The effect of computer-based learning on learning outcome of diesel engine learning

B Barokah1,*, D D Kaligis1, P T D Rompas2, Y Wibisono3, W Wiratno4 and R W Batubara5

1 Department of Fisheries & Marine Engineering, Politeknik Kelautan & Perikanan Bitung 95226, Sulawesi Utara, Indonesia
2 Department of Informatic Engineering Universitas Negeri Manado, Tondano, 95618, Sulawesi Utara, Indonesia
3 Engine Department, Politeknik Pelayaran Surabaya, Surabaya, 60294, Jawa Timur, Indonesia
4 Engine Department Politeknik Pelayaran Sulawesi Utara, Minahasa Selatan, 95355, Sulawesi Utara, Indonesia
5 Department of English Language, Universitas Muhammadiyah, Gresik, 61121, Jawa Timur, Indonesia

*barokahkarpov@yahoo.com

Abstract. Development of the world has been influenced by science and technology and one of those is educational technology. Educational technology is a science which consists of various domains supported by the utilization domain. This research focused on the use of learning media. The purpose of this research is to determine the model of learning media which is relevant to the characteristics of students in diesel engines lesson and to find the influence of multimedia for the learning outcome of the diesel engines learning process. The method used in this research is the experimental method. Tests were carried out in two groups; multimedia = the control group is using conventional learning, the conventional group = the treatment group is learning using multimedia. Data were analyzed using the t-test Two Samples assuming data were normally distributed. The t-test is carried out using the SPSS 15 program for Windows. In learning with multimedia, this shows an increase in learning outcomes. The correlation between the second sample shows a very close relationship between conventional learning and multimedia learning. Because the probability is smaller than specified then Ho is rejected and Ha is accepted. Multimedia learning can improve learning outcomes. This should be true for other lessons.

1. Introduction
Information and Communication Technology (ICT) education shows advantages when compared to traditional teaching. The application of learning with ICT is more effective and efficient [1]. Learning with the media, and demonstrating the importance of incorporating motivation into the cognitive theory of multimedia learning [2].

Multimedia also integrates transformation, motivation, and other affective variables. Overall, multimedia features can improve students’ learning by encouraging generative processes [3-5].

As time goes on the media continues to grow, as a medium that enhances significant development compared to multimedia with other media such as types, audio, and visuals. With multimedia, there is
an increase in students' interest and understanding of learning material [6-9]. Multimedia technology is increasingly being used by educators for learning, online learning and blended learning [10].

The diesel engine operation changes the chemical energy in the fuel into mechanical energy that drives the piston up and down in a confined space called a cylinder. In this process the fuel reacts chemically with oxygen from the air. At the time of compression, the pressure and temperature become high resulting in an explosion known as combustion, its development needs computer-based modeling [11,12].

Multimedia can be divided into two categories as follows: Linear multimedia is multimedia that displays active contents take place without control. An example is the screening of films in theaters. Non-linear multimedia is multimedia display contents involving user interactivity to control. An example is the computer used in computer-based training that can be operated randomly [13].

The advantages or advantages contained in multimedia is the interaction and support it provides for students. With multimedia learning can be done outside the classroom because good learning is through experience [14]. Multimedia is seen as a utilization of "a lot" of media that is used in an interaction process of delivering messages from the source of the message to the recipient of the message, one of which is in the context of instructor learning and students.

The theories above are related to learning diesel engine such as the splicing description of Wikipedia Diesel Engine [15] "A diesel engine (also known as a compression ignition motor) is an internal combustion motor that uses compression heat to start ignition to burn fuel that is injected into the combustion chamber." When burning the performance of the diesel motor produces a pressure of 80-110 kg/cm² and a temperature of 600-900 degrees Celsius. The combustion process cannot be seen clearly. To facilitate learning, a media that contains a lot of characters is needed. With multimedia learners can shape their learning experiences according to their respective characteristics. Use of the CAI Model Tutorial with Microsoft Power point

In building an interactive learning program based on computers or in a multimedia context. Actually, a lot of software that can be used. Starting from Macromedia, web even based on Windows Office. Everything can be utilized to produce a multimedia learning or CAI. Microsoft power point is actually able to produce programs that are quite powerful if we want to be creative [16]. Power point is one of the latest Microsoft Office programs that is very popular and much in demand to make a presentation. The feature is very dynamic. By utilizing the features in it, it is hoped that you will more easily design a presentation with a unique and attractive display format [17].

Multimedia is based on power point, can developed what these contains are instructions for use, content of learning, and evaluation [18,19]. In the process of produces multimedia, drafts before being developed were first validated by several experts, namely design experts, media and material [20]. In According Dale Cone theory that abstract symbols and ideas can be more easily understood and absorbed when given in the form of concrete experiences.

2. Methods

2.1. Research method
The research was conducted at the Polytechnic of Marine and Fisheries of Bitung, the respondents were 31 students in grade 1. The method is used in this research is the experimental method. The study was conducted on variables whose data did not yet exist so that the process of collecting data and providing certain treatments to the research subjects would then be observed/ measured for their impact.

2.2. Tools and materials
The research used several tools and materials consist of: - computers, interactive multimedia CDs, digital cameras, printers, papers, and inks.

2.3. Data collection and analysis
Data collection obtained by doing:
• Pretest and posttest in classes that use multimedia
• Pretest and posttest in classes without use multimedia (conventional)

Data were analyzed using the Two-Sample t-test with the assumption of normally distributed data. The t-test was carried out using the SPSS 15 program for windows. The test was carried out on two groups namely; Group 1= control is a class that without use multimedia. (Conventional learning) group 2=treatment is a class using multimedia.

3. Results and discussion
The study was conducted at the Department of Fisheries Mechanical Engineering and involved two classes, namely, classes A and B with a total of 31 students in each class of students. Data is collected by:

• Conducting a pretest simultaneously between A class and B class with the same questions and times.
• Conducting multimedia learning to the B class then proceed with taking the test value through posttest
• Conducting conventional learning to the A-class and then proceed with taking the test value through posttest.

![Figure 1. Results of test value.](image)

From figure 1 can be seen the difference in test value increases between conventional learning and multimedia learning, further clarified by the following table 1.

|                      | Conventional Learning | Multimedia Learning |
|----------------------|-----------------------|---------------------|
| Pretest              | 202                   | Pretest             | 176                 |
| Posttest             | 219                   | Posttest            | 236                 |

Table 1 explained that in conventional learning an increase in the test value of 17 score, while in multimedia learning 60 score. Besides that, it is also found that the number of students who have increased, decreased, and even those who have not increased or decreased.

The addition of score to multimedia learning can be interpreted that learning with multimedia is easier to understand than conventional learning. The addition of value to multimedia learning can be interpreted that learning with multimedia is easier to understand than conventional learning. Multimedia learning involves all the senses such as vision, hearing and touch so that students quickly understand the contents of learning.

Can be seen in the table as follow:
Table 2. Improved scores.

| Conventional Learning | Multimedia Learning |
|-----------------------|---------------------|
| Increase | Decrease | Constant | Increase | Decrease | Constant |
| 13 | 8 | 10 | 31 | 0 | 5 |

From the description above it can be seen in multimedia learning that there is an increase in test value and a greater number of students whose value increases more when compared to conventional learning. To prove the effect of learning outcomes using multimedia learning compared to conventional data analysis is carried out using the t-test with the help of the SPSS 15 for Windows program which is illustrated as follows:

Table 3. Paired sample statistics.

| Technique                  | Mean   | N    | Std. Deviation | Std. Error Mean |
|----------------------------|--------|------|----------------|-----------------|
| Pair Conventional Learning | 7.0645 | 31   | 1.31493        | 0.23617         |
| 1 Multimedia Learning      | 7.6129 | 31   | 0.88232        | 0.15847         |

Table 3 shows a summary that the average test value of the conventional learning posttest is 7.0645 while the average value of the posttest in multimedia learning is 7.6129. This means the average test value of learning with multimedia is higher when compared to conventional.

Table 4. Paired samples correlations.

| Technique                  | N   | Correlation | Sig. |
|----------------------------|-----|-------------|------|
| Pair Conventional Learning | 31  | 0.884       | 0    |
| 1 Multimedia Learning      |     |             |      |

Table 4 shows the correlation between the two samples is 0.884 with a probability number of 0.000 (below 0.05). This shows that the relationship between conventional learning and multimedia is real and very close.

Table 5. Paired sample test.

| Technique                  | Mean  | Std. Deviation | Std. Error Mean | 95 % Confidence Interval of the Difference | t     | df   | Sig. (2-tailed) |
|----------------------------|-------|----------------|-----------------|------------------------------------------|-------|------|-----------------|
| Pair Conventional Learning | -0.54839 | 0.67521       | 0.12127         | -0.79606 to -0.300072                    | -4.522| 30   | .000            |
| 1 Multimedia Learning      |       |               |                 |                                          |       |      |                 |

Table 5 shows that Sig (2-tailed) = .000 reads 0.000, then from the hypothesis:

- Ho: There is no effect after using multimedia
- Ha: There is an effect after using multimedia

Because the probability is <0.05 then Ho is rejected and Ha is accepted. This means that the use of multimedia in learning affects the learning outcomes of students.
4. Conclusion
From this multimedia research several conclusions can be illustrated including:

- Multimedia learning can increase the test value of students, and the number of students who increase in value is more when compared to conventional learning.
- Multimedia is more influential in increasing the test value of students when compared to conventional.

Acknowledgment
We would like to thank the director of the Bitung Maritime and Fisheries Polytechnic who has allowed us the opportunity to provide facilities and infrastructure so that the research can be completed well.

References
[1] Webb L, Clough J, O’Reilly D, Wilmott D and Witham G 2017 The Utility and Impact of Information Communication Technology (ICT) for Pre-Registration Nurse Education: A Narrative Systematic Review Nurse Educ Today 48 160-171
[2] Mayer R E and Estrella G 2014 Benefits of Emotional Design in Multimedia Instruction Learn Instr 33 12-18
[3] Park B, Plass J L and Brünken R 2014 Cognitive and Affective Processes in Multimedia Learning Learn Instr 29 125-127
[4] Heidig S, Müller J and Reichelt M 2015 Computers in Human Behavior Emotional Design in Multimedia Learning: Differentiation on Relevant Design Features and Their Effects on Emotions and Learning Comput Human Behav 44 81-95
[5] Al-hariri M T and Al-hattami A A 2017 Impact of Students’ Use of Technology on Their Learning Achievements in Physiology Courses at The University of Dammam J Taibah Univ Med Sci 12(1) 82-85
[6] Zaid M, Zin M, Asmadi A, and Azlina N 2013 Relationship Between the Multimedia Technology and Education in Improving Learning Quality Procedia - Soc Behav Sci 90 351-355
[7] Aloraini S 2012 The impact of using multimedia on students’ academic achievement in the College of Education at King Saud University J King Saud Univ - Lang Transl (2) 75-82
[8] Akhondi A 2011 The Effective Multimedia Instruction in Remedy Spelling Disability Students Specific Learning in Iran at Year 2009 In Procedia - Social and Behavioral Sciences 15 1951-1954
[9] Abdul R 2010 Shared Knowledge Among Instructional Multimedia Design Experts In Procedia - Social and Behavioral Sciences 9 353-357
[10] Park C W, Kim D G, Cho S and Han H J 2019 Adoption of Multimedia Technology for Learning and Gender Difference Comput Human Behav 92 288-296
[11] Henshaw B W Diesel Engine 1973 Ind Lubr Tribol 25(6) 230-235
[12] Bertrand D H 2002 Practical Combustion Analysis (Warrendale: Society of Automotive Engineers)
[13] Akbar I, Rizal M, Kurniasih N, Sutiksdno D U and Purnomo A 2018 The Effects of Multimedia Learning on Students Achievement in Terms of Cognitive Test Results 11149 (1) 012019
[14] Scout A 1997 Learning Centres (London: Kogan Page Limited)
[15] Wikipedia 2011 Motor Diesel [online] retrieved from http://en. wikipedia. org /wiki/ motor_diesel
[16] Darmawan D 2011 Teknologi Pembelajaran (Bandung: Remaja Rosda Karya)
[17] Madcom 2010 Power Point Microsoft 2010 Untuk Pemula (Yogyakarta)
[18] Lee Y H, Siao C and Ho C 2014 The effects of Various Multimedia Instructional Materials on Students’ Learning Responses and Outcomes: A Comparative Experimental Study’ Computers in Human Behavior 40 119–132
[19] Lari F S 2014 The Impact of Using PowerPoint Presentations on Students’ Learning and Motivation in Secondary Schools’ Procedia - Social and Behavioral Sciences 98 1672–1677
[20] Abdul R 2010 Shared knowledge Among Instructional Multimedia Design Experts 9 353–357