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Interactive Media Based on Contextual Teaching and Learning: Improving the Learning Outcomes of Computer Systems

Debby Latifah Simatupang
Education Technology,
Postgraduate,
Universitas Negeri Medan,
Medan,
West Sumatera,
Indonesia

Sahat Siagian
Education Technology,
Postgraduate, Lecturer,
Universitas Negeri Medan,
Medan,
West Sumatera,
Indonesia

Sriadhi
Education Technology,
Postgraduate, Lecturer,
Universitas Negeri Medan,
Medan,
West Sumatera,
Indonesia

Abstract: This research is motivated by the low student learning outcomes and the need to develop learning media for computer system learning. The purpose of this study was to produce appropriate and effective interactive media based on contextual teaching and learning models to improve student learning outcomes at SMK Muhammadiyah 11 Sibuluan. The type of research used is the ADDIE development model (analysis, Design, Development, implementation, and Evaluation). The research instruments used were teacher and student observation sheets, material expert validation questionnaires, media experts, design experts, and student response questionnaires. This study also uses quantitative data analysis techniques (data on the feasibility and effectiveness questionnaire assessment) and qualitative data (observation data and documentation). Product validation results show a score percentage of 85.88% for material expert validation, 89.41% for media expert validation, 86.25% for design expert validation, and 96.25% for student responses. The results of the normality and homogeneity tests show that the research data has been declared normal and homogeneous. The results of the hypothesis test show that the value of t count is 1.84 and the value of t table is 1.66, where t count > t table. The results of this study indicate that interactive media based on contextual teaching and learning models are effective in improving student learning outcomes at SMK Muhammadiyah 11 Sibuluan.

Keywords: interactive media; contextual teaching and learning; computer system

1. INTRODUCTION

The computer system is the set of elements related to carrying out an activity using a computer. The elements of a computer system consist of humans (brainware), software (software), and hardware (hardware). Thus, these components are elements involved in a computer system; of course, hardware means nothing if there is not one of the two (software or brainware). A simple example is who will turn on the computer if there is no human, or what commands the computer will execute if there is no software. The Von Neuman architecture describes a computer with four main parts: the arithmetic and logical unit (ALU), control unit, memory, and input and output devices (collectively called I/O). These parts are connected by a computer system bus to allow all components to carry out their duties.

One model that teachers can use to make computer learning more interesting is the Contextual Teaching and Learning (CTL) approach. This approach is a learning concept that helps teachers relate the material taught to students' real-world situations and encourages students to make connections between the knowledge they have and its application in their lives as members of their families and communities. With this concept, learning outcomes are expected to be more meaningful for students. The learning process takes place naturally in the form of student work and experience activities, not by transferring knowledge from teacher to student. Learning strategies are more important than results.

In this context, students need to understand the meaning of learning, what the benefits are, what status they have, and how to achieve them. They realize that what they learn is useful for their lives later. That way, they position themselves as those who need provision for their lives later. They learn what is beneficial to them and try to achieve it. In that effort, they need teachers as directors and mentors. In classes where the teacher uses a contextual approach, the teacher's job is to help students achieve their goals in the form of basic competencies. That is, the teacher deals more with strategy than giving information. The teacher's task is to manage the class as a team that works together to discover something new for class members (students). Something new that comes from "finding yourself and not from "what the teacher said". Such is the role of the teacher in the classroom, which is managed with a contextual approach.

The application of activities to construct or build their own knowledge on students, makes students trained to reason and think critically through inquiry activities or finding problems on their own, freedom to ask (questioning), and application of learning communities (learning communities), namely training students to work together, sharing ideas, sharing experiences, sharing knowledge, and communicating with each other so that there is positive interaction between students and in the end students are actively involved in learning together.

CTL was developed with the aim of making learning more productive and meaningful. The CTL model can be implemented without having to change the existing curriculum and arrangements. Computer learning always changes from time to time. Whatever learning model is used, computer learning consists of the same components, namely, teachers, materials, methods, and media, students, and the environment. These components interact in the process of learning computer

systems to achieve learning objectives or basic competencies that have been set.

1.1 The Nature of Learning and Learning Outcomes of Computer Systems

Learning outcomes are the abilities possessed by a student after the student receives treatment from the teacher as an educator [1]. The above understanding provides an understanding that when individuals carry out learning activities, there will be changes that occur, including changes in knowledge and behavior, which are shown through test scores.

According to Suprijono in Abdulloh [2], learning outcomes are patterns of behavior, values, understanding, attitudes, appreciation, and skills. Hamalik in Hariyanto [3] reveals that learning outcomes are the occurrence of a change in behavior or character in a person that can be observed and also measured in the form of knowledge, attitudes, and skills. We can interpret this change as an improvement and also a better development, where previously those who did not know will become aware.

Bloom mentions (in Rusman [4]) that the changes that occur in learning are learning outcomes, which include changes in the cognitive, affective, and psychomotor domains. The cognitive domain is knowledge, understanding, application, analysis, and evaluation. The affective domain is the attitude toward receiving, responding, assessing, managing, and living. The psychomotor domain includes movement and acting skills, as well as verbal and non-verbal expression skills.

Based on some of the opinions of the experts above, the authors can conclude that learning outcomes are a change achieved by students, including aspects of knowledge, attitudes, and skills, through a process that is carried out repeatedly and is permanent. The indicator of achievement of learning outcomes in this study is a change in ability in the cognitive domain. Learning outcomes in the cognitive domain are measured using written test instruments in the form of multiple choices consisting of a pretest and a posttest.

The computer system is the set of elements related to carrying out an activity using a computer. Elements of a computer system consist of humans (brainware), software (software), a set of instructions (instructions), and hardware (hardware). Computer systems subjects are productive subjects given at Vocational High Schools (SMK) computer network engineering expertise programs. In computer systems subjects, there are several basic competencies: understanding the number system, applying logic relations and logic gates, understanding arithmetic operations, and understanding computer organization and architecture.

To obtain evidentiary data that explains the level of students' ability to succeed in achieving instructional goals in computer systems subjects. For research on operating computer systems on cognitive aspects or learning outcomes that emphasize more on knowledge of understanding computer organization and architecture.

1.2 The Nature of Learning and Learning Development

Learning is not only paying attention to what students learn but also how to teach students to pay attention to what will be learned. A curriculum study that places more emphasis on descriptions of what goals to achieve and what learning content students should learn Meanwhile, how to teach students places more emphasis on ways to achieve goals, which is related to how to organize learning content and manage learning [5].

The learning process occurs because of the interaction between students and their environment. Therefore, the environment needs to be arranged in such a way that student reactions arise towards the desired behavior change. The environmental settings include analyzing student needs and characteristics, formulating goals, and determining what is needed [6].

Development is a type of research that we are more familiar with under the term research and development (R&D). Development research is research that aims to use research to produce certain products and test the effectiveness of relatively new types of research.

The definition of development research according to Borg & Gall is "a process used to develop and validate educational products". Meanwhile, according to Seels & Richey, "development research is a systematic study to design, develop, and evaluate programs, processes, and learning outcomes that must meet internal consistency and effectiveness criteria.

This development research follows the steps in a cycle. The steps of this research or development process consist of a study of the research findings for the product to be developed. Developing products based on these findings, conducting field trials according to the setting where the product will be used, and revising the results of field trials The research procedure (ADDIE) that has been implemented is described by identifying systematic stages in developing computer system learning.

1.3 Learning Model Contextual Teaching and Learning

Contextual Teaching and learning, commonly called contextual learning, is a holistic learning concept in which learning material is associated with the surrounding environment or the context of daily life, both social, cultural, and personal, so that it will produce meaningful learning and students can have knowledge and skills that can be applied to various problems [7].

Agreeing with Soimin's statement, Elaini B. Johnson in Rusman [8] says, "Contextual learning is a learning system that fits the brain that generates meaning by connecting academic content with context in students' daily lives". Concluded that the essence of contextual learning is the linkage between learning material and the experience or environment around students, so that students will play an active role in connecting their abilities because they try to learn subject matter and also associate it with the surrounding environment and are able to apply it,

Contextual learning is an alternative learning model that can help teachers create a pleasant learning climate and make learning more meaningful because learning is not only an understanding of abstract knowledge; students are also faced with clear learning activities because they are concrete, that is, they are related to the surrounding environment. As Nurdyansyah et al. [9] argue, the CTL approach is "Learning that allows students to apply and experience what is being taught by referring to real world problems, so that learning will become more meaningful and enjoyable".

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The teacher, as a measure of the success of learning, must be able to create learning scenarios so that the learning carried out will run smoothly. Likewise, the application of contextual learning can be successful. The steps in developing CTL according to Rusman [10] are: (1) Developing students' thinking to carry out more meaningful learning activities, whether by working alone, finding themselves and constructing new knowledge and skills of students; (2) Carry out inquiry activities on all topics taught; (3) Developing the curiosity of students through the questions asked; (4) Creating learning communities, such as through group discussion activities, question and answer, and so on; (5) Presenting models through learning examples through illustrations, models, even actual media; (6) Familiarize children to reflect on every learning activity that has been carried out; and (7) Conduct an objective assessment, namely assessing the actual ability of each student.

1.4 The Nature of Computer System Interactive Learning Media

Teaching and learning activities carried out both in schools and tertiary institutions, in addition to requiring accuracy in choosing strategies, models, and learning methods, also require a medium that is used to convey learning material. The word media comes from the Latin word medium," which means intermediary or introduction. Media is a tool for channeling messages from senders and recipients so that they can stimulate the thoughts, feelings, interests, and attention of students in such a way that the learning process occurs [11].

Choosing a media for learning needs is not easy, it must consider several factors. As expressed by Dick, W., And Carey [12], three factors cause compromise in the selection of media and delivery systems: (1) the availability of existing instructional material; (2) production and implementation constraints; and (3) the amount of facilitation provided by the instructor during instruction. This means that there are three factors that are often considered in the selection of media in the learning process: (1) the availability of existing teaching materials; (2) production and implementation constraints; and (3) the facilitation provided by the teacher during the learning process. The media plays an important role as an intermediary to make it easier for teachers in the teaching and learning process to achieve several criteria related to the media that have been discussed, including reference material and considerations for teachers in choosing or creating media.

Learning media is anything that can be used to channel messages from the sender of the message to the recipient so that it can stimulate the thoughts, feelings, concerns, interests, and enthusiasm of students so that the teaching and learning process occurs. According to Gagne (in Arsyad [13]), learning media only includes tools that are physically used to convey the contents of teaching material to students, which consist of, among others: books, tape recorders, videos, films, slides, pictures, and other material objects.

The use of media for abstract learning materials can be concreted and makes an unattractive learning atmosphere interesting. Many learning media are created for independent learning at this time, but finding a choice or solution that is really good for the learning process to be effective, interesting, interactive, and fun is a problem that needs to be solved. This is needed to create human qualities that do not only depend on verbal transfer of knowledge, both of which are carried out by schools and non-formal educational institutions at this time.

Utilization of computers in learning media requires supporting applications that are in accordance with the objectives of developing learning media. One medium that is suitable for use with existing problems in the field is the Macromedia Flash application. Based on the learning conditions of computer systems that have been described, it is necessary to conduct research to increase the competence of students' computer systems, namely by developing computer system learning media with macromedia flash software, which can improve student learning outcomes and improve the quality of teaching computer systems in vocational schools.

The research problems are formulated as follows: (1) Is interactive media based on Java program models suitable for use in learning computer systems? (2) Is interactive media based on Contextual Teaching and Learning in computer system learning effectively used in improving student learning outcomes?

2. METHOD

This type of research is a type of development research, commonly called development (Research and Development). Development research is research that aims to produce a product through the development process [14]. According to Sugiyono [15], research and development are both research that produces products and other activities, namely testing the effectiveness of the products to be produced. In order to be able to produce a particular product, namely research that needs analysis in nature and to test the effectiveness of the product so that it can function for a large audience, research must be carried out to test the effectiveness of the product that has been produced.

In the ADDIE model, there are several stages, namely: analysis, Design, Development, implementation, and Evaluation. The following are products with the ADDIE model:

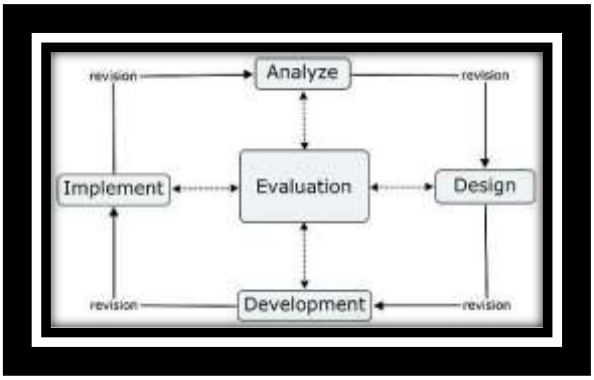

Figure 1. Stages of the ADDIE Model

In this study, models and development procedures were used with the ADDIE model as previously stated for each stage: analysis, design, development, implementation, and evaluation, based on what was stated by Branch [16], namely: Analyze, Design, Development, Implementation, and Evaluation.

This research was conducted in class X Computer and Network Engineering at SMK Muhammadiyah 11 Sibuluan Tapanuli Tengah in the even semester of the 2022/2023 academic year. Class X TKJ is the target audience for the research. The subjects of this study were students of class X at SMK Muhammadiyah 11 Sibuluan Tapanuli Tengah. As for class X TKJ 1 as the experimental class and class X TKJ 2 as the

control class, The selection of subjects in this study used a purposive sampling technique, namely the determination of the research sample based on the considerations of the researcher, who considered the desired research elements already existed in the members of the sample taken, and based on suggestions from the study teacher at the school.

Data collection techniques in this study are as follows: (1) Observation. Observations were made with the aim of observing the learning process, especially the results of students and teachers in applying the CTL approach at SMK Muhammadiyah 11 Sibuluan; (2) a questionnaireThe questionnaire contains a number of written questions that are used to obtain information from respondents. This method is used to retrieve validation data for interactive media based on the CTL learning model from a team of experts (lecturers) regarding the feasibility assessment and student response questionnaires regarding interactive media based on the CTL learning model in computer system learning; (3) Learning Outcomes Test Questions. Test questions are used to obtain data in the form of the results of students' cognitive abilities in learning computer systems. The level of difficulty of the questions used for the pretest and posttest is the same. The preparation of the test begins with the creation of a grid of multiple-choice questions.

Table 1. Feasibility Interpretation

Interval	Interpretasi	
0.00 – 2.49	Not good	Not feasible
2.50 – 3.32	Pretty good	Less Eligible
3.33 – 4.16	Good	Worthy
4.17 – 5.00	Very good	Very Worth it

(Sumber : Sriadhi [26])

This research was said to be successful if the results obtained from the questionnaire met the criteria of "Very Good" or "Very Eligible" and "Good" or "Decent" with a score interval of 3.33-5.00.

The practicality of the learning model developed in this study was measured using a questionnaire assessing the use of the learning model in the learning process. The practicality value can be calculated using the formula in Table 3 below:

Table 2. Criteria for the Practicality of the Learning Model

Score Interval	Criterion
3,5 – 4,00	Very Practical
3,00 – 3,49	Practically Without Repair
2,50 – 2,99	Practically Needs Improvement
2,00 – 2,49	Less Practical
1,00 – 1,99	Impractical

The effectiveness of CTL-based interactive media is developed by having two types of data, namely qualitative and quantitative. Qualitative data is generated from preliminary or feasibility studies, either in literature studies or field studies. Quantitative data were obtained from student learning outcomes using quasi-experiments, namely comparing pre-test and post-test scores of students using CTL-based interactive media. In this study, the data obtained were student learning outcomes from the experimental and control classes with the assessment criteria as seen in Table 3 below:

Table 3. Assessment Criteria

Value	Criteria	Percentage (%)
A	Very Good	81-100%
B	Good	61-80%
C	Enough	41-60%
D	Less Good	21-40%
E	Very Poor	0-20%

Data analysis in this study used quantitative descriptive analysis techniques, namely data from media experts, material experts, design experts, and student responses, as well as effectiveness tests. Data collection was carried out using a questionnaire by distributing questionnaires to the respondents, namely material experts, media experts, design experts, and students. The respondents gave an assessment of the quality of interactive multimedia-based learning media with the provisions of the research criteria in Table 4 as follows:

Table 4. Scoring Rules

No	Category	Score
1	Very good	5
2	Good	4
3	Pretty good	3
4	Not good	2
5	Not good	1

(Sumber: Arikunto [35])

The research results of each respondent calculated the average score obtained. The average score obtained is then converted into a qualitative value using the formula and basic guidelines to determine the level of validity as follows:

$P = \frac{\sum x}{\sum x^1}$ x 100%

Information:
P = Large Percentage
$\sum x$ = Number of Validator Answer Scores
$\sum x^1$ = Total Highest Answer Score

Table 5. Product Validation Criteria

Percentage %	Validity Level	Information
80 – 100	Very valid	Not Revised
60 – 79	Valid	Not Revised
40 – 59	Invalid	Some Revisions
20 – 39	Invalid	Revision
0 - 19	Very invalid	Revision

(Sumber: Arikunto [36])

Data analysis of the effectiveness of interactive CTL media

Normality test.
To determine the average value, the formula is used, namely:

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$$

To calculate the standard deviation (s), the formula is used, namely:

$$s = \sqrt{\frac{n\sum x_i^2 - \left(\sum x_i\right)^2}{n(n-1)}}$$

By testing criteria:
If L0<L then the sample is normally distributed and if L0> L then the sample is not normally distributed

Homogeneity Test.

Examination of the variance homogeneity test aims to determine whether the sample data has a homogeneous variance or not. Test the homogeneity of variance using the F test, with the following hypotheses:

$H_0 : \sigma_1^2 = \sigma_2^2$ the two populations have the same variance.

$H_a : \sigma_1^2 \neq \sigma_2^2$ the two populations have different variances.

To test the hypothesis above, the following formula is used:

$$F_{hit} = \frac{\text{varians terbesar}}{\text{varians terkecil}}$$

Test Criteria are:

$F_{hit} < F_{tab1/2\ \alpha(v1, v2)}$, H_0 accepted

$F_{hit} > F_{tab1/2\ \alpha(v1, v2)}$, H_0 is rejected

Under the condition:

real level $\alpha = 0{,}05$

$v_1 = n_1\text{-}1$ dan n_1 = size of the largest variance

$v_2 = n_2\text{-}1$ dan n_2 = smallest variance size

Data processing shows that Fcount <Ftable, then H0 is accepted. It can be concluded that the two samples have a homogeneous variance. If data processing shows that Fcount > Ftable, then H0 is rejected and Ha is accepted, it can be concluded that the two samples do not have a homogeneous variance.

Research Hypothesis Test. Testing the hypothesis in this study was carried out using the one-party t-test formula where the statistical hypothesis being tested can be formulated as follows:

Ha: There are differences in the learning outcomes of students who study using CTL-based interactive media and students who study with printed books.

Ho: There is no difference in the learning outcomes of students who study using CTL-based interactive media with students who study with printed books.

To find out significant differences in student learning outcomes, the t test formula is as follows::

$$t = \frac{\bar{X}_1 - \bar{X}_2}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where S is the combined variance calculated by the formula:

$$S^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}$$

Information:

t = calculated t value obtained

$\bar{X}_1$ = Average score of the experimental class sample

$\bar{X}_2$ = Average score of the control class sample

n_1 = the number of subjects in the experimental group

n_2 = number of control group subjects

S_1^2 = standard deviation of the experimental group

S_2^2 = standard deviation of the control group

S = combined variance

The test criteria are that Ha is accepted if tcount < ttable and Ho is rejected if tcount > ttable which is obtained from the t distribution list with dk = (n – 1) and level $\alpha = 0.05$. To see the value of the effectiveness of CTL-based interactive media that is being experimented on, the effectiveness calculation formula is used as follows:

$$X = \frac{\text{number of students who completed}}{\text{total number of students}} \text{ x } 100\%$$

3. RESULTS AND DISCUSSION

3.1 RESULTS

The results of the assessment by media experts, material experts, individual trials, small group trials, and limited field trials for all aspects of the assessment are determined by the average score. The results of the assessment are then analyzed and determined to determine whether or not it is appropriate to develop interactive multimedia-based learning media. The average percentage of the results of the assessment of media experts, material experts, individual trials, small group trials, and field trials is shown in Table 6 below:

Table 6. Feasibility of CTL-based interactive media

No	Categorization	Percentage of average score%	Criteria
1.	Material Expert Validation	85,88	Is very feasible
2.	Media Expert Validation	89,41	Is very feasible
3.	Learning Design Validation	86,25	Is very feasible
4.	Preliminary Field Test	89,33	Is very feasible
5.	Main Trial	90,80	Is very feasible
6.	Operational Trial	96,25	Is very feasible
Average		89,65	Is very feasible

Based on Table 6, it can be concluded that the scoring intervals for material expert validation, media expert validation, learning design validation, individual trials, small group trials, and limited field trials show an average of 89.65% with very feasible criteria. So the application of CTL-based interactive media is very feasible and appropriate for learning.

Based on the learning outcomes of students who were taught using interactive CTL-based media at Muhammadiyah 11 Sibuluan Vocational School, the lowest score was 70 and the highest score was 98. The average score was 84,406, mode 83, median 84, and standard deviation 7.741. To see student scores, an interval class is used, namely the score between absolute frequency (the number of students who have learning achievement scores) and relative frequency (the number of percent of learning achievement scores). A complete description of learning outcomes using interactive multimedia-based learning media is shown in Table 7 as follows.

Table 7. Frequency Distribution of Experimental Class Student Learning Outcomes

Class	Interval Class	Absolute Frequency	Relative Frequency
1	70 – 74	4	12,5%
2	75 - 79	3	9,375%
3	80 - 84	9	28,125%
4	85 - 89	9	28,125%
5	90 - 94	3	9,375%
6	95 - 99	4	12,5%
Total		32	100%

Based on the learning outcomes of students who were taught using textbooks at SMK Muhammadiyah 11 Sibuluan, the lowest score was 70 and the highest score was 96. The mean score was 80,969, the mode was 70, the median was 81.5, and

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the standard deviation was 7.137. A complete description of learning outcomes using printed books is shown in Table 8 below:

Table 8 Frequency Distribution of Control Class Student Learning Outcomes

Class	Interval Class	Absolute Frequency	Relative Frequency
1	70 - 74	5	15,625%
2	75 - 79	6	18,75%
3	80 - 84	11	34,375%
4	85 - 89	6	18,75%
5	90 - 94	2	6,25%
6	95 - 99	2	6,25%
Total		32	100%

The data normality test uses the Liliefors test with the null hypothesis (H0) which states that the sample comes from a normally distributed population. Acceptance and rejection (H0) are based on a comparison of the price of Lcount with the price of Ltable at a significant level α = 0.05. If Lcount < Ltable, then the data is normally distributed. A summary of the data normality test results in the experimental class and control class can be seen in Table 9 below.

Table 9. Summary of the Data Normality Test with the Liliefors Test

No.	Data	Class	L count	L table	Conclusion
1	Pretest	Experiment	0,089	0,157	Normal
2	Pretest	Control	0,070	0,157	Normal
3	Posttest	Experiment	0,115	0,157	Normal
4	Posttest	Control	0,102	0,157	Normal

Based on table 4.11, it can be seen that the results of the pretest data normality test in the experimental class obtained Lcount < Ltable (0.089 <0.157) and in the control class also obtained Lcount <Ltable (0.070 <0.157). The same thing also happened to the posttest data normality test results for the experimental class with Lcount < Ltable (0.115 <0.157) and the control class with Lcount <Ltable (0.102 <0.157). Thus, it can be concluded that the pretest and posttest data in the experimental and control classes were normally distributed at the significance level.

A homogeneity test was carried out to find out whether the data is homogeneous or not. To carry out the homogeneity test, Fisher's test is used, The sample has a homogeneous variance if Fcount <Ftable at a significant level α = 0.05. The summary of the results of the data homogeneity test in the experimental class and control class can be seen in Table 10.
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Table 10. Summary of the Data Homogeneity Test with Fisher's Test

No.	Data	Class	F count	F table	Conclusion
1	Pretest	Experiment	0,52	1,83	Homogeneous
2	Pretest	Control			
3	Posttest	Experiment	1,17	1,83	Homogeneous
4	Posttest	Control			

Based on Table 10, it can be seen that the results of the pretest data homogeneity test calculations in the experimental class and control class at a significant level α = 0.05 obtained Fcount <Ftable (0.52 <1.83), so it can be concluded that the pretest data in the two classes have the same or homogeneous variance. Then, in the posttest data homogeneity test in the experimental class and control class at a significant level α = 0.05 obtained Fcount <Ftable (1.17 <1.83), it can be concluded that the posttest data in the two classes have the same or homogeneous variance.

Hypothesis testing in this study was carried out using the t test formula. The t-test was conducted to find out whether there were significant differences between learning outcomes in classes taught using CTL-based interactive media (experimental class) and learning outcomes taught using printed books (control class). The calculation results obtained tcount = 1.84 and ttable = 1.66, so that tcount > ttable at a significant level α = 0.05. Based on these results, H0 is rejected and Ha is accepted, or, in other words, there is a significant difference between student learning outcomes in the experimental and control classes at a significance level of 5%. Thus, the learning outcomes of students who are taught using interactive CTL-based media differ from those of students who are taught with printed books.

To test the effectiveness of the developed CTL-based interactive media, the following calculations are performed:

$$X = \frac{number\ of\ students\ who\ complete}{total\ number\ of\ students)}\ x\ 100\%$$

$$= \frac{26}{32}\ x\ 100\%$$

$$= 81{,}25\%$$

The value of the effectiveness of printed books can be seen as follows:

$$X = \frac{number\ of\ students\ who\ complete}{total\ number\ of\ students)}\ x\ 100\%$$

$$= \frac{20}{32}\ x\ 100\%$$

$$= 65{,}5\%$$

Based on the calculation of the effectiveness test on both, the results showed that the learning outcomes of students who were taught with CTL-based interactive media were higher than those of students with printed books (81.25% > 62.5%). Thus, it can be concluded that CTL-based interactive media is more effectively used in learning computer systems at SMK Muhammadiyah 11 Sibuluan compared to using printed books.

3.2 DISCUSSION

Based on the results of the validation that has been carried out, CTL-based interactive media products are declared feasible to continue in field trials. The developed CTL-based interactive media meets standards based on the design of learning materials, learning media, and learning designs. For the assessment of learning material experts, a score of 85.88% was obtained, which was categorized as very feasible, for an assessment from learning media experts, a score of 89.41% was obtained, which was categorized as very feasible; and for an assessment from learning design experts, a score of 86.25% was obtained, which was categorized as very feasible.

After the experts stated that this CTL-based interactive media product was very feasible to try out in the field, field trials were carried out according to the procedure, namely individual trials, small group trials, and field trials. The score of student responses in individual trials was 89.33% (Very Eligible),

small group trials were 90.8% (Very Eligible), and field trials were 96.25% (Very Eligible). Based on the results of the questionnaire, which were validated by material experts, media experts, and design experts and then continued with product trials, it can be concluded that CTL-based interactive media in computer system learning is stated to be very suitable for use as learning media for students of SMK Muhammadiyah 11 Sibuluan.

The effectiveness test of the developed CTL-based interactive media was carried out to fulfill the procedures of the ADDIE model. The purpose of testing the effectiveness of this product is to determine whether it needs to be used continuously because it is effective or discontinued because it is not effective.

Testing the effectiveness of the product on the developed CTL-based interactive media has been carried out by comparing the average value of student learning outcomes taught using CTL-based interactive media with those using printed books. From the results of research data processing, there were differences in learning outcomes between students who were taught using CTL-based interactive media and those who used printed books (81.25% > 65.5%).

According to Soimin [17], contextual learning is a holistic learning concept, in which learning material is associated with the surrounding environment or the context of daily life, both social, cultural, and personal, of students so that it will produce meaningful learning and students can have knowledge and skills that can be applied to various problems.

This is in line with Rusman [18], Contextual learning is a learning system that matches the brain and generates meaning by connecting academic content with context in students' daily lives. According to Nurdyansyah [19], the CTL approach is learning that allows students to apply and experience what is being taught by referring to real world problems, so that learning will be more meaningful and enjoyable.

According to Bayuaji [20], CTL-based interactive media can improve learning outcomes more than conventional models or lectures. Then, according to Soleha [21], the application of the CTL model to learning media is a solution for developing learning that has a good influence on learning outcomes and is suitable for use as a learning medium in schools.

Furthermore, according to Merta [22], the CTL learning model in interactive media can be given an emphasis on the inquiry component so that it can help and facilitate students in learning. According to Zuhra [23], interactive media based on the CTL learning model shows decent and effective results in improving student learning outcomes. According to Novita [24], interactive learning media is effective in increasing the mastery of computer system concepts in terms of student learning outcomes, and it is found that the increase in student learning outcomes is between pretest and posttest scores.

This is also in accordance with the results of the development of CTL-based interactive media at SMK Muhammadiyah 11 Sibuluan. which obtains proper results in terms of product development and is effective in improving student learning outcomes in learning computer systems. In addition to the use of this media, the teacher's ability also plays an important role as a motivator that greatly influences student learning outcomes.

4. CONCLUSION

Based on the formulation of the problem, objectives, results, and discussion of research on the development of interactive media based on the CTL learning model that has been described previously, the following conclusions can be drawn:

1. CTL-based interactive media products developed for students of SMK Muhammadiyah 11 Sibuluan have met the requirements and are suitable for use as learning media. This was concluded based on the results of research from learning material experts (85.88%), media experts (89.41%), design experts (86.25%), student responses to individual trials (89.33%), small group trials (90.8%), and field trials (96.25%), which overall stated that CTL-based interactive media was in the "very good" category.
2. The effectiveness of the developed CTL-based interactive media is considered more effective than printed books. The results of testing the hypothesis prove that there is a significant difference between the learning outcomes of students who are taught using CTL-based interactive media and the learning outcomes of students who are taught using printed books. This is indicated by the results of data processing, tcount = 1.84 and ttable = 1.66, so that tcount > ttable at a significant level $\alpha = 0.05$. So the learning outcomes of students taught with CTL-based interactive media have an effectiveness of 81.25% higher than learning outcomes using printed books, with an effectiveness of 65.5%.

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