The Effectiveness of Digital Electronics Learning Based on Multimedia in Universitas Negeri Makassar

*Mahmud Mustafa*

Educational Science, Universitas Negeri Makassar, INDONESIA

**ABSTRACT**

This research aims to disover the effectiveness of multimedia using in Universitas Negeri Makassar. The design of the research is an experimental. The instrument for collecting data were observation, test, and documentation. Technique of data analysis for this research were quantitative data and qualitative data.For students, this research is expected to: 1) gain their learning proces and its result; 2) motivate to learn. For lecturers: 1) to motivate them in using innovative learning models; 2) and to change their teaching habit from only giving to a creative mediator and facilitator in learning process.The research results showed the scores from those who used multimedia learning were higher than those who used conventional learning. This also was proven bystatistical test which displayed significant difference of learning result between experimental group and control group using theories of digital electronics.

*Keywords:Effectiveness, Multimedia, Digital Electronics*

**INTRODUCTION**

Education has an important role to consider Indonesia’s competitive value and become as a sector which its quality needs to be increased continually. In fact, there are many factors which create gaps in spreading formal education equally for this nation. Some of them are quality gaps among education implementers. This caused by the geographical location and different abilitybetween central and regional implementers to implement the education.

To decrease the existed gaps, Universitas Negeri Makassar (UNM) as one of the universities and as Institute of Teachers’ Education known as *LPTK (Lembaga Pendidikan Tenaga Kependidikan*) in Indonesia or educational implementer which produces labors for industrial, governmental, and economics, also teachers, needs an exact strategy in producingskilled graduates to develop the nation.

One way for the graduates of UNM to be able to get the opportunities for employment of the country is improving the students’ quality of learning. It can be improved by giving learning which similar to a simulation of the real workfield.

A component of a university or educational institution who takes charge in preparing competitive and ready-to-work labors is the lecturer. They are supposed to possess two competencies that is personal and operational competency. Personal competency involves one’s knowledge, while operational competency covers the ability to demonstrate something in a practical way.

Some of the competencies a lecturer must have in learning process are: (1) Knowledge competence; (2) Didactic competence; (3) Pedagogical method; (4) Skillful in material presentation; (5) Skillful in giving instructions and suggestions; (6) Able to design curriculum and learning material; (7) Organizational competence;and (8) Science competence.

Keys of learning in college for effective learning are described as follows: (1) Students’ interest in learning; (2) Students’ appreciation and respect to their learning model; (3) Doing assessment correctly and giving feedback; (4) Concrete goals and interest of intellect challenge; (5) Independency; and (6) Active self-control and self-developing.

The real learning process will stick to students’ mind if it is conducted comfortably. That is why a lecturer needs to do the following as a facilitator: (1) Stimulating students’ interest in learning; (2) Describing instructional significances of each subject; (3) Delivering the material in structures; (4) Giving them chances to practice and feedback; (5) Putting extra attention and explaining difficult material for them; (6) Creating two-ways communication.

As a matter of fact, not all lecturers have enough time to be a full-time helping and supportingfacilitator in learning process. Piles of schedules for various subjects force them to deliver material merely from syllabus and only carry the objectives whatever there is.

The class will run passively and the students do not prepare themselves because they know that boring explanations are only material they will receive from the lecturers. Moreover, their chances in practicing independent learning are ignored by the lecturers, nor the feedback about their learning result.

The ability of the lecturers in delivering material is a verbal activity which connecting one fact with another fact. An incident to another incident, and also giving inductive and deductive relation to make them understand. But we have to admit that their ability have limits. We cannot expect a highly motivated and creativity instantly from the students in the learning process.

Based on the earlier observation in Universitas Negeri Makassar, especially Faculty of Engineering, it is showed that its curriculum changed. And its learning demand are highly increased which causes new barriers for the lecturers to encounter them internally and externally.

On the curriculum used of Engineering Faculty of UNM, laboratory works is an absolute subject. Learning media becomes a demanding tool to produce skilled students which also requires good facilities. Planning and developing surely are different from other faculties.

In the same way, growing creativity in learning involves various media (audio, visualization, motion animation, etc) which produces a maximum cognitive process. It is simply said that many regards this as an error. To give students more access (text, pictures, animation, and so on) will allow them to get the information unbearably.

Learning with various media known as a multimedia based learning. It is used as learning tool which defined as an integration of various media (printed media/text, audio, video, slide, radio and television broadcast) that each of them independently works and is programmed.

Learning by using multimedia tool or based on multimedia is always worked to easier the learning process. To view from learning process, presentation is one of its learning methods. It holds the highest position as the most-used method compared to others. The development of various tools has given big impact not only to practical activities in the presentation itself, but also for its basic theories.

It is specified in the development of learning model based on multimedia. The use of educational media in learning process by Hamalik (2008) is the placement of concrete basics in thinking aims to reduce ‘verbalism’, stimulate students’ interest, make learning more attractive and lead us to satisfied results.

Lots of strategies and ways are through to achieve the goals such as lecturers’ qualified and professionalism, institution’s well management, complete laboratory facilities, meaningful material, curriculum revision, and many more.

But somehow, there are several factors do not run well, including school management in large unit and class learning in small unit. To overcome, we can apply multimedia as an effective learning.

A learning strategy by using multimedia to improve students’ learning result of Electrical Engineering Education department of Engineering Faculty in Universitas Negeri Makassar needs to be applied.

To consider it, the resent research and observation of the last two years identify many problems in conducting learning in some subjects of Electrical Engineering department, specifically for laboratory works of Telecommunication Engineering, ElectronicsI, Electronics II, Basics of Electrical Engineering, Audio and Video Engineering, Microprocessor and Advanced Electronics (construction plan). To apply Electonics Digital subject, it has to be divided into two session, theory and laboratory work.

The results of the subject both from theory and lab work still need repairment. It is indicated by the achievement of cognitive aspect which attached to students still in average. Their skill are not fairly distributed. Also, the material do not reach the target of the curriculum yet.

Next, from the documents obtained when conducting observation in Electrical Engineering Education department, students’ scores of Basics of Electrical Engineering subject for three years have low category on an average. In 2011, they were in (2.61) average, 2012 (2.82), and 2013 (2.87).

This caused worriness from the lecturers and even the students. They wanted a learning model which based on multimedia in class or at home for each student to review the material independently.

Furthermore, we will reveal how the effectiveness of digital electronics based on multimedia used in Electrical Engineering Education Department of Universitas Negeri Makassar.

**REVIEW OF RELATED LITERATURES**

Gerlach dan Ely (1979: 241) defined media as general which can be claimed as every thing, object, even school environment which allow students to receive knowledge, behavior, and skill. In this way, lecturers, books, and school or college environment can be regarded as media. Specifically in learning process, it tends to be known as graphics tool, photography, or other electronic tools to catch, process, and re-construct visual and verbal information.

Additionally, Gerlach and Ely (1979: 242) divided media into two important parts, namely *material* and *equipment*. Material of the learning media such as pictures implemented in a movie or being transparrent through *overhead projector*, also it can be hung on the wall. Equipment involves *overhead projector* or player tools and picture recorder in movie. It also involves writing board to display the pictures.

For the next, both *material* and *equipment* are no longer used nowadays. The computer technologyhas dissolved the words into *hardware*and *software*with certain differences of each.

Hardware known as material or equipment which can be used to save files and transmit learning stimulation or learning material.

It involves overhead transparency, overhead projector, video tape recorder, audio tape, and many more. While software can be regarded as a stimulation or saved and transmitted material.

In a concept of hardware and software, you will be familiar with *technique*. It is a procedure or process used by hardware to transmit software, for instance, audio technique, visualization technique, and multimedia technique.

Gagne and Briggs in Azhar (2002) states that limited media is tools which phisically used to deliver learning material such as: book, tape recorder, cassette, camera video, video recorder, film, slide, photos, pictures, graphics, television, and computer.

Considering the mentioned facts, you can see why in general learning media is all things, object, even school environment which build a condition where students gain the process, situation, and learning effectively. That is why we need to develop a learning model based on multimedia.

Product development in learning should be adjusted with the intended goals. Moreover, it has to be matched with characteristics in the real life including the condition and availability of the media used.

Of course, when choosing a model to develop, we need consideration, like learning material, the extent of students’ cognitive development, and available facilities and infrastructures, to easier the way in achieving learning objectives. This showed that in constructing and developing a learning model, we need the students to become easier in learning a source.

According to Smaldino, Lowther, andRussell (2008), a well-designed learning started with students’ interest or anyone, continued with presenting new material, involving students to give learning feedback, assessing students’ understanding, and giving relevant activities in advance.

Suparman (2004) observed that learning development emphazises on the objective of problem solving learning, increasing the quality of learning process, or creating a situation which allows students interaction that leads into behavior changing through the process of design, produce, and evaluate.

It begins with problem identification, developing strategies and learning material which ends by evaluating the effectiveness and efficiency. To prove its properness extent based on validity aspect, it needs expert and practicioner to validate the developing learning model.

As for practicality and effectiveness aspect, it needs a learning tool to apply the developing learning media. Therefore, by seeing both aspects, we need to develop a learning tool and research instruments as needed.

The learning model is useful to direct learning accomplishment. It is also used as an orientation in learning implementation to be more effective, efficient, useful, interesting, and humane. Next, it can be used to communicate and as guide plan of activities in managing and drawing conclusion.

The development of learning model is a series of activities which produces a learning tool based on the existing theories.There are two objectives of the development research: (1) developing the prototype product; (2) formulating methodological suggestions to design and evaluate the prototype.

Richey and Nelson (2000) defined development research as a systematic research of designing, developing, and evaluating programme. Also focusing on its process and learning product which requires validity, practicality, and effectiveness.

Using multimedia or computer based instructionis expected for the lecturers to overcome barriers especially in Digital Electronics subject.

Various definition of multimedia keep growing along with the growth of information and communication technology. Similiarly to software and hardware which support it. Media experts consider that before IT (Information Technology) took control, multimedia had been regarded as a tool of ‘various’ media used in an interaction process of message delivering from the source to the receiver. In the case of education, we can regard it as an interaction between teacher and students.

Comparable with IT growth, the definition of ‘multimedia’ tends to be more focused on system integrating and communication procedure of certain equipment, such as television, radio, computer, notebook, and netbook.

Just as the growth or development in telecommunication field, the network system tends to strengthen the modernism of multimedia, like the change of wire media into wireless using fiber optic made by telecommunication industries today.

Even so, as the academision or practicioner in viewing and understanding multimedia, we should act wisely and stick to the former invention and its paradigm. To act responsibly of the newest invention, it is forced to do innovation and engineering creatively and excellently through its using based on theories of former experts.

Multimedia uses computer flexibility to solve learning problems. In common with the teaching system, a computer can be used as a teaching tool especially in strengthening early stages of learning, which is also stimulating and motivating. Many uses can get from its flexibility such as the availability of inserting videos, audios, graphics elements, shapes, process, roles, and other responsibilities (Lee & Owens, 2004: 181).

Criswell (1989: 1) defined the application of computer in learning as*Computer Based Instruction* (CBI). This is one way to serve learning material which allows students to participate actively, so the teacher can give respond to their activities.

According to Anderson (2003: 197), CBI is a direct computer using with students in delivering learning materials, practices, and tests in order to acknowledge their ability. Basically it indicates to every educative software which students’access from their computer to interact with it.

Learning in college is an effort of managing from the lecturers. Though the ability, media, and methods used now are still quite far from the expected result. That is why we need effective and integrated learning plans based on students’ characteristics, learning standard and objectives, strategies, media which appropriates the context, and the evaluation of students’ learning result.

The management of learning strategy runs by choosing certain method in achieving learning objectives that impact the media used. To revise the quality, you need to revise the learning design first.

Component connection in the system found on the analysis of students’ necessity in learning by choosing the method and media to achieve the objectives. To accomplish, we design and develop learning based on multimedia in creating effective learning.

**RESEARCH METHOD**

This research used adalah true experimental design. It is because the researcher can control all the external variables affecting the experiment. There were two groups. One of it is experimental group contains of 40 participants by giving treatments and the other contains 40participants as the control group by giving conventional learning. Next, the comparison between experimental and control group with each 60 participants.

Samples of this research werethe students of Electrical Engineering Education who took Electronics Digital subject in odd semesterfor the 2013/2014 academic year. The research object was multimedia tool in Electronics Digital subject.

The procedures of data collection was the most essential step of the rsearch. The data collected were used to test the hypothesis proposed. In this research, there were two kinds of methods in data collection used by the research that is documentation and test.

**RESULTS AND DISCUSSION**

This research was conducted as scheduled with constructing a learning multimedia first. A learning model based on multiedia was revised to be a manual in learning process.

Before using it, all the multimedia based learning has been validated by experts to obtain good extent of validity and reliability. After validation, there was limited trial in a short time because of less time and finance.

When processing tool validation, the data obtained were divided into two, expert validation data and formative evaluation data. The expert validation data involved two material experts, two media experts, and two design experts. The results, suggestion, and comments of the experts turned into material for revision. The accepted analysis of those experts of material, media, and design can be seen in table1.

Table1.The Estimate of Instrument Reliability Index

|  |  |  |  |
| --- | --- | --- | --- |
| **No** | **Instrument** | **PA (*Percentage of agreement*)** | **Description** |
| 1 | By media expert | 0.812 | Reliable |
| 2 | By material expert | 0.750 | Reliable |
| 3 | By design expert | 0.773 | Reliable |

The reliability extent shows the assessment by estimating the average coefficient of reliability among the ratersusing coefficient of*Cohen’s Kappa* (Қ) and compared to the minimum criteria of reliability.

Based on the analysis result of reliability between raters, it is clear that table1shows 0.82 of media expert intrument, 0.75 of material expert, and 0.773 of design expert.Reliability coefficient of each instrument from the experts were higher than the standart of 0.70by Linn (Mansyur, 2010)*,* which fulfill the requirements of reliable criteria.

**Normality test:** Before conducting further analysis, the data needs to be tested with normality and homogeneity test. The aims of normality test are discovering the distributed data of respondents as normal or not. It affects the use of statistical test tool in model effectiveness test. A proper data model is distributed normally or nearly. There are several ways in testing the data normality, some of it known as Kolmogorof Smirnov (K-S) method.

It is the most used normality test compared to the latest statistical programs. With the criteria of significance (Asym Sig) > 0.05, then the data claimed as normally distributed. If the significance shows (Asym Sig) < 0.05 then it is not distributed normally.

Based on the result of Kolmogorof Smirnov (K-S) normality test above by using media, it shows Asym Sig > 0.05 (0.594 > 0.05) and the significance becomes Asym Sig > 0.05 (0,451 > 0,05) after using media which classified as normally distributed. The advantage of this test are the simplicity. It also avoids different perception between one observer and other observers which usually happen in normality test by graphics.

Table2. Normality Test

| One-Sample Kolmogorov-Smirnov Test |
| --- |
|  |  | Kelas konvensional teori digital | Kelas eksperimen teori digital |
| N | 40 | 40 |
| Normal Parametersa,,b | Mean | 52.7250 | 76.3500 |
| Std. Deviation | 20.15452 | 18.28485 |
| Most Extreme Differences | Absolute | .122 | .136 |
| Positive | .122 | .118 |
| Negative | -.116 | -.136 |
| Kolmogorov-Smirnov Z | .770 | .860 |
| Asymp. Sig. (2-tailed) | .594 | .451 |
| a. Test distribution is Normal. |
| b. Calculated from data. |

**Homogeneity Test:** It is used to acknowledge whether the group of respondents came from the same population or not. By using SPSS, the researcher can calculate the test of homogeneity of variances.

Table 3. Homogeneity Test

| Test of Homogeneity of Variances |
| --- |
| Hasil Belajar |
| Levene Statistic | df1 | df2 | Sig. |
| 1.871 | 1 | 78 | .175 |

Based on the analysis result, it can be seen that the output test of homogeneity of variances shows the significance (sig) of 0,175. Because it is higher than alfa 0.05, it is concluded that both learning result data have similar variance (homogenous).

**T-test as the implementation of Electronics Digital learning theory:** Parametric statistics of model effectiveness test by SPSS is using t-testof Paired Samples Test. Based on the test result, the conventional/control group and experimental group are explained the managing data of T-test as seen on table 4.28.

Table 4.The Descriptive Analysis Result of Control Group

|  |
| --- |
| Conventional/Control Group |
| N | Valid | 40 |
| Missing | 0 |
| Mean | 52.73 |
| Median | 50.00 |
| Mode | 50a |
| Std. Deviation | 20.155 |
| Variance | 406.204 |
| Range | 87 |
| Minimum | 10 |
| Maximum | 97 |
| a. Multiple modes exist. The smallest value is shown |

Based on the tabel above for conventional/control group, it seems that mean value shows 52.73, median as 50.00, mode as 50, standard deviationas 20.15, variance as 406.20, range as 87, minimum as 10, and maximum as 97.Next, to complete the descriptive analysis in table 4.28, the frequency distribution of data can be seen in figure 1.



Figure 1. Data distribution of Control Group

Based on the data analysis above, it shows that one respondent got 10;20;26;28;30;38;44;46;68;75;76;78;80;83;85 and 97. Two respondentshave 32 and 34. Three respondents have 63 and 70 scores. Four respondents have 46, and five respondents have 50 and 60.

Table5. The Descriptive Analysis Result of Experimental Group

|  |
| --- |
| Experimental Group |
| N | Valid | 40 |
| Missing | 0 |
| Mean | 76.35 |
| Median | 78.00 |
| Mode | 95 |
| Std. Deviation | 18.285 |
| Variance | 334.336 |
| Range | 78 |
| Minimum | 20 |
| Maximum | 98 |

Based on the tabel above for conventional/control group, it seems that mean value shows 76.35, median as 78.00, mode as sebesar 95, standard deviation as 18.28, variance as 334.33, range as 78, minimum as 20, and maximum as 98. Next, to complete the descriptive analysis in table 4.29, the frequency distribution of data can be seen in figure 2.



Figure 2. Data distribution of Experimental Group

Based on the data analysis above, it shows that one respondent got 55; 60; 70 dan 93. Two respondents have 20; 65; 85; 98. Three respondents have 73. Four respondents have 80, six respondents have 63 dan 78, and nine respondents have 95.

Table6. The Analysis Result of Independent Samples Test



From the output above, it is known that the valid data in conventional/control group as 40and experimental group as 40 without any missing data. For the second output of independent samples test contains of Levene’s (homogeneity) test and two independents samples test. Firstly, we conducted Levene’s (homogeneity test) with F test. It means if the variances are similar, than the t-test will use the output of ***Equal variances assumed* (**assumed as similar variances**)**and if it is different, then it uses ***Equal variances not assumed*** (assumed as different variances).

* **T-test with two independent samples of hypotheses: dua sampel independen dengan hipotesis:**

Ha: There is difference found in learning result between students of conventional/control and experimental group.

Ho: There is no difference found in learning result between students of conventional/control and experimental group.

**T-distribution**

From the output above, its t-distribution (***Equal variances not assumed)*** showed as 5, 491.

* **T table**

Distribution of Table t found in alfa = 5 %: 2= 2.5 % (two tailed) with degree of freedom(df) n-2 atau 80-2 = 78, with two tailed test (significance = 0,018) which obtained t table as 1.99.

* **Criteria of Decision Making**
* If t distribution ≥ t table, then H0is rejected and there is difference.
* If t distribution<t tabel, then H0is accepted and there is no difference.

There is another criteria in decision making that is probability value or Asymp.sig with those requirements:

* If the probabilityor Asymp.sig > 0,05 then H0 is accepted
* If the probabilitas or Asymp.sig < 0,05 then H1 is accepted

Based on the analysis result above, it is found that t-distribution as 5,491, while t-table as 1.99 because if t-distribution>t-table (5.491 >1.99) it can be concluded that H1 is accepted.

If it is based on the significance of 0.018, then it is lower than the alfa 0.05 as determined. Because Karena the significance value (0.018 < 0.05), then the accepted H1 found difference of learning results between conventional and experimental group students of electronics digital theory.

As with several theories review that multimedia based learning able to create a quite independent learning. The experts said that giving real concrete of the material can emerge motivation and belief to the users in constructiong design of proper learning system in the class as needed. Absolutely it is a brilliant way to guide students learn independently.

By independent learning, it covers an active learning pushed by motive to master a competence and built by knowledge or the existing competence.

The strengthened learning based on multimedia is used to discover how far the user comprehend the material. Genrally, they become more motivated if the environment integrated with multimedia.

Fenrich (1997) concluded that multimedia learning has some advantages as follows: (1) Students can learn with their own ability, readiness, and willingness. It means the user itself control the process; (2) Students can learn from ‘a patient tutor’ (computer) which adapt the students’ ability; (3) Students are motivated to get the knowledge and receive instant feedback; (4) Students face the objective evaluation by participating the drill/test given; (5) Students enjoy their privacy where they do not need to feel embarassaed when haning mistakes; (6) ‘Just-in-time’ learning; (7) Learn anytime they want.

While according toA. G. De Sa and G. Zachmann(1999), there are several reasons to apply multimedia learning such as: (1) Improve students’ motivation and their behavior in accepting the knowledge; (2) Learning experience through real product; (3) Give chances for them to explore by using actual technology; and 4) Enhance active participation and strengthen students interaction.

**CONCLUSION**

Based on the results and discussion about the development of multimedia based learning in Electircal Engineering Education Department of Engineering Faculty of Universitas Negeri Makassar, then it can be concluded that the product of multimedia based learning fulfils the valid and reliable criteria.

Moreover, its use for Electronics Digital subject can be more effective because the learning result in experimental group is higher than conventional/control group. This was proven by analysis result of independent samples test (t-test) which stated the difference result experimental and conventional/control group.

**ACKNOWLEDGEMENTS**

Series of activities of this research can be well conducted by the assistance of many people involved in the completion of this research. At this time, the researcher would like to dedicate special gratitudes and highest appreciation to:

1. Rector of Universitas Negeri Makassar who gave permission and opportunity to conduct the research;
2. The Director of Postgraduate Studies of Universitas Negeri Makassar who gave oppurtunity and helps during the research;
3. Promotor and Co-promotor with endless support and meaningful guidance through the research completion.

**REFERENCES**

A. G. De Sa and G. Zachmann, *Virtual reality as a tool for verification of asembly and maintenance processes*, Computer Graphics 1999, 23(3), pp. 389-403.

Azhar Arsyad. (2002) Media pembelajaran , Jakarta : Raja Grafindo.

Anderson, Lorin W. (2003). *Classroom Assessment, Enhancing the Quality of Teacher Decision Making.* Lawrence Erlbaum Associates, Publishers.

Criswell Eleanor, (1989: 1)*the Design Computer Based Instruction*. New York: Macmillan Publishing Company.

Fenrich, P. (1997). *Practical Guidelines for Creating Instructional Multimedia Applications*.Forth Worth: The Dryden Press.

Gerlach, V.S., & Ely, D.P. (1979: 241) *Teaching &media: a systematic approach (2nd ed.). Englewood Cliffs: Prentice-Hall Incorporated*.

Lee, W.W & Owens, DL. (2004). Multimedia-Based Instructiononal Design Training Computer-Based, Distance Broadcast Training, Performance Based Solution (2nd). San Fransisco: Peiffera Wiley Imprin.

Oemar Hamalik (2008), Media Pendidikan. Bandung . Penerbit : Alumni.

Richey dan Nelson (2000) Design Research: *What We Learn When We Engage in Design THE JOURNAL OF THE LEARNING SCIENCES, 11(1), 105–121 Copyright © 2002, Lawrence Erlbaum Associates, Inc.Rice dan Wilson*.

Suparman,Atwi (2004:15-20)Desain Instruktional.( Jakarta: Universitas Terbuka.).

Sharon E. Smaldino, Debaroh L. Lowther, and James D. (2008). Russel.*Instructional Technology & Media for Learning.*Teknologi Pembelajaran dan Media untuk Belajar (Jakarta: Prenada Media Group.).