

IMPLEMENTATION OF ONLINE COLLABORATIVE LEARNING IN DATABASE SYSTEMS COURSES

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Abstract: *This study aims to determine the effectiveness of the implementation of online collaborative learning in the Database System Course. Respondents in this study were second-semester students in the Undergraduate Program, Faculty of Information and Communication Technology, Mataram University of Technology. The respondents used were 25 students, who were taken from one class in the Department of Informatics Engineering. Techniques for Problem Solving were chosen as a collaborative technique by choosing one of the techniques in it, namely Send-A-Problem. Send-A-Problem is a technique of solving a problem in groups, then forwarding the problem and its solution to the closest group who then does the same thing; the last group will evaluate all these solutions. From the results of the research conducted, it was obtained that the average value of students from the previous 58.52 rose to 80.36 after the implementation. There is a difference in the increase in the value of the Database System course exam of 21,840. This indicates that student learning outcomes increase if learning is done online collaboratively. The results of the t-test also show the value of Sig. (2-tailed) is $0.000 < 0.05$, so it can be concluded that there is an average difference between the learning outcomes before and after, meaning that there is an influence on the implementation of online collaborative in the Database System Course. The online collaborative is suggested as a way to improve learning outcomes, which of course are not bound by space and time.*

Keywords: *Online Collaborative, LMS, Problem Solving.*

Introduction

The utilization of computer technology to improve the learning process is very necessary. Computers are effective learning media that can be connected through a network. Media is a means of communication that brings together the source and recipient (Putri "Analisis et al., 2021). Computer technology can be used as a distance learning media or online so that learning can be carried out anytime and from anywhere. Online learning can be done independently or in groups. Online learning tends to be individualistic. This is due to the lack of direct interaction between students (Amarulloh et al., 2019)(Handarini & Wulandari, 2020).

The database system is a system of compiling and managing records using a computer to store or record and maintain complete operational data of an organization/company so as to provide optimal information needed by users for the decision-making process (Hardiansyah et al., 2020). Database System is the use of a database where the system can compose and manage records in a computerized manner which can facilitate a company/organization for the decision-making process. The Database System course provides knowledge about basic database concepts in general by emphasizing the notion of databases, database systems, data models, Entity Relationship Diagram (ERD) modeling, Normalization, and Structural Query Language (SQL) query languages. The Database System course is a compulsory subject for study programs and is available in every study program at the Faculty of Information and Communication Technology, Mataram University of Technology.

Based on data obtained from the Academic Section, student learning outcomes are still not optimal, there are still many students whose learning outcomes are in the C, D, and E grades. In the 2019/2020 school year of 172 students, 77 people (45%) scored below B. Meanwhile, in the 2020/2021 academic year, out of 216 students, 87 people (40%) scored below B. When compared to the learning outcomes of students who scored above B, they are very far apart. In the 2019/2020 academic year, 59 students (34%) got A grades out of a total of 172 students, while in the 2020/2021 academic year, 92 students (43%) got A grades from a total of 216 students. Learning outcomes can be influenced by physical factors, psychology, fatigue, and others (internal factors), and family factors, school/campus factors, community factors (external factors) (Kompri et al., 2017)(Sardiyanah et al., 2018). At Mataram Technological University, learning outcomes can be influenced by the availability of learning materials, lecturer readiness, learning support systems, study time, and learning methods.

According to Waje and Sankpal (2012), Collaborative learning is an educational approach to teaching and learning that involves the collaboration of students in groups to solve problems, complete tasks, or make products (Made et al., 2021). Collaborative learning is learning in which students with different backgrounds and abilities work together in small groups to achieve a common goal. There are several characteristics of collaborative learning, namely: (1) positive dependence, (2) interaction (face to face), (3) individual and group responsibility, (4) development of interpersonal skills (interpersonal skills). (5) heterogeneous group formation, (6) knowledge exchange between teachers and students, (7) division of authority or roles between teachers and students, and (8) teachers as intermediaries (Fauziah et al., 2021). Learning by applying the collaborative learning model will be formed into small groups that are heterogeneous (Made et al., 2019). Piaget with his concept of "active learning" argues that students learn better if they think in groups, if an active group the group will involve others to think together so that learning is more interesting (Nerona, 2019). Collaborative learning has been studied and carried out in many places and if done correctly, the results will be much better than conventional learning (Barkley et al., 2014). In collaborative work, students share the responsibilities that are defined and agreed upon by each member. The agreement includes (1) the ability to attend, readiness, and punctuality to fulfill teamwork, (2) discussions and disagreements focus on the problem being solved by avoiding personal criticism, and (3) having responsibility for tasks and completing them on time (Hernández-Sellés et al., 2019).]. Collaborative learning can benefit "almost anyone". Collaborative learning can improve and enrich a university's goals is important for students with the term "learning from diversity" (Diana et al., 2020).

Theory of Collaborativism (Online Collaborative Learning - OCL) is a new form of Constructivism, consisting of online learning groups led by at least one teacher (Harasim, 2017). The important role of the teacher is as a facilitator and mentor of these learning groups. The shift can be seen from traditional learning, namely the role of teachers and learners. In collaborativism, the role of the teacher shifts from being a teacher (provider) to being a facilitator, and learners take responsibility for their independent learning process to get satisfactory results. Online teacher roles as Instructional Designer, e-moderator, Administrator, and Assessor.

Research on the application of online collaborative in database system courses is important to do to find out the extent of its influence on learning. The goal is to find out whether it can improve student learning outcomes or not. This study, it is not only tested whether online collaborative can improve learning outcomes, but also begins with the development of learning materials.

Methodology

The research method used to develop an online collaborative model for the database system course is Research and Development (R&D). The research development procedure consists of two main objectives, namely developing a product and testing the effectiveness of the product in achieving the goal. The stages are as follows:

Research and Information Collecting

The initial survey was conducted to find out the description of the implementation of the Database System course learning that has been running so far by interviewing the Head of the Study Program and lecturers. Value data for the last 2 years was also collected as study material.

Identify Instructional Goals

The formulation of Learning Objectives is carried out by inviting students, alumni, supporting lecturers, heads of study programs, and practitioners to identify skills and knowledge that must be possessed, competencies that must be mastered, prerequisite courses in a discussion group forum.

Conduct Instructional Analysis

Mapping the competencies and materials that must be studied to achieve the desired learning objectives needs to be analyzed whether the designed instructional is appropriate. It is necessary to invite stakeholders, course supervisors, students, alumni, and heads of study programs in instructional analysis.

Analysis Learner and Contexts

Analysis of the level of knowledge and skills that students must have is carried out by looking at and paying attention to student data such as their educational background, the results of entrance selection scores, test scores at previous levels, and others.

Write Performance Objectives

Specific Instructional Objectives are structured as the basis for constructing the test grid. Making Special Instructional Objectives must contain elements of the learning environment such as Audience, Behavior, Condition, and Degree.

Develop Criterion-Referenced Test

Assessment instruments or test criteria for evaluating the learning process are designed to determine the extent to which the planned or desired competency achievements are met.

Develop Instructional Strategy

Learning strategies are prepared in the Semester Learning Plan by sorting the material, descriptions of activities or student learning experiences, and determining how the material is stored and its delivery activities.

Develop and Select Instructional Material

The development of relevant learning materials or materials consists of several teaching materials that will be used by students during the learning program so that learning objectives can be achieved. The development of learning-based materials is carried out on a website-based basis to accommodate collaborative online learning.

Design and Conduct Formative Evaluation

Formative evaluation is carried out in stages through validation evaluation and effectiveness evaluation. Validation evaluation is through one-to-one evaluation, small group, and field trial. evaluation of effectiveness conducted field trials.

Revise Instruction

Revisions are made based on the results of the evaluation in the previous stage by taking into account the recommendations from the evaluation results

Design and Conduct Summative Evaluation

The main purpose of this evaluation is to determine the level of effectiveness of the developed product. In conducting the effectiveness test, it is carried out by conducting a T-test. The T-test is carried out by paying attention to the learning outcomes before and after using the online collaborative method.

There are many collaborative learning techniques such as 1) Techniques for Discussion, 2) Techniques for Reciprocal Teaching, 3) Techniques for Problem Solving, 4) Techniques Using Graphic Information Organizers, and 5) Techniques Focusing on Writing. However, not all techniques will be used in this study. The application of collaborative online learning in the Database System course is carried out by applying one of the collaborative methods. The technique to be used is Techniques for Problem Solving. Techniques for problem-Solving itself consist of several types: Think-Aloud Pair Problem Solving TAPPS, Send-A-Problem, Case Study, Structured Problem Solving, Analytic Teams, and Group Investigation. In this technique, there are several types and the Send-A-Problem type is selected for its application. Techniques for Problem Solving provides a problem-solving framework that generally includes problems that are very structured to loosely structured. Send-A-Problem tries to solve a problem in groups, then forwards the problem and its solution to the closest group who then does the same thing; the last group will evaluate all these solutions. The purpose of this technique is to help students practice the collective thinking skills needed to solve problems effectively and to compare and contrast the various solutions provided.

Send-A-Problem (Sending Problems), in this technique, students are divided into small groups consisting of 2-4 people to do assignments within 30-45 minutes. Each group is given one problem, tries to solve it, then forwards the problem and its solution to another group. Without

looking at the resolution of the previous group, the next group solves the problem they received. The last group analyzes and evaluates responses to issues they receive and reports on the best solutions. This means Send-A-Problem has two stages, namely problem solving and solution evaluation. Problem-solving aims to provide opportunities for students to practice and learn the thinking skills needed to solve problems effectively. Solution evaluation aims to help students learn to compare and contrast various solutions. This is why the researcher chose the Send-A-Problem technique in this study.

The procedures in the Send-A-Problem technique can be carried out as follows:

- a) Make groups of 2 - 4 people.
- b) Distribute a different problem to each group, ask each group to discuss their situation, find the best solution, then record and put their responses in a folder.
- c) Give a time limit, and instruct the group to pass the problem on to the next group.
- d) When receiving a new problem, the students again make suggestions, record the results until the specified time limit, and then pass the problem on to a new group.
- e) Repeat this process until it is sufficient and appropriate for the problem.
- f) The last group reviews the responses given to the problem, analyzes, evaluates, synthesizes the information, and adds any other information they want.
- g) The activity was closed with a group report. When the group makes the report, add points that the group missed and reinforce the correct process and solution.

As a note, these study groups, including learning materials, are placed in a Learning Management System (LMS) application. Through LMS, each group discusses and the teacher becomes a facilitator who directs and helps smooth online discussions.

Results and Discussion

The online collaborative application is implemented by applying one of the collaborative methods, namely Techniques for Problem Solving, the Send-A-Problem type. Students are divided into small groups of 2-4 people online at LMS to do assignments with a period of 30-45 minutes.

Respondents in this study were second-semester students in the Undergraduate Program, Faculty of Information and Communication Technology, Mataram University of Technology. The respondents used were 25 students, taken from one class in the Informatics Engineering department.

Based on the results of the trial implementation of online collaborative learning on 25 students of the Mataram University of Technology in the Database System Course, the results of the test scores are as follows:

Table 1. Recapitulation of Student Test Scores

Respondent	Test Scores	
	Before	After
Respondent 1	72	84
Respondent 2	75	75
Respondent 3	40	86
Respondent 4	45	83
Respondent 5	75	83
Respondent 6	70	95
Respondent 7	72	85
Respondent 8	80	85
Respondent 9	46	75
Respondent 10	70	81
Respondent 11	40	70
Respondent 12	70	85
Respondent 13	45	70
Respondent 14	70	75
Respondent 15	80	82
Respondent 16	35	65
Respondent 17	35	80
Respondent 18	65	75
Respondent 19	53	80
Respondent 20	43	78
Respondent 21	65	80
Respondent 22	72	85
Respondent 23	50	80
Respondent 24	45	86
Respondent 25	50	86

Based on the Recapitulation of Student Test Score in Table 1, statistical analysis was carried out to determine whether there was an increase in the average score of students.

Table 2. Result of paired samples statistics

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 before	58.52	25	15.188	3.038
after	80.36	25	6.448	1.290

Based on Table 2, it can be seen that there are differences in student learning outcomes before and after the implementation of online collaborative learning in the Database System course at the Mataram Technological University. The results before and after the implementation showed an increase in the average score of students from 58.52 to 80.36 after the implementation. There is a difference in the increase in the value of the Database System course exam of 21,840. This indicates that student learning outcomes increase if learning is done online collaboratively.

To determine whether the differences that occur are significant before and after implementing online collaborative learning in the Database System course, it is necessary to look at the results of the Paired Samples Test produced.

Table 3. Result of Paired Samples Test

		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 1	before - after	-21.840	13.924	2.785	-27.588	-16.092	-7.842	24	.000

Based on Table 3 above, it is known that the value of Sig. (2-tailed) is $0.000 < 0.05$, so it can be concluded that there is an average difference between learning outcomes before and after, meaning that there is an influence on the implementation of online collaborative in the Database System Course. The mean paired differences show -21.840. The difference is between -27,588 to 16,092.

The results of this study are in line with the research conducted by Ajayi in 2020 with the title Use of online collaborative learning strategy in enhancing postgraduates learning outcomes in science education. The result is that the use of Online Collaborative Learning Strategies improves learning outcomes and student retention in Science Education (Ajayi & Ajayi, 2020). Nerona also expressed a similar result in her research Effect Of Collaborative Learning Strategies On Student Achievement In Various Engineering Courses. As a result, there was a significant difference in respondents' posttest scores, with the experimental group engaged in collaborative learning obtaining significantly higher posttest scores than their control group counterparts, who studied using traditional lecture or discussion methods and individual learning methods (Nerona et al., 2019). Collaborative models can be used to support more effective learning practices between teachers and students in a social collaborative environment (Ban et al., 2017).

Conclusion

The implementation of online collaborative learning in the Database System Course is proven to improve student learning outcomes. The selection of Techniques for Problem Solving and applying the Send-A-Problem technique is effective in improving learning outcomes. It is possible that other techniques will also be very useful for improving learning outcomes. Researchers suggest trying to apply other collaborative techniques in other learning as well in order to obtain better learning variations.

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