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Learning Effectiveness of Using E-Assignment Application as a Learning Model with Jigsaw Method

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ABSTRACT

Effective learning for students is when a conducive learning atmosphere is created and the achievement of educational goals in higher education is achieved. Furthermore, technological advances in learning and learning strategies are very important in the higher education learning process, considering all student conditions, both internal and external. This study aims to develop an e-assignment application as an effective learning medium during the pandemic and measure the effectiveness of the e-assignment application using the Jigsaw method. The research was conducted on students in the Database Design course. The system used in this exploration is the ADDIE(Analysis, Design, Development, Implementation, Evaluation) model, one of the models that attendants in developing effective, dynamic literacy and supports learning itself. These results demonstrated that learning by using the e-assignment application in the comparison class could increase learning outcomes higher, from 81.9 to 96.7. Compared with the control class, there was a slight increase from the value of 63.3 to 75.9.This research resulted in the development of an e-assignment application that was effectively used in the learning process for students and lecturers at universities.

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1. INTRODUCTION

With the rapid advancement of modern science and technology, knowledge can be disseminated to the general public via information facilities that employ appropriate new media technology [1]. The increasingly rapid development of computer technology and penetration in various fields has improved education management in higher education [2]. Higher education should give more attention to active learning in educational delivery. In the current era of technology and information, it has brought changes in learning [3]. The digitization of the teaching process is represented in the form of e-learning and is understood as technology-based learning [4]. Learning models is very important for the next generation of the nation so it needs to be presented in the form of active, innovative, imaginative, interesting and fun learning [5]. The more innovation that is facilitated the better; quality will look after itself. However, conventional learning methods are still used in the student learning process, while the teacher only functions as a guide for students [6]. Conventional learning does not train students to interact and be skilled in using computers. As a result, students do not get valuable skills in the computer field as a provision for the future. In this case, the learning media plays an important role in learning [7]. Learning media aims to facilitate educators in delivering material to students. Students must be able to adopt advanced technology solutions in this professional activity synergistically and creatively [8]. In online teaching, educators and students must communicate effectively and efficiently to produce the best learning outcomes [9]. Distance learning relies on the internet, computers, and the ability to adapt to various types of technology.

Education is one aspect that determines the future and is given to educate the nation's life. The high quality of education can affect the quality of human resources. The issue of education quality in Indonesia's most remote, developed, and underdeveloped areas has become a must-discuss topic for education activists. Distribution of education is still a sustainable development agenda in Indonesia [10]. Education is one aspect that determines the future and is given to educate the nation's life. The high quality of education can affect the quality of human resources. The issue of education quality in Indonesia's most remote, developed, and underdeveloped areas has become a must-discuss topic for education activists. Distribution of education is still a sustainable development agenda in Indonesia [11]. This learning media is used as a learning tool to help students understand the material presented and the assignments given. In this case, the level of student motivation influences academic achievement in traditional learning environments [12].

Online learning in universities has developed rapidly before the pandemic. Almost all educational institutions have used online learning media in their learning process. The teaching methods implemented are used for online learning, running in parallel with the development of models and methods that enrich the data by analyzing it and thereby contributing to the optimization of the learning process. For this reason, it is necessary to develop and improve terms of learning media for students in higher education. Therefore,

many augmented reality-based learning media have been developed [13]. This media is used as a learning tool to help students understand the material presented.

E-learning is the use of new multimedia technologies and the Internet, to improve the quality of learning. The learning model is a pattern always used to guide classroom learning and tutorials for Lecturers in Higher Education. The learning model must refer to the approach used, including learning objectives, environment and management [14]. Lecturers can use the learning model to help students obtain information, ideas, skills, ways of thinking, and expressing ideas. It also serves as a guide for learning designers. Learning models can also be defined as procedures or steps that educators need to take to facilitate students to learn actively, participatory, and interactively to achieve educational goals, namely the optimal development of students' potential. The application of active learning requires the ability of teachers to design and develop learning tools in the form of learning models that can help students and teachers in the learning process [15]. There has been some progress in research on educational equity and theoretical research on e-learning. Nowadays, with the emergence of various forms of learning resource services such as online learning and network resource libraries, e-learning and ubiquitous learning have become common learning methods for learners [16]. Instructors need to improve the system of teaching and learning by providing useful resources and activities for students through the use of technology. A change in behaviour marks the achievement of learning objectives. These behavioral changes include knowledge (cognitive), skills (psychomotor) and attitudes (effective) [17].

This research develops an e-assignment application, a web-based jigsaw learning model, to create student assignments given by lecturers. Many studies have used the jigsaw technique in collaborative learning methods. The advantage of the Jigsaw method is its unique cooperative learning approach, requiring each student to become an "expert" in their respective fields. Other advantages include fostering social and communication skills and fostering individual responsibility. However, many educators still assign assignments to students manually. Manual assignments mean that assignments are still completed verbally or in writing. [18]. The downside of the Jigsaw method is that it takes a long time. Teachers must facilitate the movement of students from their Home Groups to their Expert Groups, and then back again. If classroom management isn't strict, time can be wasted on the logistics of changing seats.

In this case, students were introduced to the electronic learning process or web-based learning. Students were divided into several groups who had to do the assignments given by the lecturer. Paper-based tasks were replaced with web-based tasks given to lecturers through online media. This model can improve the quality of learning for students and can be used as an alternative for developing a more effective and efficient education system at lower costs in the future. The results showed that the students' ability to answer questions before learning using the jigsaw learning model was still in the low category [19]. Using Jigsaw technique in teaching writing descriptive text is very effective [20].

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2 RESEARCH METHOD

The method used to test the effectiveness of this e-assignment was an experimental method, which is causal research (cause and effect), in which proof was obtained through comparisons between the experimental group (which was treated) and the control group (which was not given treatment); or the condition of the subject before being given treatment with after being given treatment [21]. The observations in this Database Design learning were assessed from the affective, cognitive and psychomotor aspects by conducting pre-test and post-test on students.

2.1 Jigsaw Method

The method used in developing this application is the Jigsaw method. Cooperative learning with the jigsaw method is a learning model that focuses on student group work in the form of small groups. Cooperative learning is a teaching model that helps students to learn from each other in small heterogeneous groups in terms of various variables [22]. Students were divided into several groups of 4-6 each and given one material.

The jigsaw cooperative learning steps are as follows: (1) Students are grouped with a total of four to six members, which are called the home group, (2) Each member in the home group is given a different task, (3) Members from different home groups with the same assignment form a new group known as the expert group, (4) After the expert group discusses, each member returns to their respective home group and explains to the original group members about the sub-chapters they master, (5) Each expert team presented the results of the discussion, (6) Discussion, (7) Closing [23]. The relationship between the home group and the expert group can be illustrated in Figure 1 below.

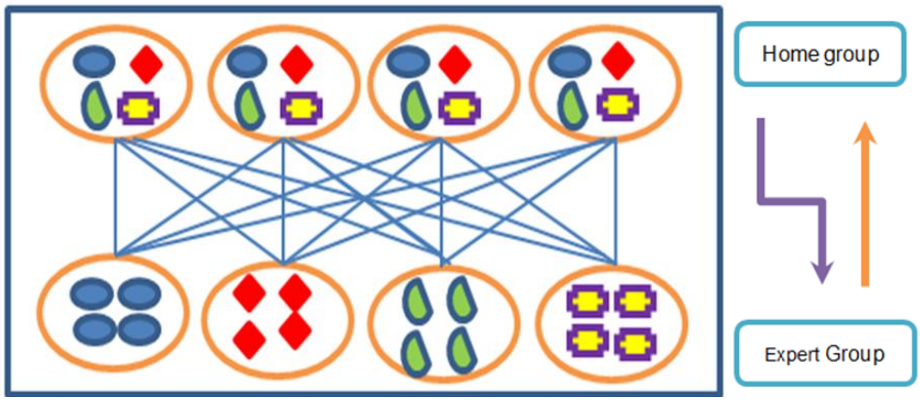

Figure 1. Illustration of Jigsaw Group

From Figure 1, it can be explained that students are grouped with four students, and each member of the home group is assigned a different task. Members of the original group

who have the same task will form a new group called the expert group. After discussing in the expert group, they will return to their original group.

2.2 ADDIE Development Procedure

ADDIE (Analysis, Design, Development, Implementation, Evaluation) is one of the models for designing learning models. This ADDIE model can guide effective, dynamic learning and support learning itself. The ADDIE model is a system-oriented general learning design model [24]. The development of this application used the ADDIE model. The procedure for developing an e-assignment application with the ADDIE model can be illustrated in Figure 2.

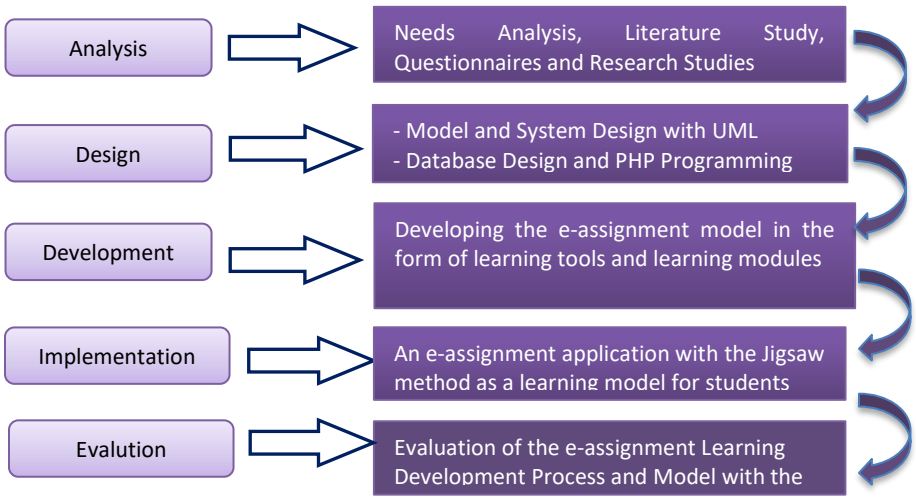

Figure 2. Stages of the E-Assignment Application Development Procedure

The development of the ADDIE model consists of 5 development steps, namely:

1) Analysis. At this stage, identification of problems contained in learning, curriculum and learning objectives, analysis of the needs of students and teachers in the learning process is carried out.
2) Design. This stage is to verify problem-solving and design the learning models needed to solve problems in the learning process.
3) Development. This stage is to build and validate the application of the learning model that has been designed. This process is time-consuming and complicated.
4) Implementation. At this stage, the implementation of the learning model that has been built and developed is carried out.
5) Evaluation. This stage assesses the quality of the development product before or after implementing the developed learning model, whether there are still weaknesses or shortcomings that need to be improved.

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3 RESULTS AND DISCUSSION

3.1 System Implementation

The development of the e-assignment application using the jigsaw method resulted in an application as a learning medium for students. The development of this application is more focused on the assignment of students in groups, where the group work system is based on the jigsaw method. The results of the development this application can show in Figure 3 and Figure 4.

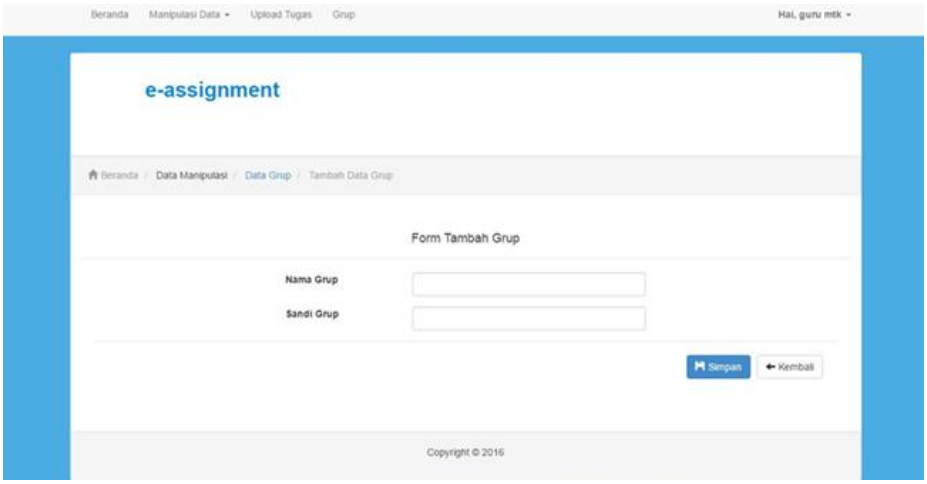

Figure 3. Add Group Form

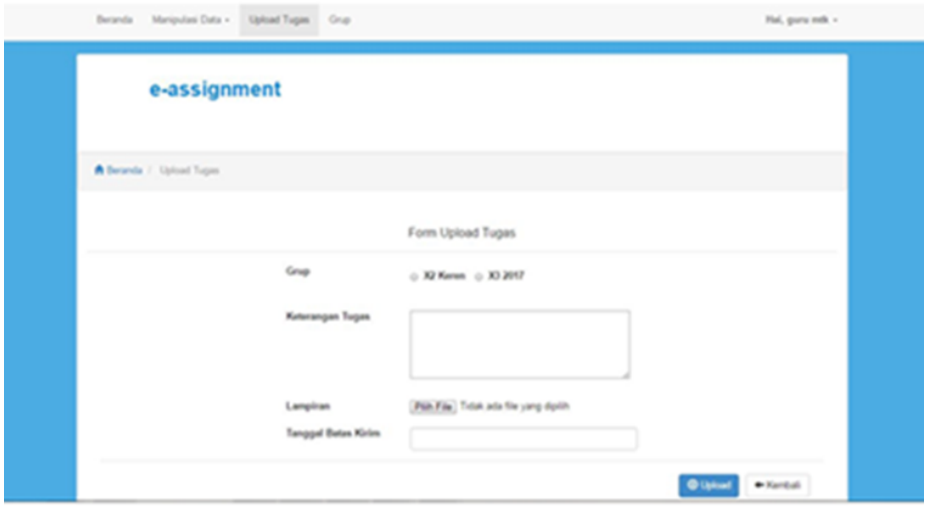

Figure 4. Task Upload Form

3.2 Effectiveness Test

This study used two variables: the independent variable (x) the application of e-assignment in learning and the dependent variable (y) learning outcomes. Data on student learning outcomes were obtained using multiple-choice tests called cognitive aspects, psychomotor aspects (practice) and affective aspects of behaviour. These three aspects were carried out in the comparison class or the experimental class in the study. In addition, a test of cognitive, psychomotor and affective abilities was given to students before treatment in the pre-test control class. In contrast, the post-test was conducted after students received treatment.

The learning process that pays more attention to the formation of the realm of knowledge and attitudes will have an impact on the formation of student literacy [23]. The e-assignment application was implemented in the learning process at this stage, especially for student assignments. After this stage, pre-test and post-test analyses were carried out after receiving treatment in the comparison class. These two tests were conducted to measure the learning program's effectiveness. After the two classes were given treatment, a post-test was given to both classes. It was done to determine the active ability of students as a result of their learning after being treated. The researchers grouped the data based on the comparison and control class data to provide a clearer picture.

3.3 Data Analysis Of Pretest And Posttest In The Control Class And Comparison Class

This data is taken from pretests and posttests of 129 students in two control classes and 129 students in two comparison classes in the Database Design course. In addition, scores for the cognitive, psychomotor, and affective aspects were taken from student practice, and the data were processed manually, as shown in the observations below. The sampling technique used to select data for this pretest and posttest is Cluster Random Sampling. This technique is particularly suitable for research conducted in schools. The researcher randomly selects one "group" (e.g., Class SI-A) to receive the treatment.In addition, the results of the scores from the cognitive, psychomotor and affective aspects were taken from student practice, and the data was processed manually, as shown in the observations below.

3.3.1 Description of Control Class Pretest Data

The observation results in the Database Design learning pre-test were assessed from the affective, cognitive and psychomotor aspects at the first meeting with 129 students in the control class. The results of data analysis in the form of a score frequency distribution can be seen in Table 1.

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Table 1. Frequency Distribution of the Score Control Class Pretest

No	Class Interval	Frequency
1	50-56	18
2	57-63	16
3	64-70	29
4	71-77	15
5	78-84	14
6	85-90	37
	Total	129

The number of classes in the frequency distribution table of the control class pre-test score was six, which was the number of class intervals with a value class length of seven, which could be seen in the class interval column. Frequency is the number of students who have grades between the class value intervals [24] [25]. The distribution of the pre-test scores in the control class can be seen in the graph in Figure 5.

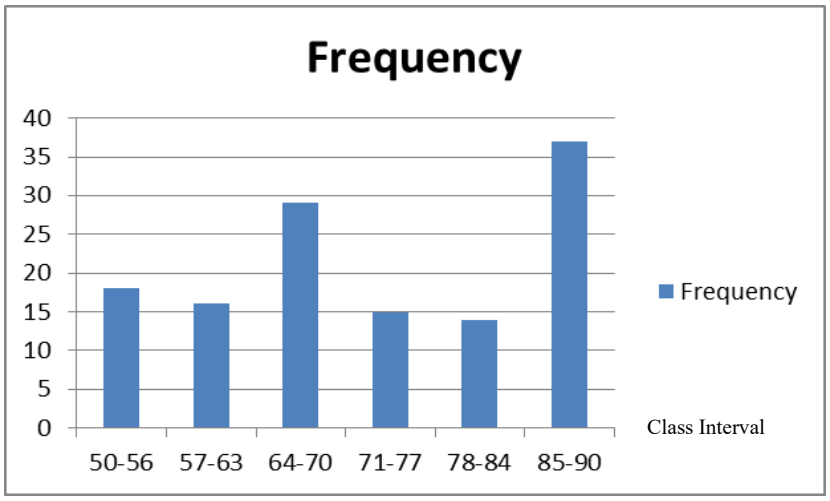

Figure 5. Histogram of the Results of the Pre-Test in The Control Class

The histogram of the pre-test results in the control class, shown in Figure 5, illustrates the number of frequencies of student scores in each class score interval. For example, in the histogram above, it can be seen that the results of the highest student scores were in the class value interval of 64-70, with as many as nine students. Conversely, the lowest scores were in the 57-63 grade interval for the number of frequencies, which was one student.

3.3.2 Description of Comparison Class Pretest

The results of observations in the pre-test of Database Design learning were assessed from the affective, cognitive and psychomotor aspects at the first meeting with 129 students in the comparison class.

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Table 2. Frequency Distribution of Pretest Scores for the Comparison Class

No	Class Interval	Frequency
1	55-61	16
2	62-68	13
3	69-75	35
4	76-82	19
5	83-89	16
6	90-95	23
	Total	129

The number of classes in the frequency distribution table for the pre-test scores for the comparison class was six, which was the number of class intervals, with a class length value of 7, which was the class interval, as seen in the class interval column. Frequency is the number of students who have grades between the class value intervals. For a more detailed description of the frequency distribution of the pre-test scores in the comparison class, it can be seen in Figure 6.

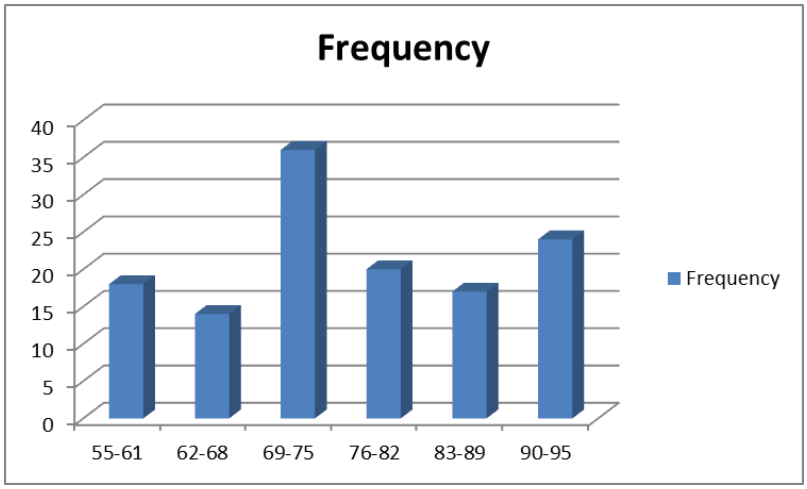

Figure 6. Histogram of the pretest results in the comparison class

The histogram of the pre-test results in the comparison class shown in Figure 6 illustrates the frequency of student scores in each class value interval. In the histogram above, it can be seen that the most student scores were in the 69-75 grade interval, which was 11 students. For the number of frequencies, one student's lowest scores were in the 83-89 class value interval.

3.3.3 Description of Posttest Control Class

The observations in Database Design learning were assessed from affective, cognitive and psychomotor aspects at the first meeting with 129 students in the control class. The distribution of post-test scores in the control class can be seen in Table 3 and the graph

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in Figure 7. The results of data analysis in the form of a score frequency distribution can be seen in Table 3.

Table 3. Frequency Distribution of Control Class Post Test Scores

No	Class Interval	Frequency
1	55-60	14
2	61-66	16
3	67-72	29
4	73-78	15
5	79-84	14
6	85-90	37
	Total	129

In the frequency distribution table for the control class post-test scores, it can be seen that there are six classes which are the number of class intervals with the same class length value, which can be seen in the class interval column [26]. Frequency is the number of students who have grades between the class value intervals. The histogram of the frequency distribution of post-test scores in the control class can be seen in Figure 7.

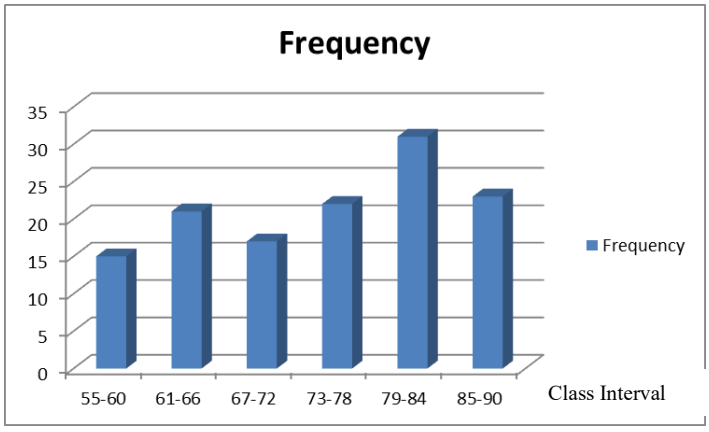

Figure 7. Histogram of the Posttest Results in the Control Class

The histogram of the post-test results in the control class shown in Figure 7 illustrates the frequency scores of students in each class value interval. The histogram above indicated that the most student scores were in the 79-84 class grade interval, as many as eight students. The lowest score was in the 55-60 class value interval for the number of frequencies, one student. The results of data analysis in the form of a score frequency distribution can be seen in Table 4.

Table 4. Frequency Distribution of Post Test Scores for Comparison Class

No	Class Interval	Frequency
1	60-65	18
2	66-71	16
3	72-77	19
4	78-83	20

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5	84-89	24
6	90-95	32
	Total	129

In the table 4, it can be seen that the number of classes was 6, which was the number of class intervals with a class length value of 6, which was the range of student values. The value can be seen in the class interval column. Frequency is the number of students who have grades between the class value intervals. The histogram of post test results in the comparison class can be seen in Figure 8.

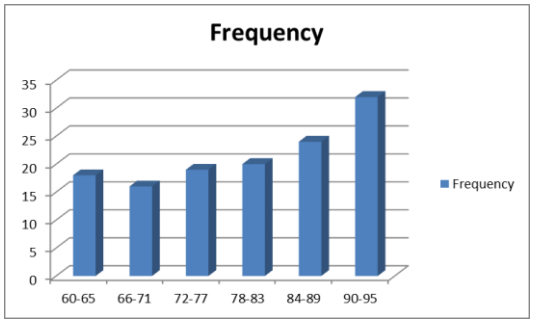

Figure 8. Histogram of Post Test Results in the Comparison Class

The histogram of the post-test results in the comparison class shown in Figure 8 illustrates the frequency scores of students in each class value interval. For example, in the histogram above, it can be seen that the most student scores were in the 84-89 grade interval, which is nine students. Conversely, the lowest score for the number of frequencies was in the class value interval 66-71, which was one student.

3.4 Effectiveness Test Results Based On Pretest And Posttest Values

3.4.1 Cognitive Learning Outcomes

The cognitive learning outcomes are student learning results seen from the cognitive aspect in the control class and comparison class after implementing the e-assignment application in the Database Design course. It was to compare student learning outcomes before and after being given treatment. At the beginning of the lecture, the control class got an average score of 63.3, and the comparison class got an average score of 81.9. At the end of the lecture, the control class's average score was 75.9, and the comparison class got an average score of 96.7.

In the initial college conditions, there was no significant difference in students' academic ability in the two classes. That is, it could be stated almost the same. Therefore, the following compared student learning outcomes for the control and comparison classes at the beginning and end of learning.

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Table 5. Comparison of Student Cognitive Learning Outcomes

Meeting	Control Class	Comparison Class
Beginning	63,3	81,9
Ending	75,9	96,7

From Table 5, it can be concluded that the control class with its conventional learning model showed a slight increase in learning outcomes (gain score). These results prove that learning by using the e-assignment application in the comparison class in the Database Design course could increase student learning outcomes from 81.9 to 96.7. Compared with the control class, there was a slight increase in the score from 63.3 to 75.9. It proved a significant increase in value in the class that received treatment (comparison) compared to the control class. Improved learning outcomes in the beginning and ending learning in the control and comparison class can be seen in Figure 9.

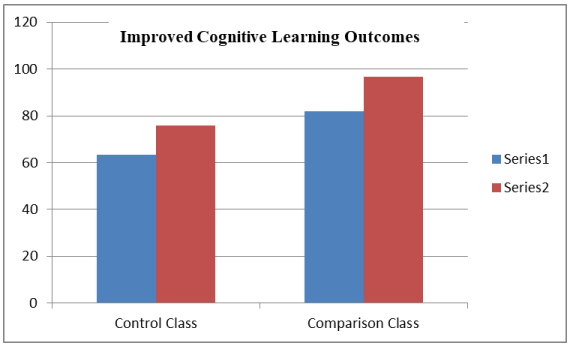

Figure 9. Histogram of the Average Improvement of Cognitive Learning Outcomes in Control and Comparison Classes

Figure 9 shows the increase in learning outcomes from the pre-test results to the post-test scores. It demonstrated that the class that received treatment (comparison) had a significant increase in value than the control class that did not receive treatment.

a) Affective Learning Outcomes. The results of the affective domain assessment were seen through observations by the observer on aspects of skills during the learning process. Aspects of assessment in the affective domain were the assessment of integrity, discipline, interest in learning, self-concept, responsibility, acceptance of tolerance, cooperation and group discussion. Besides, the researchers also took the value of affective learning outcomes through a questionnaire filled out by students. Observer data were taken through a lecturer in the Database Design course. According to the data on the results of the assessment of the affective aspects of students after learning to use e-assignment applications in the Database Design course in Higher Education, eight students had quality with cum laude, 11 students had excellent quality, six students had very good quality, and four students had good quality. Evaluation of results is identified from the impact, effectiveness, sustainability and adaptability (Rahabav & Souisa, 2021).

b) t-Test This t-test is used to see if there is a difference in mean values between the two sample groups. In addition, the t-test is used to determine the impact of each independent variable on the dependent variable. The table below shows the test result data given to the control and comparison classes. It proved differences in values in the condition after the treatment in the two classes. The results of the t-test can be seen in Table 6.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Nilai	Equal variances assumed	1.961	.167	-.804	56	.425	-2.069	2.574	-7.225	3.087
	Equal variances not assumed			-.804	52.578	.425	-2.069	2.574	-7.232	3.095

Figure 10. Results of the Posttest T-Test Analysis for the Control and Comparison Class

Post-test t-test for the post-test result scores for the control and comparison classes is something very crucial to do. The t-test was carried out to know whether there were differences in student learning outcomes between the control class that still used the conventional learning model and the experimental class that was treated by using the e-assignment application in Database Design learning.

he results of the t-test analysis of the post-test values above showed significant results in both classes, namely 0.425 for the control class and 0.425 for the comparison class, at df 56 and df 52.58. The value of both classes determined a result greater than 0.05. These results show that after receiving treatment in the comparison class, there was a significant difference between the post-test results for the control class and the comparison class at the end of the lecture.

4 CONCLUSION

The study's findings included the development of ane-assignment operation as a literacy medium and determining the effectiveness of a literacy medium in the form of a web- grounded pupil assignment operation using the Jigsaw system for scholars in advanced education. The development of this model has been enforced in the Database Design course, Information Systems Study Program at STMIK Indonesia Padang. The exploration results showed that the control class with conventional literacy models had a slight increase in learning issues (gain score). It proved that there was a significant increase in value in the class that received treatment (comparison) compared to the control class. It

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can be concluded that the development of this e-assignment application can increase the effectiveness of student learning independently and can increase student scores in higher education.

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