Edutec
Journal of Education And Technology
2597-9221 (Online)
Volume 5 Number 2 December 2021

Meta-analysis: Effectiveness of E-Learning-Based Learning Media in Vocational Education

Nadia Utari, Ambiyar , Usmeldi, Nurhasan Syah, Arwizet, Muhammad Anwar
Fakultas Teknik, Universitas Negeri Padang, Padang, Indonesia
nadia.utari79@gmail.com

Article History	Received : August 12th 2021
	Revision : October 11th 2021
	Publication : December 30th 2021

Abstract
This study aims to discuss the effectiveness of e-learning-based learning media in vocational education. This study uses a meta-analysis method with secondary data types. The data were obtained in the form of post test results for the control class and the experimental class from research articles using e-learning-based learning media. A total of 27 research articles were dissected and the data obtained were calculated using the Effect Size (ES) formula. The calculation results show that e-learning-based learning media has a high effect on learning outcomes in vocational learning. The e-learning media as a whole has a very large influence on the learning outcomes of vocational education students according to the Cohen classification table with an effect size value of 1.68. Based on the results of the analysis, the implementation of e-learning media is effective in increasing the learning outcomes of vocational education students with an average of 70.64 increasing by 10.49 to 81.13. Thus, the implementation of e-learning-based media is very effective in improving student learning outcomes in vocational education..

Keywords: E-learning, Meta-Analysis, Learning Outcomes, Effect Size

INTRODUCTION

Education is the right investment for a better life. With education the existing potential will be converted into competencies that will save from problems (Ramdani, 2018). This potential change occurs with the learning process which is generally carried out in educational institutions in the form of schools or colleges (Dannur, 2017). One of these institutions is a vocational education institution.

Vocational education is education that prepares students to have the ability to work in the world of work and entrepreneurship, both from graduates of secondary education and higher education (Kholis, 2019). Vocational education certainly aims to produce graduates who are ready to work or are entrepreneurs in the field of engineering technology. For this reason, it is necessary to have an effective learning process in achieving this goal.

In implementing effective learning, it is necessary to support effective learning media as well (Safitri, & Adistana, 2021). This is because effective learning media will determine whether or not learning information is conveyed to students which will affect the learning outcomes of vocational education students. The implementation of effective and interesting learning requires a learning model with the help of appropriate media in order to support learning activities, so that participants take part in learning and can receive the knowledge conveyed. Various learning media are needed so that learning is more interesting and learning objectives are realized (Andayani, et all 2021). Interesting learning will stimulate participants to study teaching materials, so media that are suitable for the situation and conditions in the learning are needed.

Therefore, to adapt to technological developments, the learning model that fits the needs of today's learning demands is e-learning. E-Learning is a form of utilizing information technology for distance teaching and learning. E- learning adopts a conventional way of learning coupled with the provision of freedom of time, place and is not always oriented to educators (teacher centered) (Pinem &Hutagaol 2020).

E-learning is defined as the use of computers and network technologies, especially intranets or the internet, to deliver information and instructors to individuals (Sundhari et all, 2020). E-learning is an attempt to create electronic (virtual) classes that are equivalent to classes in formal education (Nasution & Zainy 2021). The purpose of e-learning is to distribute learning materials in real time , so when uploading learning materials, students can access them right away. E-learning is expected to be able to grow the knowledge, abilities and potential of students, and can show an increase in learning outcomes when using e-learning media (Andayani, et all 2021). Through e-learning, teaching materials can be virtualized in various formats and can be accessed without space or time limits. The advantages of e-learning- based learning media are widely used by the vocational education community in learning (Elyas, 2018).

E-Learning is a form of learning that utilizes electronic media and Information and Communication Technology (ICT) which allows learning materials to be delivered to students without a limited learning process in a space. Through e-learning students are encouraged to manage the entire learning process themselves in terms of managing their own environment, motivating, increasing knowledge independently, proactively and full of consideration (Herlandy & Novalia 2019). In addition, e-learning has the potential to make learning more effective because the opportunities for interaction between students and educators as well as learning materials are wide open. Because students can communicate with educators anytime and anywhere (Andayani, et all 2021).

E-learning is a form of learning model with innovative use of information and communication technology. E-learning has characteristics, including: having content that is relevant to the learning objectives; 2) using instructional methods, for example presenting examples and exercises to improve learning; 3) use media elements such as words and pictures to convey learning materials; 4) allows direct learning to be centered on the teacher (synchronous e-learning) or designed for independent learning (asynchronous e-learning) ; 5) build understanding and skills related to learning objectives either individually or improve performance (Zuraini & Nurhayati, 2021).

This e-learning- based learning is carried out in an effort to provide an alternative learning process using a distance learning model (Muharto & Ambarita 2017) . This online learning is carried out with the aim that face-to-face learning that cannot be done if it can still be effective in achieving learning objectives. The effectiveness of a learning activity is an indicator of the achievement of learning objectives that have been carried out (Huurun'ien 2017).

This study aims to identify the effectiveness of learning using e-learning-based learning media carried out in vocational education. The analysis was carried out related to the achievement of learning objectives carried out to achieve the cognitive domain with reference to the achievement of learning objectives referring to the Semester Lesson Plans for high-level vocational education, and Learning Implementation Plans for secondary-level vocational education(Irwanto, 2020).

In considering e-learning- based learning media which has become a current learning trend , educators need accurate information for mediators in influencing the effects of learning on vocational education. In this study, we will discuss the effectiveness of e-learning- based learning media in vocational education in various concentrations. This study was conducted with the aim of revealing the overall effect of the learning process using e-learning- based learning media so that the results can be considered for further implementation of e-learning- based learning media

METHOD

The type of research used by the researcher is meta-analysis, which is a statistical method to examine more than one similar previous study and obtain a quantitative mix of data. Meta-analysis method is a method used to analyze conclusions from various studies with statistical calculations (Mahmudah, 2020). In this meta-analysis research, the researcher will review, collect data and analyze the data that has been collected and which has been tested for truth. This research uses descriptive analysis technique. In this study Effect Size is the main basis in meta-analysis research, Effect Size is used to answer the formulated hypothesis (Eskris, 2021).

Effect Size is a quantitative category as a measure of the magnitude of the effect or the relationship between the variables studied. The meta-analysis used primary study data into the study. The primary data of this research include national journals regarding the effectiveness of e-learning implementation on student learning outcomes of vocational engineering education sourced from electronic journal repositories and searches on Google Scholar . The purpose of this meta-analysis is to draw more accurate conclusions from related or linked research and obtain a theoretical basis that supports solving the observed problems. The results of the research can later become material for proposals and references as an anticipatory measure for vocational education educators in implementing e-learning (Murni 2016).

The search results in this study obtained as many as 27 samples of articles related to the research topic. Each sample will be collected data in the form of post-test mean value for analysis. Then the data that has been obtained is calculated using the effect size formula . The formula for this effect size is as follows.

$$\boldsymbol{ES = \frac{M_e - M_c}{SD}}$$

Description:
ES = Effect Size Value
Me = The average value of the experimental class
Mc = Average value of control class
SD = Pooled standard deviation

Furthermore, to obtain the pooled standard deviation value can be calculated using the pooled SD formula. Conducting effect size test based on Cohen's d to measure the effect between research variables (Cohen 2007). The calculation formula used is:

SD pooled =

$$\sqrt{\frac{(N_E - 1)\, SD_E^2 + (N_C - 1)\, SD_C^2}{N_E + N_C - 2}}$$

Description:
d = Effect Size
N e = Number of students in the experimental class
N c = Number of students in the control class
SD e = standard deviation of the experimental class
SD c = standard deviation of control class

After the pooled SD value is obtained, then the average value of the experimental class is reduced by the average control value, then divided by the

standard deviation. The calculation results will obtain a value, which is then interpreted with an effect size category table , which will be based on the results of this interpretation, the effect category of a treatment is obtained. In this case, the treatment is the application of e-learning- based learning media in vocational education.

RESULTS AND DISCUSSIONS

After conducting a review of 27 research articles that implement *e-learning* in the learning process in technical vocational education, the *post-test* results were obtained . *Post-test* data came from each control class and experimental class. The data obtained comes from the research range from 2016 to 2021 with various fields of expertise in vocational education. The data set is presented in table 2 .

Table 1. Meta Analysis of data

Name	***Year***	***E-learning Tool***	***Major***	***Post-test***	
				Mark Experiment Class	**Control Class Value**
Meta Analysis 1 [12]	2017	E-Learning – Web	SMK	90.41	79.58
Meta Analysis 2 [13]	2016	E-Learning – School	SMK	96.47	81.79
Meta Analysis 3 [14]	2020	E-Learning – LMS Moodle	SMK	84.26	70.09
Meta Analysis 4 [15]	2019	E-Learning – Edmodo	SMK	80.31	67.65
Meta Analysis 5 [16]	2019	E-Learning	SMK	80,20	69.85
Meta Analysis 6 [17]	2019	E-Learning – Edmodo	SMK	88.89	84.69
Meta Analysis 7 [18]	2017	E-Learning	POLTEK	83.33	69.24
Meta Analysis 8 [19]	2019	E-Learning – Edmodo	SMK	85.00	82.77
Meta Analysis 9 [20]	2016	E-Learning – Moodle	SMK	82.66	81.75
Meta Analysis 10 [21]	2021	E-Learning – Moodle	SMK	85.23	80.03
Meta Analysis 11 [22]	2021	E-Learning – Moodle	SMK	77.32	69.87
Meta Analysis 12 [23]	2017	E-Learning	SMK	83.14	78.19
Meta Analysis 13 [24]	2018	E-Learning – Moodle	SMK	92.50	72.50

Meta Analysis 14 [25]	2021	E-Learning – Google Meet	SMK	86.72	73.75
Meta Analysis 15 [26]	2019	E-Learning	SMK	85.07	72.15
Meta Analysis 16 [27]	2018	E-Learning	SMK	83.10	81.73
Meta Analysis 17 [28]	2021	E-Learning	SMK	73.00	45,12
Meta Analysis 18 [29]	2020	E-Learning – Learning House	SMK	79.06	62.41
Meta Analysis 19 [30]	2020	E-Learning	S1.PTE	61.06	52.22
Meta Analysis 20 [31]	2021	E-Learning	S1.PTO	67.14	63.57
Meta Analysis 21 [32]	2016	E-Learning – Web	SMK	80.38	75.56
Meta Analysis 22 [33]	2018	E-Learning	POLTEK	80.75	69,50
Meta Analysis 23 [34]	2017	E-Learning – School and Edmodo	SMK	80.08	71.25
Meta Analysis 24 [35]	2020	E-Learning – Edmodo	SMK	75.51	68.15
Meta Analysis 25 [36]	2017	E-Learning – Quipper School	SMK	80.42	67.80
Meta Analysis 26 [37]	2020	E-Learning	S1 PTM	62.94	62.36
Meta Analysis 27 [38]	2021	E-Learning – Google Meet	SMK	78.97	68,80

To make it easier to analyze the post-test data, the post-test collection is presented in graphical form. The graph of the post-test collection is as follows.

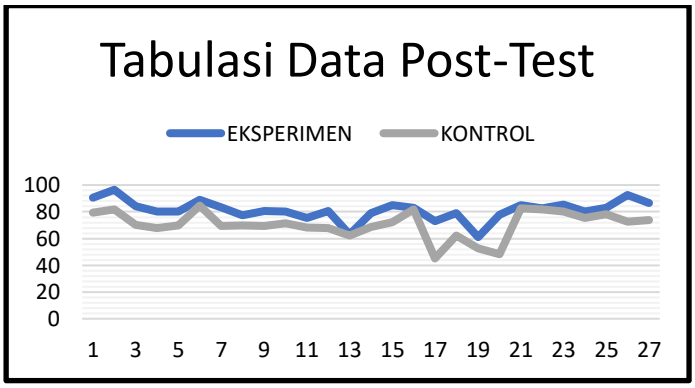

Figure 1. Meta Analysis Data Tabulation

The magnitude of the effect of the implementation of e-learning media can be measured through the *Effect Size* (ES) test . This study uses Cohen's d *effect size*

calculation , the greater the ES value, the greater the effect of e-learning media on the learning outcomes of vocational education students. The provisions in the ES measure can be categorized as follows:

Table 2. *Effect Size* Criteria

Effect Size	**Information**
0.00 – 0.20	Has a weak effect
0.21 – 0.50	Has low effect
0.51 – 1.00	Has a moderate effect
> 1.00	Has a high effect

Source: (Cohen, L., Manion, L., & Morrison, 2007)

The ES calculation in this study consists of the data in table 2. The mean value of the control class is 71.21, while the mean value of the experimental class is 80.72. Then the results of the ES calculation obtained 1.17 which is included in the category greater than 1.00. Based on table 3 of *effect size* classification , it can be concluded that the implementation of *e-learning*- based media has a very large influence on the progress of the academic value of vocational education students.

This means that learning using *e-learning* has a positive and effective impact on spurring p. The ES calculation in this study consists of the data in table 2. The mean value of the control class is 71.21, while the mean value of the experimental class is 80.72. Then the results of the ES calculation obtained 1.17 which is included in the category greater than 1.00. Based on table 3 of *effect size* classification , it can be concluded that the implementation of *e-learning*- based media has a very large influence on the progress of the academic value of vocational education students.

This means that learning using *e-learning* has a positive and effective impact on increasing student learning outcomes in vocational education. The positive impact of the application of the *e-learning* in teaching is to train students to take the initiative to find a reference self-study materials from various sources in *the interne* t *(self-learning materials)* . In addition, the time and place for learning to take place is very flexible with the existing situations and conditions so that the learning process between educators and students is not limited by space and time as long as the *internet* connection *is* still affordable and other supporting devices are adequate.

The implementation of *e-learning*- based learning media can be the best choice in vocational education, the use of *e-learning* has become an alternative learning in carrying out the teaching and learning process during the current pandemic. *E-learning* has features that can replace the teaching and learning process in the classroom so that it can meet the expected goals in the learning process, so that learning using *e-learning is* an option. Increasing student learning outcomes in vocational education. The positive impact of the application of the *e-learning* in

teaching is to train students to take the initiative to find a reference self-study materials from various sources in *the interne* t *(self-learning materials)* . In addition, the time and place for learning to take place is very flexible with the existing situations and conditions so that the learning process between educators and students is not limited by space and time as long as the *internet* connection *is* still affordable and other supporting devices are adequate.

The implementation of *e-learning*- based learning media can be the best choice in vocational education, the use of *e-learning* has become an alternative learning in carrying out the teaching and learning process during the current pandemic. *E-learning* has features that can replace the teaching and learning process in the classroom so that it can meet the expected goals in the learning process, so that learning using *e-learning is* an option.

CONCLUSION

Based on the results of data analysis that has been carried out on 27 articles from 2016 to 2021 with the aim of knowing the learning outcomes of vocational education students using e-learning- based learning media by looking at the post-test results after implementing e-learning- based learning media . There are differences in the learning outcomes of the experimental class and the control class , so that the implementation of e-learning- based learning media can be accepted in vocational education. The conclusion is based on the interpretation of the effect size calculations that have been carried out. Tests show that e-learning- based implementation has a very large impact on the progress of vocational education students' academic scores. The average result of the students' learning scores, which was originally 71.21, increased by 9.51 to 80.72. So it can be concluded that the implementation of e-learning- based learning media is proven to be effective in increasing the learning outcomes of vocational education students for the current situation and condition. Learning media based on e-learning can be the best option in the flipped classroom and blended learning methods because this method carries out learning partly at home and partly at school]. Especially in the current Covid-19 pandemic condition, this e-learning-based learning media is the right choice to use in learning without having to spend a lot of money to learn.

Suggestions for similar research are to collect and analyze more research samples with more specific data so that research results are more accurate and can analyze effectiveness not only from learning outcomes, but also from the scope of the media used and the material being studied.

REFERENCES

Andayani, D. D., Fathahillah, F., & Abdal, N. M. (2020, November). Penerapan E-Learning Sebagai Alternatif Pembelajaran di Masa Pandemi Covid-19. In Seminar Nasional Pengabdian Kepada Masyarakat.

Cohen, L., Manion, L., & Morrison, K. (2007). Research Methods in Education. Routllege Falmer.

Dannur, M. (2017). Teori Adult Learning , Ekspriental Learning Cycle Dan Perubahan Performance Individu Dalam Pendidikan Dan Pelatihan. Fikrotuna, 5(1).

Elyas, Ananda Hadi. (2018). "Penggunaan Model Pembelajaran E-Learning Dalam Meningkatkan Kualitas Pembelajaran." 56.

Eskris, Y. (2021). Meta Analisis Pengaruh Model Discovery Learning dan Problem Based Learning terhadap Kemampuan Berfikir Kritis Peserta didik Kelas V SD. Mahaguru: Jurnal Pendidikan Guru Sekolah Dasar, 2(1), 43-52

Huurun'ien, K. I. (2017). Efektivitas Penggunaan E-Learning Berbasis Schoology dengan Menggunakan Model Discovery Learning Terhadap Prestasi Belajar Siswa Pada Mata Pelajaran Sistem Komputer Kelas X Multimedia SMK Negeri 6 Surakarta pada Tahun Pelajaran 2015/2016

Irwanto, I. (2020). Use Of E-Learning Models For Lesson Activities On Microcontroller's Eyes To Improve Student Learning Outcomes In Vocational Education In Electrical Engineering Sultan Ageng Tirtayasa University. 5(1).

Kholis, N., Wibawa, B., & Soeprijanto. (2019). Analisis Rantai Nilai Pendidikan vokasi dalam Mengembangkan Entrepreneurship : Studi Kasus pada SMK PGRI 20 Jakarta. 3(2), 124–135.

Mahmudah. Umi. (2020). Meta Analisis Pengaruh Model Discovery Learning dan Problem Based Learning Terhadap Kemampuan Berpikir Kritis Matematis Peserta Didik Kelas V SD. Vol. 3. No 2, Tahun 2020. p-ISSN: 2615-4692 e-ISSN: 2615-6105

Muharto, M., Hasan, S., & Ambarita, A. (2017). Penggunaan Model E-learning dalam

Mulyana, a. (2021). Pengaruh Media Pembelajaran Dan Motivasi Belajar Terhadap Hasil Belajara. 1(4), 220-228.

Murni, C. K. (2016). Pengaruh e-learning berbasis schoology terhadap peningkatan hasil belajar siswa dalam materi perangkat keras jaringan kelas X TKJ 2 pada SMK Negeri 3 Buduran, Sidoarjo. 1(01).

Nasution, H. N., & Zainy, A. (2021). Penerapan Media E-Learning Berbasis Edmodo Pada Mata Pelajaran Komputer dan Jaringan Dasar Terhadap Hasil Belajar Siswa Kelas X di SMK Negeri 1 Sipirok. 1(3), 25-31.

Pinem, S., & Hutagaol, V. E. (2020). Pengaruh Penerapan Elearning Berbasis Schoology Terhadap Peningkatan Hasil Belajar Siswa (Studi Kasus SMK Negeri 1 Kabanjahe). 5(2), 115-119.

Ramdani, Z. (2018). Collaboration between School Principals, Teachers, and Students in Creating a Good Quality of Educational System. PROSIDING 1st National Conference on Educational Assessment and Policy,

Safitri, N. A., & Adistana, G. A. Y. P. (2021). Efektivitas Implementasi Media E-Learning Terhadap Hasil Belajar Siswa Sekolah Menengah Kejuruan: Studi Meta-Analisis. 5(2), 4021-4031.

Sundhari, K. I., Wahyuni, D. S., & Santyadiputra, G. S. (2020). Efektivitas Media E-Learning Dengan Model Experiential Learning Pada Mata Pelajaran Komputer Dan Jaringan Dasar. 9(2), 56-66.

Zuraini, Z., & Nurhayati, N. (2021). Efektifitas Pembelajaran E-Learning Diera New Normal. Genta Mulia: Jurnal Ilmiah Pendidikan, 12(1)