conventional methods rather than discuss with friends.
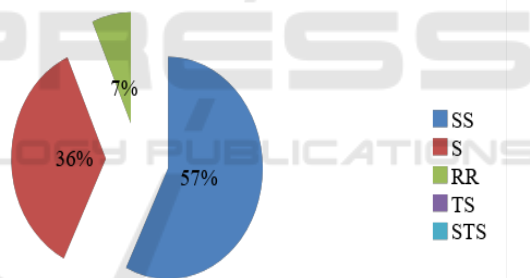
SS = strongly agree, S = agree, RR = hesitation, TS = disagree, STS = strongly disagree

Figure 4: Percentage of Student Satisfaction Levels on Learning Process of Computer-Based Economics

Based on data analysis, it can be stated that the current learning process of Computer-Based Engineering Economics can help increase learning interest. This can be proven in the percentage of students who strongly approve and approve it, respectively by 36% and 57%, although in reality there are also 7% of students who feel that they are still not interested in this learning method. In short, students who strongly agree that this learning method can help increase interest in learning is 8 times greater in number than students those who state that this learning method cannot help increase learning interest.
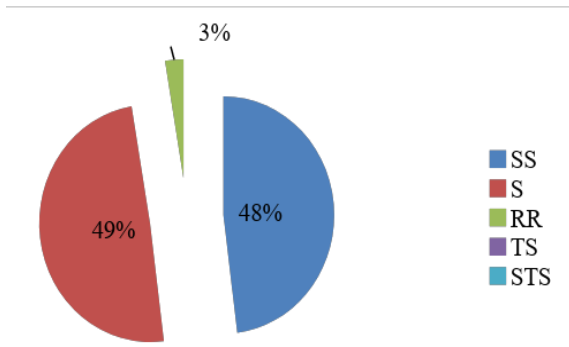
SS = strongly agree, S = agree, RR = hesitation, TS = disagree, STS = strongly disagree

Figure 5: Percentage of Student Satisfaction Levels on Interactive Learning Media

As much as 48% of students strongly agree and 49% of students agree that lecturers currently use interactive learning media. However, there are also 3% of students who state that this learning method is not interactive.
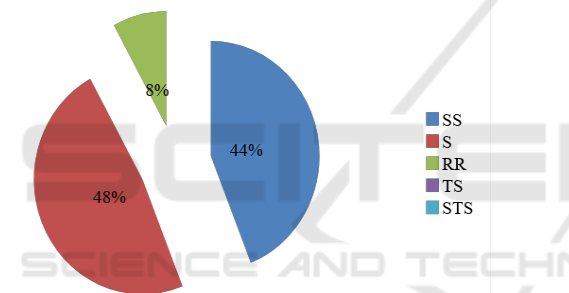
SS = strongly agree, S = agree, RR = hesitation, TS = disagree, STS = strongly disagree

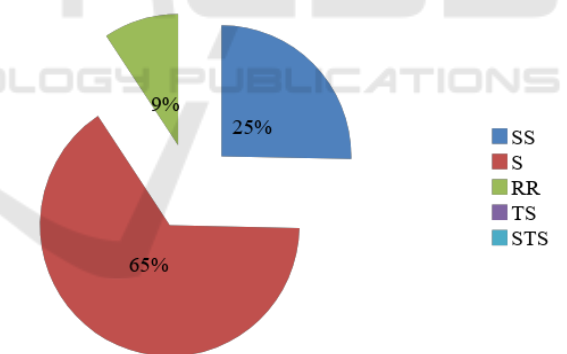Figure 6: Percentage of Student Satisfaction Levels on Computer-based Economics of Engineering

Figure 6 shows that many students feel computer-based economic engineering class today is not boring. This is evidenced from the percentage of students who highly approve (44%) and approve (48%). When compared with the percentage of students who feel bored with this method as much as 8%, the number of students who feel not bored is six times more than students who feel bored..
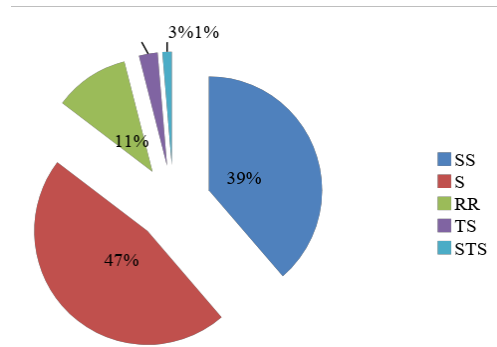
SS = strongly agree, S = agree, RR = hesitation, TS = disagree, STS = strongly disagree

Figure 7: Percentage of Student Understanding Level on Computer-Based Economics Engineering Students

Based on the results shown in the figure above, it can be stated that there are still students who do not understand this computer-based learning economics. This is evidenced from the percentage of students who do not understand, which is 3%. However, with the economic learning of computer-based techniques this resulted in students as much as 38% strongly agree and 47% agreed that the economics of computer-based engineering learning was easier to understand.
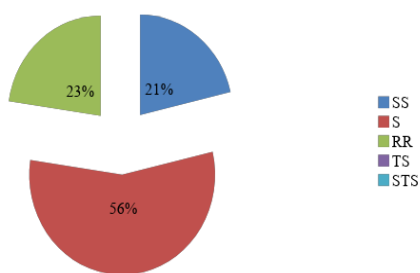

SS = strongly agree, S = agree, RR = hesitation, TS = disagree, STS = strongly disagree

Figure 8: Percentage of Student Satisfaction Levels on the Current Learning Media

Based on the data analysis above, it can be stated that the current learning media is by the applicable curriculum. This is evidenced by the percentage of students who approve of this by 65%, and the percentage of students who strongly approve is 25%.

SS = strongly agree, S = agree, RR = hesitation, TS = disagree, STS = strongly disagree

Figure 9: The Percentage of Student Ability Level to Conduct Economic Analysis

Based on the data analysis shown above, it can be stated that students have been able to conduct an economic analysis of agricultural equipment and machinery quickly and precisely after lectures using this computer-based technique learning method. It can be proven in the percentage of 56% of approved students and 21% of highly approving students.

3.3 Evaluation of Student Exam Result

To see the success of the implementation of this lecture, a comparison was made between the value of students in the previous year (2016/2017 academic year) with current students (2017/2018 academic year). Based on the comparison between the students' grades in the previous year (2016/2017 school year) with the current student scores (2017/2018 school year), it can be stated that the current student grades are better than those in the previous year. It can be proven from the percentage of A value of, which is 38% in this year, and 18% in the previous year. This means that the percentage of students who got A has increased 2 times.

4 CONCLUSIONS

From the research conducted it can be concluded that the application of technology is needed to improve the quality of learning given to students. From the results of the research data shows that students more easily understand the material using computer media. From the questionnaire results that had been distributed to students after the lecture was conducted, it was found that students considered 52% strongly agree and 42% agreed that learning using media (computer) was more fun than just the lecture method. From the aspect of value, the percentage of

the value of A in the 2017/2018 academic year increased 20% compared to that in the 2016/2017.

ACKNOWLEDGEMENTS

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