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Implementation of Contextual Teaching and Learning Model on Web-Based Learning Multimedia for Database Subjects

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ABSTRACT

Database is one of the important components in an information system because the database will provide information that will be used by the user. Preliminary research reveals information that understanding material regarding Entity Relationship Diagram (ERD) is still difficult for students to understand. Understanding database concepts requires relationships that are based on perceptions in the real world. Contextual Teaching and Learning (CTL) is a learning concept that will help teachers to relate learning material to the actual situation experienced by students. This research uses comparative causal quantitative research and applies the Extensive Lifecycle (ELC) software development method. This research got the following results: 1) Multimedia web-based learning has a percentage of 188.5 with the category "Very Good" by media experts. 2) The use of web-based learning multimedia with the CTL model has been proven to improve students' conceptual understanding as evidenced by an increase in the mean gain value of 0.59 with the effectiveness criterion of "moderate". 3) Based on the correlation test, there is a relationship between student gain scores and multimedia learning. 4) Students provide an assessment of multimedia learning by giving a score of 312 from the ideal score of 334.

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1. INTRODUCTION

Almost every aspect of the utilization of computer devices in an organization/company is linked to a database, as it is one of the main supporting components of any information system, and most applications, especially those involving data processing, can be ensured using databases (Hidayat *et al*., 2017). All data that will be treated will be stored in a file warehouse called database (Kurniawan, 2016). According to conventional wisdom, Active Database Management System (ADBMS) is a conventional database with the potential to operate in real-time (Sucipto, 2017). It is one important component of the information system because it would provide the information that the user would later use.

Preliminary research conducted in the form of an interview for one of the database teachers in one of the SMK in Bandung subjects revealed that an understanding of the entiy relationship diagram (ERD) was still difficult for the elite-student student studying the ERD material. It is essential to have a database design for academic information systems in educational institutions, especially in institution of higher learning. This is because, with a database design, any computerized system may be built on solid ground, minimizing any potential anomalies that might arise during system construction (Khotijah, 2016). The basic problem with some students is that students still cannot distinguish from every existing ERD component. Students are struggling with identity identification in the design ERD, this is because there are cases that the student has never experienced before.

Understanding the concept of the database requires a relationship based on a perception in the real world of a host of objects and interconnections between them. According to the understanding of the data itself, it represents a tangible world fact that represents real objects like humans, animals, goods, concepts, and so on (Chairina, & Candrasa, 2022). The process of teaching learning is an activity that involves teachers and students in achieving the purposes of learning (Emda, 2018). The active process of learning and teaching is that when teachers can realize an atmosphere of learning and can manifest the learning process in class (Juanengsih *et al*., 2017).

Based on these issues, a learning approach needs that can facilitate students to learn based on their life experiences. Contextual teaching and learning (CTL) are a concept that will help teachers enhance a learning material with the actual circumstances of students (Zulaiha, 2016). With this, CTL will encourage students to be fully involved in the learning process in order to obtain the material to be studied. The main components in CTL are platelets, inquiry, inquiry, studied communities, modelling, reflection, and authentic judgments (Karim, 2017). The components will encourage students' involvement in finding their knowledge, so students will be motivated to follow the learning activity.

Using web-based learning media makes it possible to support all learning stages in a CTL model. On web usage, teachers can include theories, problems, videos, even animation to support learning. Web-based learning can be effectively used to cut the gap between theory and practice, and even as an improvement in qualified nurses. This means that if we use multimedia web-based learning will enhance the student's ability not only in theoretical comprehension but also in psychological matters. For this reason, researchers have decided to select multimedia web-based learning to help students with problems in database subjects.

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2. METHODS

In this study employs quantitative research methods with comparative causal design. The reason for selecting the research design is because it aims to know the impact that multimedia already developed on the increasing student conceptual knowledge of the ERD material (Entity Relationship Diagram).

As for the development of multimedia learning software that will be applied to multimedia this learning is the comprehensive life-cycle model (SHM) developed by Munir (2015). SHM has several phases in its development phase, which are analysis, design phase, development phase, implementation phase, and assessment phase.

2.1. Research Procedure

The research procedure carried out is presented by a *flowchart* in **Figure 1**.

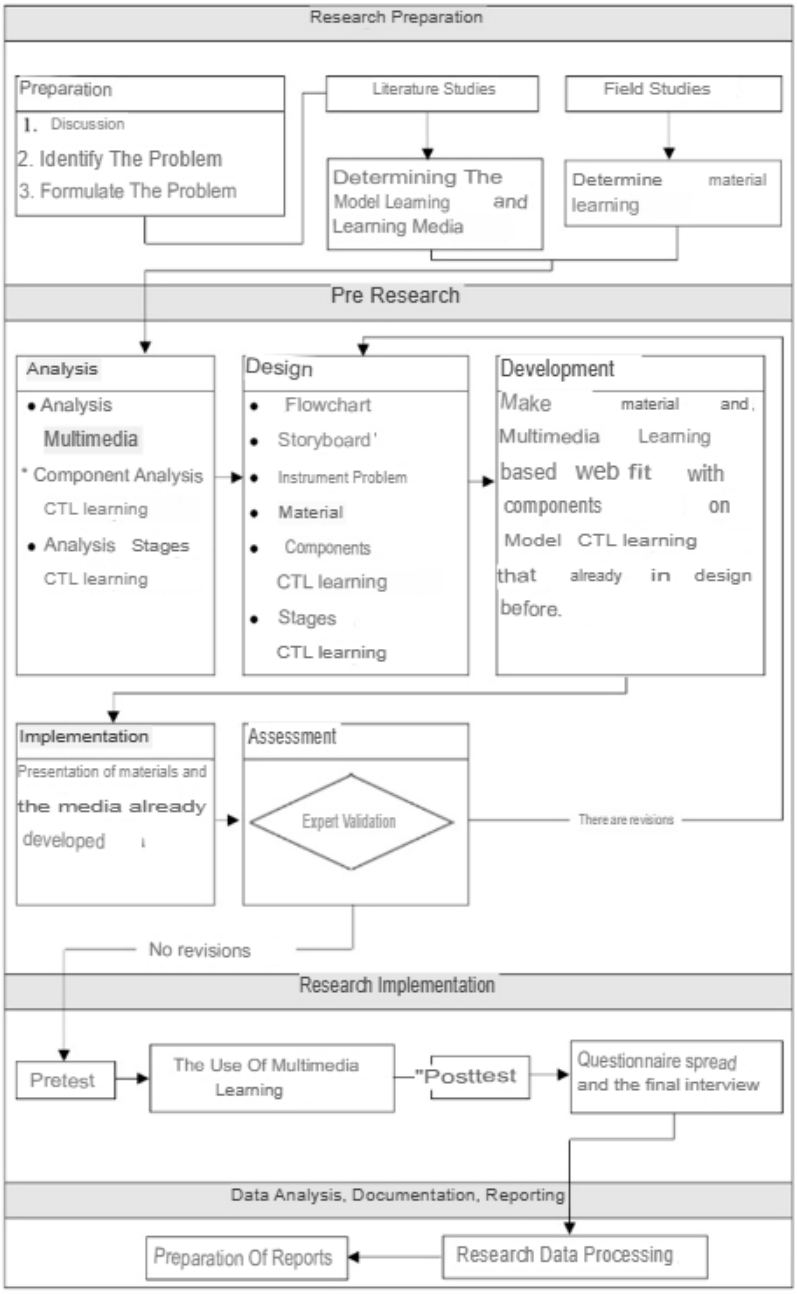

Figure 1. Research Procedure

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As for the description of the research procedure already illustrated by **Figure 1** will be described as follows:

1) Research Preparation

In the beginning of the study, the preparatory stage that is the initial stage of this study. At this stage have a discussion on the learning issues present in students especially in the subjects of database and reinforce them with literature studies. At the time it also did field studies to get the data needed for research. The activities being done are as follows:

a. Study Literature

This study collects data from sources such as journals, previous studies, and books as boosters in the concepts and production of multimedia to be made.

b. Study Field

The study by interviewing teachers according to the subjects that will be studied to get valid data and to fit the valid curriculum. The teacher's ultimate interview is to know the difficulty experienced by learners in terms of learning materials.

2) Pre-Research

At this stage there is a multimedia development of learning and research instrument. For multimedia learning development, this research adopted an Extensive Life-Cycle (ELC) software development method. There are 5 stages found in this method of development, the critical, design, development stages, implementation stages, and assessment stages.

a. Analysis

At this stage it contains multimedia analysis, and the learning component analysis in the CTL model. At material analysis, done material analysis to be given to learners, materials to be given were adapted to the concept in the CTL learning model. At multimedia analysis, there is also a multimedia learning analysis that can include the learning scenario from the CTL model. And at CTL learning stage analysis, there are stages analysis in a CTL learning model adapted to the learning materials to be given.

b. Design

After analyzing the materials, media, and learning stages, the data will be the subject of the development of the multimedia, based web that will be developed. The designs to be made are storyboard, flower-chart, relevant instruments, defense materials, and CTL learning stages to be implemented. The design will guide the multimedia design to be created. At this stage the instrument for problems already made will be validated by the educationists to know that the issues already made by are already viable or not.

c. Development

At this stage of development, a flower-and-storyboard project of learning is carried on a flowchart and storyboard that has been done at the design stage, thus becoming a prototype in multimedia development of learning. Whereas the materials designed by it will be incorporated into multimedia learning.

d. Implementation

The material presented is presented as well as multimedia based on the developing CTL stages.

e. Research Assessment

After that, it will be validating by experts to know that multimedia software that has been developed is viable. Validation is done for multimedia as well as for the material content that is in multimedia. If the software is said to be inviable, then it isa revision process, but if feasible, then it can continue for the implementation stage.

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3) Research

At this stage, the highly regulated software used by experts will be applied to students who have or are studying materials used in the multimedia of already established learning. Before multimedia gives, the student will be given the pretest, after which the student will observe. After observing, the student will use multimedia, after which the student will be given a post test.

4) Data Analysis, Documentation, Reporting

At this stage researchers will examine the data obtained from the research that has been done. After that the student will be interviewed and given by questionnaire to know the advantages and flaws of the software given by the researcher. From this data a flaw in the software will be used as a recommendation material for further research.

2.2. Research Design

The research design used was pre-non-existent with a one-group prepackaged design shown in **Table 1**. Thus, the results obtained after treatment are more accurate, as they are comparable to the circumstances before treatment.

Tabel 1. One group pretest post test design.

Pretest	Treatment	Post test
O_1	X	O_2

Description:

O_1 : pretest results (before given treatment)

X : Treatment given

O_2 : post test results (after given treatment).

2.3. Population dan Research Sample

The population of this research was sophomores at SMKN 1 Cisarua with software engineering programs. Whereas the sample from this study was the xi class RPL protege who had or was studying the material Entity Relationship Diagram (ERD). The sampling technique used by researchers is the simple random sampling, which is the sampling technique where each member of the population has the same opportunity to be chosen as a sample. The reason the researchers chose the simple technique random sampling is because at the first semester especially the xi RPL class cuss were going to study the database subjects with an Entity Relationship Diagram (ERD).

2.4. Research Instrument

The population of this research is sophomores at SMKN 1 Cisarua with software engineering programs. Whereas the sample from this study was the sophomores who had been or were studying the material about *Entity Relationship Diagram* (ERD). The sampling technique used by researchers is the simple random sampling, which is the sampling technique where each member of the population has the same opportunity to be chosen as a sample. The reason the researchers chose the simple random sampling technique was because at the first semester especially the sophomores RPL would study the basis subjects with matter *Entity Relationship Diagram* (ERD).

2.5. Analysis Instrument

Data analysis obtained from field studies can be directly described because data is obtained through interview processes. Instrument assessment analysis and student

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responses use scale rating. The resulting data of the instruments drawn from the testing of the students will first be an instrument analysis of validation, religious testing, the degree of hardship, and the problem. The analysis for the final interview instrument to the students will be described by the results. As for the analysis of the learning media validation will be categorized in four categories using a scale such as on **Figure 2**.

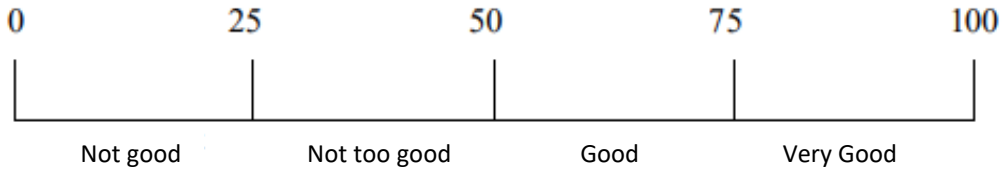

Figure 2. Category interval results from expert validation responses

N-gain test analysis aims to see increased student capabilities. Such calculations can be obtained from the average students' scores on pretests and post-tests. Next n-gain will be classified on **Table 2**.

Table 2. N-gain Classification**.**

Presentation	Effectivity
$g \geq 0.70$	High
$0{,}30 \leq g < 0.70$	Average
$g < 0.30$	Low

3. RESULT AND DISCUSSION

3.1. Research Preparation

In the early stages of research planning, researchers did literature and field studies first. On literature studies, researchers have found that multimedia web-based learning works to improve learning results, one of the early studies already done is by Sulfemi & Yuliani (2019) who gets the results that 53.3% of students' natural acuity increases to 93.34%, Whereas the result of the student's ability to answer the teacher's question experienced an increase in the number of students that all 16 people increased to 29 of the total number of students by 30. To help students understand what they have read, the PQ4R strategy is used. It consists of the following steps: Preview (quickly reading), Question (asking questions), Read (Reading), Reflect (reflection), Recite (asking questions of one's own), and Review (reviewing thoroughly) (Sudarman, 2009).

At a field study, researchers conducted an interview with a database subject teacher in smkla11. The problems encountered according to the teacher's interview were students had difficulties in ERD materials and normalization; Students have difficulty receiving learning materials, so that when learning there are students who pay attention, and there are those who don't; And the learning method used is the talk method and at the time explaining the material using power point.

3.2. Pre-Research

3.2.1. Analysis Stage

At the analytical stage, researchers do multimedia analysis, components of contextual teaching and learning (CTL) learning and CTL learning stages analysis. The results obtained for multimedia analysis are the hardware and software needed for the manufacture of media. For the stage of the CTL learning component analysis, researchers determine the CTL components implemented into the multimedia of modelling, constructivism, incubation,

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questioning, and tangible judgment. Whereas the components of society study and reflection are done by hand. Then for CTL learning stages analysis, researchers will undertake the learning steps of the introduction, core, and conclusion.

3.2.2. Design Stage

At the design stage, researchers design the content of matter, instruments of matter, storyboards, flowery charts, CTL components and the learning stages CTL. The content of matter designed by researchers is to pass the matter through a simple game of drag and drop. The design of the CTL component to be implemented into multimedia learning, which is: on the modelling component there will be a learning video; Constructive components or building new knowledge based on experience, will be obtained on learning videos; The asking component is found at the end of the learning video that will make students have questions; Incubators are present in student observation assignments; And the real assessment component lies in the process students do from watching the learning video, studying the material from the simple game of drag and drop, doing the exercises on the problem, doing observation duty, and doing the evaluation. Next for the design of the CTL learning stage is the preliminary, core, and conclusion stages.

3.2.3. Development Stage

This is the stage in which researchers perform multimedia, web-based development based on previously planned designs. Here is the interface display of the developed multimedia:

This web-based multimedia learning process USES HTML programming, PHP, CSS, and JavaScript programming languages. Here are the stages in the construction of an interface on the software Sublime Text.

3.2.3.1. Front Page

On the front page contained 7 available pages shown in **Figure 3**. However, if the student has not already begun the process of login, then the student cannot access the available menus.

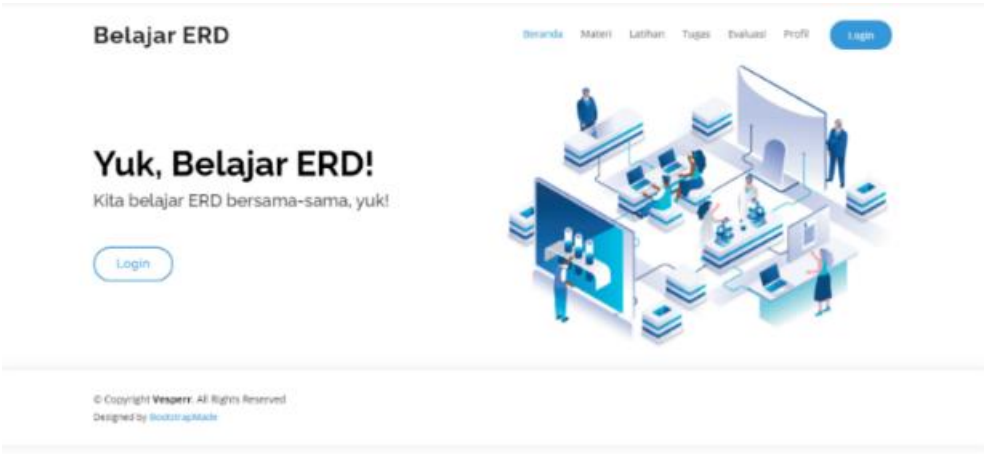

Figure 3. Front page.

3.2.3.2. Login Page

If the student already has an account, then the student can perform the login process shown in **Figure 4**. But if the student does not have an account, then the student is required to register themselves first.

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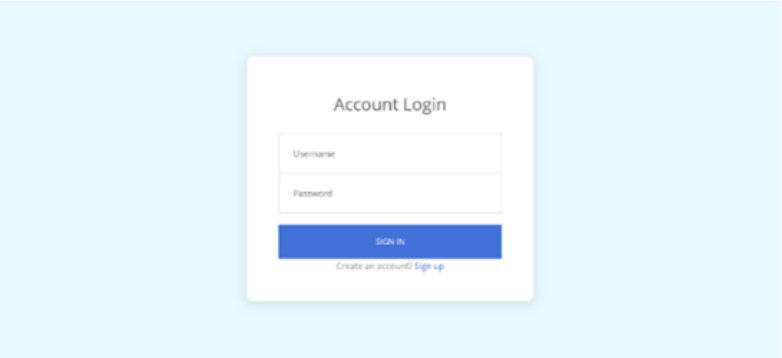

Figure 4. Login page.

3.2.3.3. Signup Page

For students who will register the account, the student is required to fill a form in **Figure 5** and enter the full name, username, class, group, and password to register the account.

Figure 5. Signup.

3.2.3.4. Home Page

The student's front page has 7 selected menu choices. On this front-page in **Figure 6** student are required to watch the learning video first to discuss it with other students and with researchers.

Figure 6. Main page.

3.2.3.5. Content Page

The menu of each material in **Figure 7** will be a drag and drop menu that will require students to work on. Here students can answer games according to available options. And if all the "drop here" columns are filled, then the student can submit the answers that have been filled.

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Figure 7. Content page.

3.2.3.6. Exercise Page

The practice page in **Figure 8** provides exercises according to selected materials. Students are required to answer any question if will submit the answer.

Figure 8. Exercise page.

3.2.3.7. Assignment Page

On this page shown in **Figure 9**, students will know the theme and reference link of the assigned assignment theme. After students have observed according to a predetermined theme, then students can fill in the provided column of answers and students can select the answer files and upload the assignment's answers.

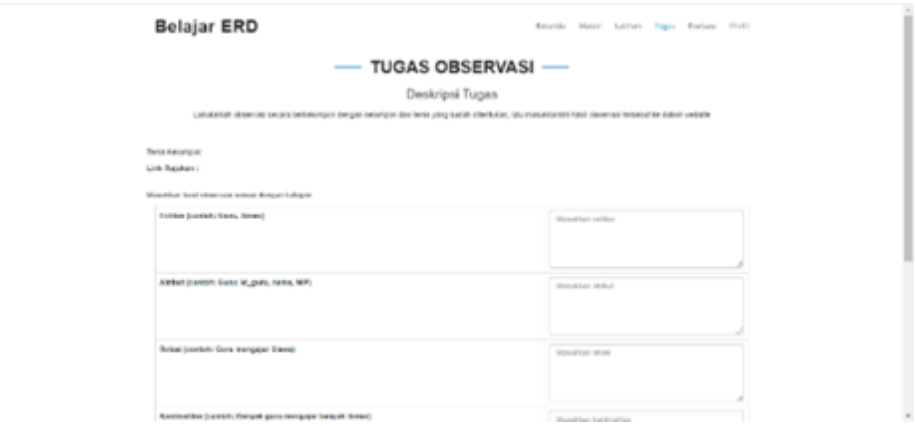

Figure 9. Assignment page.

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3.2.3.8. Evaluation Page

On this page, students are required to determine the entities, attributes, associates, and virtue based on the provided story issues shown in **Figure 10**. Once the student has become convinced of the answer, then the student can submit the answer.

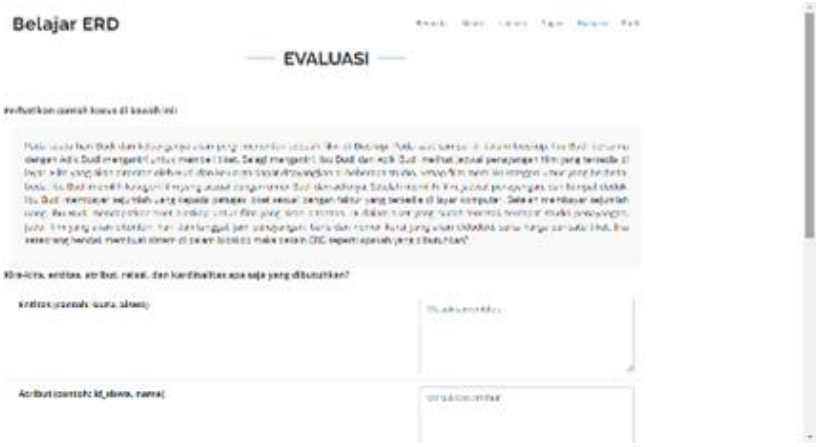

Figure 10. Evaluation page.

3.2.3.9. Profile Page

The profile menu provides a list of names, usernames, groups, and class of students who were registered at the time of sign-up shown in **Figure 11**. On this menu also students can see the exercise values, the value of the assignment, and the value of assessments that have been done or collected before.

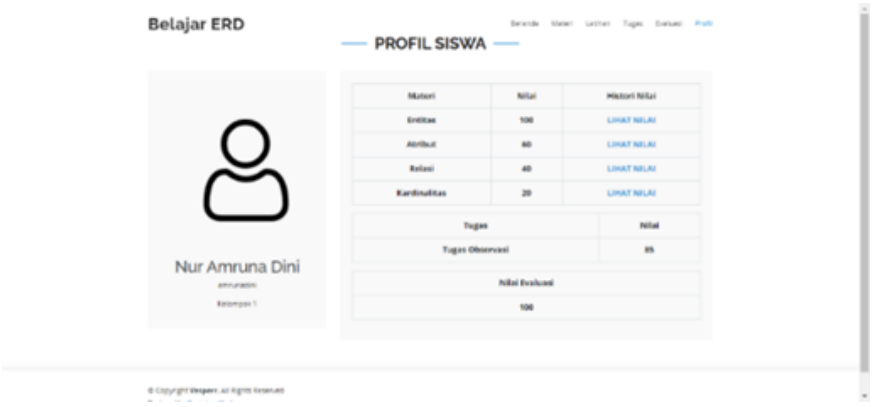

Figure 11. Profile page.

3.2.4. Implementation Stage

The multimedia of learning that researchers are developing is a learning tool that applies the contextual teaching and learning model to address a problem. There are five CTL components that researchers are trying to apply to the multimedia.

3.2.4.1. Modelling

In the study video provided on the home page, researchers present hospital examples. In the video presented, researchers ran a story scenario on visualization of someone who was sick enough to be taken to the hospital to receive a doctor's checkup to receive a prescription.

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3.2.4.2. Constructivism

Based on the given video, there will be a process of building knowledge based on previously acquired knowledge. The video given was a visualization of the process that occurred when students were receiving treatment at the hospital.

3.2.4.3. Asking

One of the components found in the contextual teaching and learning model is the questioning process. In essence, the question process is intended as a reflection of the individual's curiosity. To arouse students' curiosity about the entities, attributes, relationships, and qualities found in the learning video, so researchers provided a scenario in which students would wonder about the materials.

3.2.4.4. Inquiry

The scenario for the incubation component applied by researchers to multimedia learning is that when students do the simple game of drag and drop that has been provided and when students are doing observation assignments with their groups.

3.2.4.5. Real Assessment

The scenario for a real assessment found in the multimedia learning developed by researchers is during a process students perform from beginning learning to end learning. Starting from watching a learning video, doing exercises, playing a simple game of drag and drop, doing observation duty, to doing an evaluation.

3.2.5. Assessment Stage

3.2.5.1. Instrument testing process

Researchers make up an instrument of several indicators with 75 different matters. On the test subject of 27 students. The instrument test includes tests of validity, religious testing, hardship levels, and differentiation with the Anates application. Analysis of the problem obtained 63 items of the problem are declared valid, whereas 12 of the problem is declared invalid. Analysis of the problem is known that a coefficient value (r11) of 0.90 with a "high" category. This data gets an r11 of 0.90 on which it already qualifies and can be said to be used. According to test levels of difficulty, data from 18 problems go into the easy category, 46 go into the moderate category, and 11 issues go into the hard category. Based on the results of the differentiating test results, the data of 8 grains of matter is pronounced very bad, 12 items of matter are stated bad, 15 articles of problem stated enough, 29 articles of good judgment, 11 articles of good judgment.

3.2.5.2. Expert validation process

Expert validation tests are being made to earn learning multimedia worthiness that has been developed. There are two experts involved in the multimedia feasibility testing phase of the study, that of a media expert and a material expert. The instrument used by multimedia tester refers to the 2004 multimedia mania. Here are the results of validation visible on **Table 3**. At **Table 3**, show that multimedia web-based learning has a score on aspects of the mechanism of 29.5 from 32, a multimedia element of 14 from 16, information structure of 30 from 32, a documentation of 15 from 16, and a quality content of 100 out of 104. The total score from both experts was 188.5 out of the total ideal score of 200. If the score is interpreted into the **Figure 14**, it will be as shown in the following:

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Figure 14. The scale of the media validation.

Table 3. Validation Result

Aspect	Tester	Criteria	Ideal Score	Scores
Element Mechanism	2	4	32	29.5
Multimedia	2	2	16	14.0
Information Structure	2	2	32	30.0
Documentation	2	2	16	15.0
Content Quality	2	5	104	100.0
Total			**200**	**188.5**

3.3. Research Execution

This step is implemented after instruments of matter and multimedia are already considered worthy by experts. The description of the implementation process is as follows:

3.3.1. Pretest

After opening the learning process, researchers give the pretest questions given before students use multimedia learning. The pretest given to students is a matter of multiple choice of 25 issues consisting of 5 individual fruits.

3.3.2. Multimedia use based on web in the teaching of ERD

After the student has done the pretest problem, the student will be directed to use the newly developed multimedia learning media. Students will be directed to watch the learning video and then students will be expected to study the material first, and then students will work on the provided problem exercises, after which the student observes the group, until finally the student will do the evaluation.

3.3.3. Post test

The next stage after students use multimedia learning is that students are doing post testing. The post-test is about 25 problems of multiple choice, consisting of five problems at a time.

3.3.4. Multimedia assessment questionnaire

After the students have done the post-test, the student will be given a Multimedia assessment. The questionnaire will be filled by the student refers to Multimedia Mania 2004-student checklist. After the student fills the questionnaire, there will be a process of interviews to identify obstacles and questions regarding the media.

3.4. Analysis Stage

3.4.1. Student response angular results

Questionnaire was given to the student after the research. The list of aspects that students must judge by the multimedia mania 2004-student checklist. As for the aspects that students

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value are mechanisms, multimedia elements, the structure of information, documentation, and the quality of content. Here are the results of the student's responses at **Table 4**. Based on **Table 4**, it shows that web-based learning multimedia score on mechanisms of 50 out of 52, multimedia elements of 23 out of 26, information structures of 50 out of 52, documentation of 23 out of 26, and content quality aspects of 166 of 178. The combined score of student responses is 312 out of the total ideal score of 334.

Tabel 4. Student response angular results

Aspect	Students Total	Criteria Total	Ideal Score	Scores
Mechanism	13	4	52	50
Multimedia Element	13	2	26	23
Information Structure	13	2	52	50
Documentation	13	2	26	23
Content Quality	13	5	178	166
Total			**334**	**312**

3.4.2. Pretest, post-test, and questionnaire response results

To know the student's cognitive increase, the researcher USES an instrument about pretest and post-test shaped multiple choice of 25 items each. Pretesting is used to test students' cognitive levels before students use multimedia web-based learning with a model contextual teaching and learning. After the student has completed the learning process, the student will be given the post-test. Pretest and post-test assessments can be seen on **Table 5**.

Tabel 5. Pretest and Post test Results

No	Respondents	Pretest Results	Post Test Results
1	R1	72	88
2	R2	36	76
3	R3	20	72
4	R4	68	84
5	R5	60	88
6	R6	20	64
7	R7	60	80
8	R8	56	92
9	R9	56	84
10	R10	52	84
11	R11	52	80
12	R12	60	68
13	R13	56	88
Average		**51,38**	**80,62**

Based on the above chart, it can be seen in **Figure 15** that a very signific increase between the students' before and after using multimedia learning with the contextual teaching and learning model. This can be known by the increased value of pretest and post-test. The value recovers from pretests and posttests based on the chart's calculations is 51.38 and the post test scores by 8062. The value of the results can be described in the diagram below.

Based on the above charts it is likely to be known that the pretest and posttest values rise in value. From its ratio a discrepancy of 28.28. After the value gains from pretest and post test results, researchers look for a correlation between the value gains on the questionnaire

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student response. Pretest calculations, posttest, gain, and student responses listed on **Table 6**.

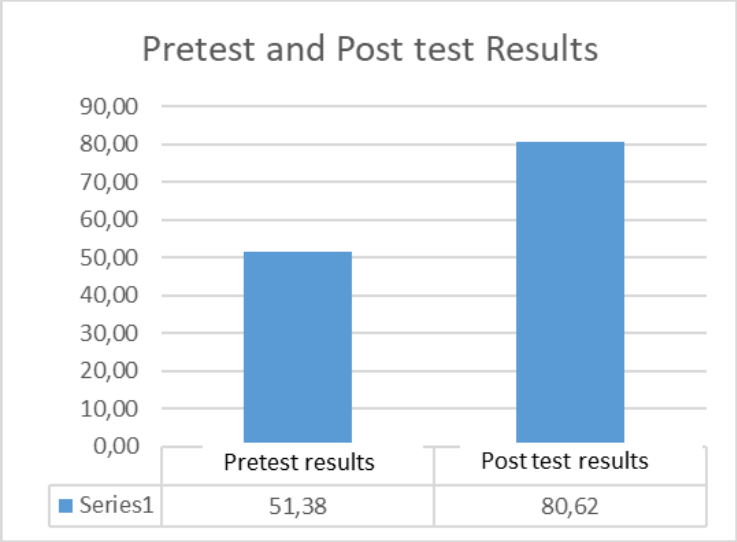

Figure 15. Pretest and post test results diagram.

Based on **Table 6**, gain is grouped by student group. In the upper group, by 0.54 gain in the "moderate" category, while for middle groups it has a gain value of 0.60 in the "moderate" category, and in the lower group it has a gain value of 0.61 in the "moderate" category. The value of the value gain from the upper, middle, and lower groups gets a result of 0.59 included in the "moderate" category. After gaining some value gain, researchers are trying to connect a correlation between the value gain and the student's assessment of the media. The relationship is presented at **Table 7**.

From the calculations it can be known that there is a positive relationship of 0.636 between the student's gain value and the student's assessment of media. According to **Table 7** the coefficient correlation found by 0.636 falls into a very strong category. Therefore, there's a very strong relationship between the gain value and the questionnaire assessment of students.

Tabel 6. Assessment result of student and n-gain.

n	r_{xy}
13	0,636

Table 7. Research result table.

		Pretest	Post test	Gain	Multimedia Assessment
Upper Group	Average	70.00	86.00	0.54	22.00
	Standard deviation	2.83	2.83	0.05	1.41
	Maximum value	72.00	88.00	0.57	23.00
	Minimum value	68.00	84.00	0.50	21.00
Middle Group	Average	56.50	83.00	0.60	24.25
	Standard deviation	3.34	7.33	0.19	1.04
	Maximum value	60.00	92.00	0.82	25.00
	Minimum value	52.00	68.00	0.20	22.00
Lower Group	Average	25.33	70.67	0.61	24.67
	Standard deviation	9.24	6.11	0.05	0.57
	Maximum value	36.00	76.00	0.65	25.00
	Minimum value	20.00	64.00	0.55	24.00

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4. CONCLUSION

Multimedia, web-based implementation design with contextual teaching and learning models that are implementing modelling components, constructivism, inquisitiveness, questioning, and tangible judgment.

The multimedia, which experts already validate, has a 94.25% rating, which can be categorized as "excellent" and worthy of use. From the results of the pretest and post-test, it has been obtained that students experience an increased value. On pretest students have a regular value of 51.38 while for post-test students have halts value 80.62, while the gains value is 0.59 with a "moderate" in effectiveness.

Based on the calculations for finding a correlation between the student's gain values with the questionnaire media assessment has a r_{xy} value of 0.636, it belongs in a very strong category. Therefore, there's a very strong relationship between the gain value and the questionnaire assessment of students. Student responses on web-based multimedia learning score 312 out of a total ideal score of 334.

Based on research already done, there are some suggestions that can be used as a substitute for further research, following Suggestions that can be used:

(i) Multimedia may be developed to be more interactive, which is that students can have group discussions as well as discussions with teachers on the websites already developed.
(ii) Context Learning Component.

The contextual teaching and learning component implemented into the multimedia of learning to complete, including the seven CTL components of constructivism of inquisitiveness, of inquiry, of real judgment, of learning society, and of reflection into the multimedia of learning.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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