MULTIMEDIA LEARNING APPLICATIONS AS EQUIPMENT HELP LESSON TECHNIQUES OF CHEMICAL LABORATORY WORK

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ABSTRACT

The basic technique of chemical laboratory work (TDPLK) is one of the subjects that is being studied by vocational students in chemical analyst department. Based on the discussion of TDPLK learning process in SMK Negeri 1 Cikampek not maximal, accept the material in class using only the media book so that the students difficulties in understanding the material that contains some practice. Solution offered to solve existing problems by building a computer-assisted learning media using the method Computer Assisted Insstruction (CAI). Based on the testing of questionnaires to students of engineering majors as measured by Likert scale shows a total score of 1136 which states that students more easily understand the material and practicum with the help of multimedia applications, the results of interviews with teacher analysts show teachers assisted with multimedia applications TDPLK, based on comparison of the average tested In the control class and the experimental class showed the TDPLK multimedia application yielded significantly better results.

Keywords: Multimedia Learning, CAI, Chemical Analyst, Basic Chemical Laboratory Technique, Likert Scale.

1. INTRODUCTION

The basic technique of chemical laboratory work (TDPLK) is one of the subjects studied by vocational high school students (SMK) majoring in chemical analyst. TDPLK is studied when students are in class X (ten) because the material contained in TDPLK's eyes is the basis of chemical analytical majors. In TDPLK students are given basic materials and practice such as weighing with analytical balance, laboratory waste handling, studying basic techniques of titrimetric analysis and gravimetry.

The learning process of TDPLK taught in the competence of chemical science expertise of Vocational High School 1 Cikampek, TDPLK learning is not considered effective, based on interview result, when the chemistry department has only 2 lab labs used for class X, XI And XII, because the practicum done by the students of class XI and XII takes a long time. In addition to the lab labs, the tools and supporting materials available are still limited, so that the TDPLK subject teachers only provide materials on the board.

Based on the results of questionnaires calculations taken from 74 students of X class of Chemical Analysts showed that students expressed attitude that leads to the students feel difficult to understand learning materials TDPLK, with the results of questionnaires that show this agree attitude can be concluded that the students really feel difficult when at the time of giving Material theory .. This has an impact on the difficulty of students in doing the quiz given by the teacher so that the value of quizzes obtained by students in the sense has not been optimal.

Multimedia interactive learning is one of the computer-based learning media that is usually used as a media tool peyampaian message between educators to learners that enable communication between people and technology through systems and infrastructure in the form of application programs and the utilization of electronic media as part of its educational methods. Interactive multimedia learning has several advantages such as more interesting, clearer, more efficient in terms of time.

Based on existing problems in TDPLK learning in SMK Negeri 1 Cikampek, interactive multimedia learning can be a tool in the learning process. In the multimedia application of learning allows students to understand the material more clearly in addition to that in the multimedia application of learning can be inserted TDPLK simulation and also evaluation. This is what encourages the need for a multimedia-based media learning by raising the title "Multimedia Applications Learning As A Tool for Learning Basic Chemical Engineering Subject Work Chemistry" with the purpose of applications that will be built can help the process of learning and teaching subjects TDPLK in SMK Negeri 1 Cikampek. The purpose of this research is as follows:

1. Make it easier class X students in understanding the materials and laboratory techniques basic chemistry laboratory (TDPLK).
2. Make it easier teachers to show how the tools work tools supporting basic laboratory techniques laboratory work (TDPLK) through simulation.
3. Make it students in doing the test subjects basic engineering chemistry laboratory work (TDPLK).

RESEARCH CONTENTS

2.1 System Description

In the design of this system will be built an interactive multimedia applications in which contains basic materials engineering chemistry laboratory work. This application is built using Computer Assisted Instruction (CAI) method. Features contained in the application that will be made is the delivery of material, simulation and evaluation. Frontend multimedia application learning basic techniques of desktop-based laboratory chemistry work.

Backend multimedia application learning basic technique of chemistry work of web-based chemistry laboratory, The description of system description to be built can be seen in Figure 1.

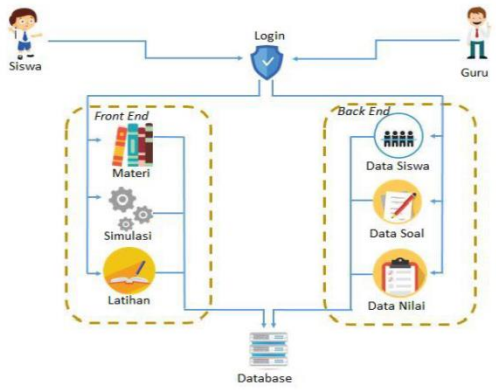


Figure 1. System description description

1.2 Built Concept Description

To generate a multimedia application that is used to convey material with visual media, it takes a good visual concept to avoid errors in the delivery of material Here is a table of conceptual descriptions of applications to be built can be seen in table 1 below.

Table 1. Description of the Built Concept of Applications

The Building Elements	Description
Title	Application of Multimedia Learning Basic Chemical Laboratory Technique
User	Student and teacher of Class X Chemical Analyst
Audio	Audio consists of backsound instruments and button sounds
Animation	Animation in the built application is 2D animation.
Interactivity	Interactivity between users and applications can be found in the simulation and evaluation menu, where users are required to perform simulation stages and answer questions already provided by the application.

To generate an interactive multimedia application that is used to convey messages (information and skills) with visual media. Here is the visual concept of interactive multimedia-based learning media applications.

1. Screen size format

The built application is designed with the size 1366 x 768 pixels. Here is a picture of the screen size format can be seen in Figure 2

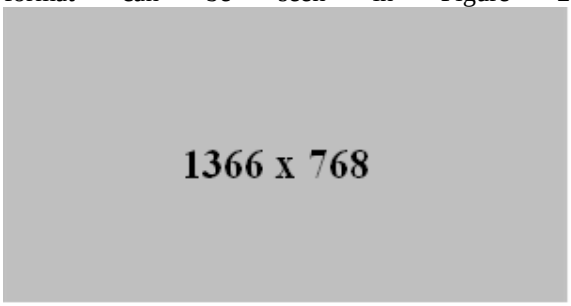


Figure 2. Screen Size Format

2. Layout

Layout is the positioning settings of application elements such as images, animations, and text. So the message or information in the application can be delivered properly. Here is a sample image of the layout can be seen in Figure 3

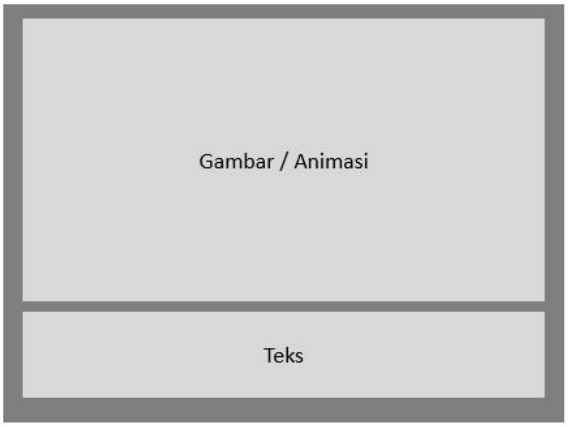


Figure 3. Layout

3. Color

The colors used in this multimedia application use pastel colors. Below is a sample image of pastel colors can be seen in figure 4

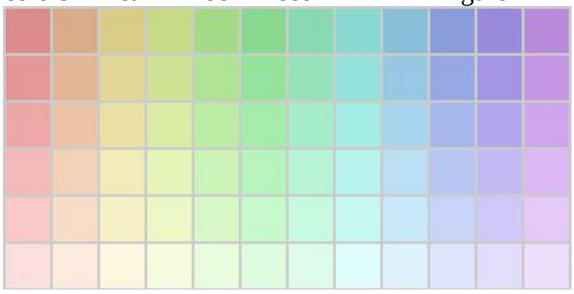


Figure 4. Pastel Color

2.3 Analysis of Multimedia Applications Built

Multimedia Learning Applications The basic techniques of chemical laboratory work can be described as a learning facility based on the curriculum of 2013 basic engineering subjects of

chemical laboratory work For Chemistry Analytical skill students at SMK Negeri 1 Cikampek. The following is a description of the multimedia learning app that will be built:

2.3.1 Tutorial Teaching Method

The concept of the tutorial will be used in the development of interactive multimedia learning applications and simulation of basic chemistry laboratory techniques to deliver material to students in the form of text, animation, and visual. The flow of material delivery in multimedia learning applications can be seen in figure 5.

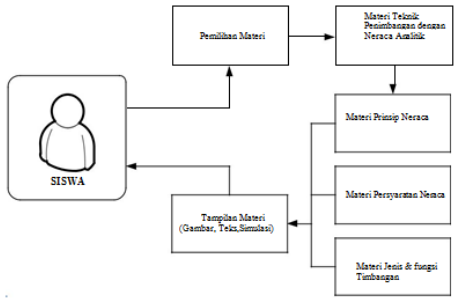


Figure 5. Material Submission Flow

2.3.2 Evaluation Submission Flow

The evaluation consists of multiple choice questions based on the material present in the material menu. Flow of delivery Evaluation in multimedia learningapplications can be seen in Figure 6:

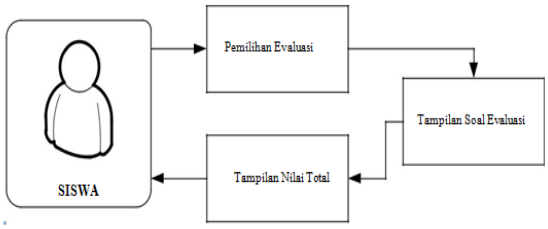


Figure 6. Evaluation Submission Flow

2.4 Interface Implementation

Implementation of the interface is done with every page of the program created and coding in the form of program files. The following is the implementation of the interface for students.

2.4.1 Interface Implementation of Student Login Form

Here is the implementation of the login form interface can be seen in Figure 7

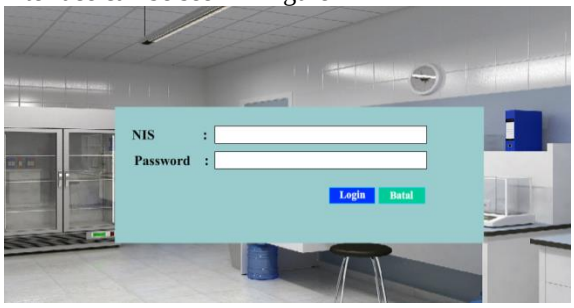


Figure 7. Interface Implementation Login page

2.4.2 Home Page Interface Implementation

Here is the implementation of the main page interface can be seen in Figure 8.



Figure 8. Home Page Interface Implementation

2.4.3 Implementation Select the Material Menu

Here is the implementation of the interface select menu material can be seen in Figure 9.

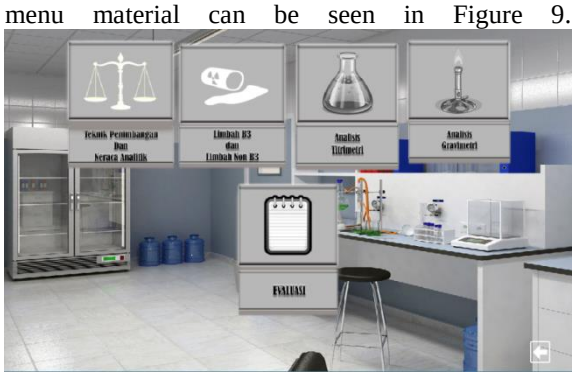


Figure 9. Implementation of the Material Menu Page Interface

2.4.4 Implementation of the Content Menu Interface

Here is the implementation of menu interface material can be seen in Figure 10.

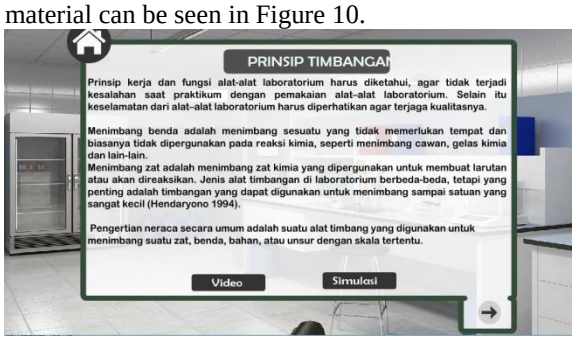


Figure 10. Page Material Interface Implementation

2.4.5 Video Content Interface Implementation

Here is the implementation of video material interface can be seen in Figure 11.



Figure 11. Video Material Page Interface Implementation

2.4.5 Implementation of Simulation Interface

Here is the implementation of material interface Simulation can be seen in Figure 12.



Figure 12. Implementation of Simulation Page Interface

2.4.5 Implementation of Evaluation Interfaces

Here is the implementation of the evaluation interface can be seen in Figure 13.

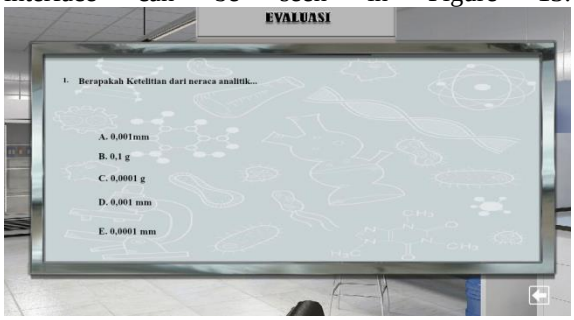


Figure 13. Implementation of Evaluation Page Interfaces

2.4.6 Implementation of Evaluation Results

Here is the implementation of the interface evaluation results can be seen in Figure 11.



Figure 14. Implementation of Evaluation Result Page Interface

2.5 System Testing

Testing Software system is a step to find errors and deficiencies in software built so it can be known whether the software has met the criteria in accordance with the purpose or not. The test used to test the application of multimedia learning basic chemistry laboratory techniques carried out by using blackbox testing functionally and also testing responses from application users.

2.5.1 Blackbox Testing

The type of blackbox testing used is functional testing. Inside the functional blackbox testing consists of application testing scenarios, case and application test results and application testing conclusions.

2.5.1.1 Functional Testing Scenarios

Functional testing scenarios in the application is done with the aim to test the functional existing on the frontend application and also backend multimedia application learning basic chemistry laboratory techniques. Here is an interactive learning media application test scenario. The Backend scenario can be seen in Table 2.

Tabel 2. Backend Testing Scenarios

No	Test Class	Test Item	Type of Testing
1	Login	Login Teachers	Black box
2	Student Processing	Add student data	Black box
		Change student data	
		Change student data	
		Search student data	Black box
3	Processing questions	Add questions data	Black box
		Change questions data	
		Delete questions data	
4	Processing evaluation	Search value evaluation theory	Black box

The Frontend scenario that can be done can be seen in Table 3.

Table 3. Frontend Testing Scenarios

No	Test Class	Test Item	Type of Testing
1	Logging in	Verify Student Identity	Black box
2	Viewing the Material	Material selection	Black box
		Selection of video material	
3	Conducting Simulation	Selection of simulation	Black box
4	Evaluate	Selection of evaluation answers	Black box

2.5.1.2 Cases and Test Results

Here is a case for testing the built-in software using the black-box method based on tables 2 and 3 of the pre-made test scenarios.

Table 4. Cases and Test Results Master Login

Cases and Test Results (Data true)			
Data Input	**Which are expected**	**Observation**	**Conclusion**
Sample Input Username : Guru Password : Guru	Log into Master's main menu	Log into Master's main menu	[√]Be accepted []Rejected
Cases and Test Results (Data False)			
Data Input	**Which are expected**	**Observation**	**Conclusion**
Sample Input Username : Guru Password : 1234	Message appears "Gagal Login .. Username atau Password Tidak Terdaftar"	Message appears "Gagal Login .. Username atau Password Tidak Terdaftar"	[√]Be accepted []Rejected
Kasus dan Hasil Uji (Data Kosong)			
Data Input	**Which are expected**	**Observation**	**Conclusion**
Contoh Masukan Username : Guru Password :	Message appears "Isi Field yang kosong"	Message appears "Isi Field yang kosong"	[√]Be accepted []Rejected

2.5.1.3 Conclusion Testing System

Based on the results of functional testing has been done on multimedia applications learning basic techniques of chemical laboratory work can be concluded that the functional system has been able to meet the needs of the expected system.

2.5.2 Interview

Interviews were conducted on users who had their Master user types. The interview has been done with the mother Eko Karyani S.Pd., Mp.Kim. Here is a table of questions and answers from interviews with teachers can be seen in Table 5

Table 5. Interview With Teacher

No	Questions and answers
1	**Questions** : Before implementing TDPLK application why do teachers find difficulties in teaching material tdplk?
	Answer : Previously the teachers of chemical analysts had difficulties in delivering the material because in the material manual there was a practicum illustration where in the practicum illustration it involved the practicum tools that can not be provided by the chemistry laboratory today.
2	**Question :** How is the teacher's response to chemical analysts related to the application of multimedia TDPLK?
	Answer : The responses of the teachers of positive chemistry analysts, many of which ask about the application and also want to implement it in other subjects
3	**Question** : How is the chemistry teacher's response related to TDPLK multimedia application interface?
	Answer : The application is pretty good, just maybe if more in the chemical element in the application
4	**Question** : How does the teacher's response to chemical analysts related to the material contained in the TDPLK multimedia application?
	Answer : The material is sufficient, the essence of each chapter is included there is also a video that discusses the meteri so that students are not too rigid in receiving the material.
5	**Question** : What is the response of related simulation chemistry teacher teacher in TDPLK multimedia application?
	Answer : The simulation is good, helping teachers deliver the material.
6	**Question** : Is it difficult for teachers of chemical analysts to operate applications for student data, issues and values?

	Answer : Initially it was difficult because many chemistry teachers are not used to processing the students' questions and values in one application, but for a long time have started to understand and not too difficult.
7	**Question** : Is the TDPLK multimedia application a problem that was previously resolved?
	Answer : Overcome probably not yet because in the manual many illustrations and chemical labs are described, only with this application the chemistry teachers feel helpful in terms of delivery.
8	**Question** : Is there a new problem with TDPLK multimedia application?
	Answer : I do not think so .
9	**Question** : Is the enthusiasm of students in learning TDPLK increased after the use of this application?
	Answer : Yes, they are enthusiastic about the existence of this application, probably because it becomes a new thing they use in terms of learning.
10	**Question** : What about student grades? Is there an increase?
	Answer : For relative true values, there are students who score increases, some are retarded, but the majority of their value leads to a positive value, perhaps the effect of that enthusiasm.

Based on the results of interviews with the teacher, it can be concluded that this learning application can assist in learning activities of basic chemistry subjects.

2.5.3 Questionnaire

Scenario Testing Response to the students is by way of spreading the questionnaire (questionnaire), the content Questionnya is a closed statement using Likert scale.

scale Answer :

SS : Strongly agree
S : agree
KS : Less Agree
TS : Disagree

Here are some Questions that are submitted to student users. Here is a table of student Question can be seen in Table 6.

Table 6. Student Question

No	Statement	SS	S	TS	STS
1	The view of the TDPLK multimedia learning app is interesting.				
2	The use of TDPLK learning multimedia application is easy to do.				
3	The contents of the TDPLK multimedia learning applications are fulfilled to support teaching and learning activities.				
4	This TDPLK learning multimedia app lets you understand the content of TDPLK subjects.				
5	With the simulation menu, you find it easier to describe the conditions of the actual lab				
6	With the embedded video, you find it easier to understand the content of the subject matter of TDPLK.				
7.	With this TDPLK multimedia learning application, you become more fond of TDPLK subjects.				
8.	With this TDPLK learning application, you become more curious about the content of the material delivered.				
9	With the				

No	Statement	SS	S	TS	STS
	application of this TDPLK multimedia learning, the value of your evaluation to be better.				
10	With this TDPLK multimedia learning application, you become more familiar with chemical laboratory tools.				

2.5.3.1 Results of Student Questionnaire

Based on the total score obtained from the questionnaires distribution to 36 respondents, to know the individual attitude of each respondent can be done by the following stages.

2.5.3.1.1 Determine the score

The specified score is minimum score, maximum, middle value, interval value 1, and interval value 3.

a) Determine the total maximum score

Maximum score * number of respondents

= 40 * 36

= 1440

b) Determine total minimum score

Minimum score * number of respondents= 10 * 36

= 360

c) Determine the middle value

(Maximum total + minimum total)/ 2

= (1440 + 360) /2

= 900

d) Determining the value of interval 1

(Total minimum score + middle score)/ 2

= (360 + 900) / 2

= 630

e) Determining the value of interval 3

(Maximum score + Midpoint)/ 2

= (1440 + 900) / 2

= 1170

2.5.3.1.2 Creating Scale From Score gained.

360	630	900	1170	1440
Minimal	Interval 1	Nilai tengah	Interval 3	Maksimal

2.5.3.1.3 Determining the Score Limit

Determine the score limit for each attitude,

The following is the category of attitudes that have been determined.

a) Category Strongly Agree, ie the area bounded by the third interval and the maximum score. (Interval 3 ≤ x ≤ Maximum score)

b) Agreement Stage Category, which is the area bounded by Midpoint and the third interval. (Middle value ≤ x <quartile 3)

c) Category Disagree is the area bounded by interval 1 and the middle value (interval 1 ≤ x <middle value)

d) Categories of Strongly Disagree, ie areas limited by minimum score and interval 1 (minimum score ≤ x <interval 1)Batas Skor dapat dilihat pada Tabel

Category	Score
Attitude Strongly Agree	1170– 1440
Attitude Agree	900 – 1170
Attitude less Agree	630 – 900
Attitude Disagree	360 – 630

2.5.3.1.4 Determine the total score of the respondents

Based on the distribution of the results of the scores of each respondent as in the distribution of the results of data collection of respondents, the total score obtained for all respondents is 1136.

360	630	900	1136	1170	1440
Minimal	Interval 1	Nilai tengah		Interval 3	Maksimal

2.5.4 Quantitative Data Processing

Quantitative data processing is done by statistical test of value results before, after, and N-Gain from CAI class and conventional class. To test the hypothesis, the statistical analysis of the average N-Gain test between the CAI group and the conventional group after the data normality and homogeneity test was done to determine whether in hypothesis testing Parametric or non Parametric statistics were used.

N-Gain calculations were obtained from the pretest and posttest values of each CAI class and conventional class. Increased competence occurring before and after learning is calculated by the g-factor formula (N-Gain) by the formula (Hake, 1999):

$$g = \frac{S_{postest} - S_{pretest}}{S_{maksimum} - S_{pretest}} \quad (1)$$

2.5.4.1 Test Data Normality

Normality test aims to determine whether the research data is normally distributed or not. In statistical parameters the normal distribution of data is a necessity and an absolute requirement that must be met. Normality test data used is statistical test Shapiro-Wilk. The result of normality test of N-Gain data can be seen in figure 15.

	Kelas	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Nilai	CAI	.127	36	.150	.947	36	.087
	KONVENSIONAL:	.128	36	.143	.955	36	.146

Figure 15. Normality Test Results

Based on the results of normality test data obtained values of significance for the CAI class of 0.087 while the significance value for the conventional class of 0.146 because the significance level of the two classes greater> 0.01 then it can be concluded that the data berpistrubisi normal.

2.5.4.2 Data Homogeneity Test

The data homogeneity test is used to determine the variance of several populations equally or not. Results Homogeneity of CAI class can be seen in figure16

CAI Pretest

Levene Statistic	df1	df2	Sig.
3.584	4	28	.018

Figure 16. Homogeneity Test Result

Based on the results of homogeneity test data obtained homogeneity value for CAI class of 0.018, because the homogeneity is greater> 0.01 then it can be concluded that the data is homogeneous.

2.5.4.3 Test Independent T-test

The independent sample Sample T-test is part of the parametric inferential statistics (Test difference). The independent T-test N-Gain test results can be seen in the figure 17

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1 CAI - Konvensional	.24444	.35681	.05947	.12372	.36517	4.111	35	.000

Gambar 17. Independent Test Results T-test

Based on the results of the T-test test N-gain data obtained probability value that is equal to 0.00, because the probability value is smaller <0.05 then it can be concluded CAI class as the experimental class produce significantly better learning outcomes.

2. CLOSING

The results obtained from research development of multimedia application learning TDPLK conducted in SMK Negeri 1 Cikampek, through the test and also the response from the user application, shows the total score of respondents located between the score 900 (middle score) with the score 1170 (interval 3) Positive where the test and also the user's response to the application refers to the objectives that exist in this study. In addition, the results of inferential parametric test obtained normal and homogeneous data therefore an independent t-test was conducted to test the average value of the two classes which then resulted in the conclusion that significantly TDPLK multimedia applications are better than conventional methods.

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