INNOVATIVE LEARNING MEDIA FOR DISTANCE EDUCATION: META-ANALYSIS

Memet Casmat[1], Ali Muralitharan[2]

[1]*Universitas Terbuka (INDONESIA)*
[2]*EON (SINGAPORE)*

memet.casmat@ecampus.ut.ac.id

Abstract

This research aims to evaluate the influence of innovative learning media in distance education on learning motivation, learning activities, and learning achievement of distance learners. This research uses a meta-analysis method which is a quantitative research approach. There are 17 pieces of literature that meet the requirements to be included in the database. The results revealed that, for learning motivation variables, the effect size value in the form of the analysis showed that the 17 effect sizes of the studies analyzed were heterogeneous (Q = 55,396; p < 0.001). The Random Effect model showed that there was a significant positive correlation between learning media innovation and student distance education learning outcomes (z = 156,099; p < 0.001; 95% Cl (0.952; 0.977). From the forest plot, it can be observed that the size effect of the analyzed studies varies between 0.86 and 0.99. The Fail-safe value of N obtained is 800489,000, with a target significance of 0.050 and p < 0.001. Because the Fail-safe value of N > 5K + 10. 800489 > 95, it can be concluded that there is no publication bias problem in this meta analysis study. The urgency of implementing learning media in supporting the evaluate the influence of innovative learning media in distance education on learning motivation, learning activities, and learning achievement of distance learners. It could be concluded that innovative learning media are able to increase learning motivation, learning activities, and learning achievements of distance learners. Future work should address the interactions between each of these innovative learning media and distance education specific topics.

Keywords: Innovative learning media, Distance education, Distance learners

1 INTRODUCTION

Technology is developing so rapidly in the last 20 years, especially information technology. All segments are exposed to technology and those who are unable to adapt will be constrained in various cases. For instance technology can bu use for Distance Learning is learning with use a medium that possible to occur interaction between teachers and learners. In Distance Learning between teachers and learners is not face-to-face, in other words through Distance Learning possible between teachers and learners in different places, they can even be separated by a very long distance [1].

The development of technology, communication and information, especially the internet has become a demand for teachers in Indonesia to be able to use it as a source of positive learning media in supporting teaching and learning processes. The use of technology media provides benefits for teachers and students to access learning materials and interact directly in learning in the classroom, and also outside the classroom through online media [2]

Learning media are tools or intermediaries that function to facilitate the learning process so that communication between teachers and students is more effective. This can make it easier for students to accept and understand the lesson [3]

So that, this study aims to determine the effectiveness of the use of learning media when compared to conventional learning in various countries. It is hoped that the results of this meta analysis research can used as an overview of the effects of learning media in improving the learning outcomes of distance education students so that can be used as a basis for policymaking, integration of learning media in distance education.

2 RESEARCH METHOD

This research was a meta-analysis that summarized the results of similar studies and conclude with a global conclusion. The theme of this research was the innovative learning media in supporting the distance education learning process . Thus, the data population in this article is a study of all studies that compare the results of a learning process by utilizing or integrating learning media and conventional (in this case translated as learning without learning media).

The articles analyzed are those published in the journal from 2013 to 2023 in English. The article collection technique uses Google Scholar as a search engine that is linked to various journal portals and indexing agencies. This strategy is used to collect data as widely as possible in order to obtain a lot of data so that it can represent global conditions comprehensively and keep away from bias.

The inclusion criteria in this study based on articles published from 2013 to 2023 were: i) Articles published in the United Nations Language; ii) The article discusses the influence of media on learning achievement; iii) Articles are analyzed quantitatively; iv) The article describes the data in the form of sample size, standard deviation, and average; v) Articles are published in journals indexed in Google Scholar.

Articles that did not meet the six inclusion criteria would be included in the set of articles that fall under the exclusion criteria. Articles that fall within the exclusion criteria would not be included in the meta analysis process. Finally, the researchers collected a total of 40 articles

with relevant themes to the research focus. However, only 15 articles were found that writing data on the number of samples, the standard deviation of the data, and the mean of the research results.

These three data are basic in finding global conclusions. If the three data were not written completely, a search would be carried out on the final page to find the raw data from the research results which could then be used to identify data on the number of samples, the standard deviation of the data, and the mean of the research results. If these data were not available, the article would be eliminated from the set of samples to be analyzed. In these 15 articles, there were several that contain more than one research result so that from the final collection of research results there were 17 research results that would be analyzed using meta-analysis techniques.

This study used a random effect model with the aim that the results of the research could be generalized to the population (not only applies to inferring data findings). The requirement to choose a random effect model was heterogeneity information I2>25%. The type of meta-analysis in this study is a contrast group that will show whether or not there is a difference between learning media-based and conventional learning. The data obtained had a variation interval (difference in the minimum and maximum value), so the data must be standardized. Estimating of sample mean/effect size (d) are standardized by (1):

$$d = \frac{x_1 - x_2}{Swithin} Swithin = \sqrt{\frac{(n_1 - I)\, S_1^2 + (n2-1)\, S}{(n_1 - 1)\,((n_2 - 1)}} \quad (1)$$

The formula that used for find the standard error of d (SEd) is (2):

$$SEd = \sqrt{Vd}, with\ Vd = \frac{n1+n2}{n1\ n2} + \frac{d2}{2\ (n1+\ n2)} \quad (2)$$

Hedge [4] showed that d that resulted has a slight bias. To minimize the bias, Herges changed to g with the (3) and (4).

$$g = J\ x\ d, with\ J = 1 - \frac{3}{4df - 1} \quad (3)$$

$$df\ degree\ of\ freedom\ (n1 + n2 - 2)$$

$$SEg = \sqrt{Vg}, with\ Vg = \ J\ x\ Vd \quad (4)$$

Then, the analysis process is carried out using JASP software. The data entered were g as the effect size and SEg to produce a forest plot in which there were a value interval and standard error for each study and its conclusions. In addition, JASP also helped in the calculation of heterogeneity and publication bias (funnel plot). Thus, it could be concluded the effect of media learning in the distance learning process.

3 RESULTS AND DISCUSSION

3.1 Result

This study analyzed 17 research results taken from 15 articles. There are several studies that produce several research results. Several studies [5], [6] shared the impact of learning media to improve learning outcomes among female and male distance learning students. Riana Nurhayati and Suranto, *et al* [7] shared the fact of achievements (memory, understanding, and application) affected by media utilization. I Putu Ade Andre Payadnya and I Made Wena, *et al* [6] divided achievement, namely mathematics, geometric concept, characteristics of students, that was improved by media utilization in learning. Vilanets [8] divided two studies of the influence of learning media on achievement and problem-solving abilities.

In general, the research selected is research that found the influence of the use of learning media in improving learning outcomes distance learner. In this research, what is meant by learning outcomes are student achievements in various domains, subjects, and levels of education. The results of the study compared the control group with the experimental group (Learning media-based). Based on the data sample size, mean, deviation standard, researchers can produce the effect size and standard error.

Categorized firms as conservative or entrepreneurial, using the extent of product innovation. The two types differed in their degree of environmental hostility, organizational differentiation, environmental heterogeneity and technocratization. Conservative firms engage in innovation with reluctance, usually as a response to serious challenge. Entrepreneurs aggressively pursue innovation, and control systems were used to warn against excessive innovation. [9]

3.1.1 Heterogeneity Test

Fixed and Random Effects

	Q	df	p
Omnibus test of Model Coefficients	24366.830	1	< .001
Test of Residual Heterogeneity	55.396	16	< .001

Note. *p* -values are approximate.

The results of the analysis showed that the 17 effect sizes of the studies analyzed were heterogeneous (Q = 55,396; p < 0.001). Thus, the Random Effect model is more suitable to be used to estimate the average effect size of the 17 effect sizes analyzed. The results of the analysis also indicate that there is potential to investigate the moderator variables that affect the relationship between learning media innovation and student distance education learning outcomes.

Summary Effect/Mean Effect Size

Coefficients

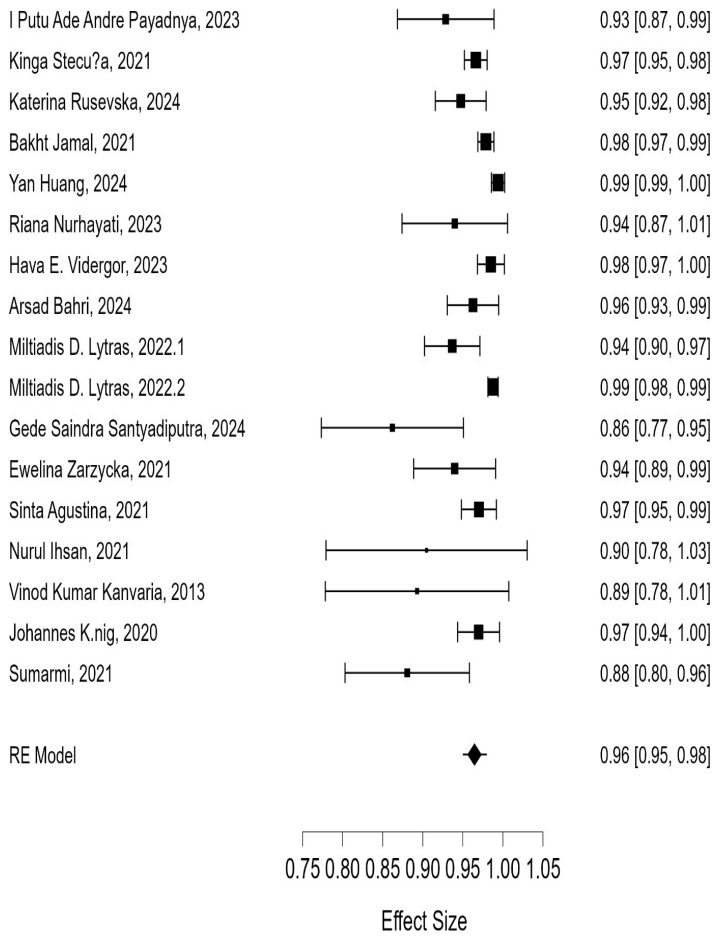
					95% Confidence Interval	
	Estimate	Standard Error	z	p	Lower	Upper
intercept	**0.965**	0.006	156.099	**< .001**	0.952	0.977

Note. Wald test.

The results of the analysis with the Random Effect model showed that there was a significant positive correlation between learning media innovation and student distance education learning outcomes (z = 156,099; p < 0.001; 95% Cl (0.952; 0.977). The influence of learning media innovation on the learning outcomes of distance education students is included in the high category* (rRE = 0.965).

* r = 0.1 (low); r = 0.3 (moderate); r = 0.5 (high) (Cohen, 1988)

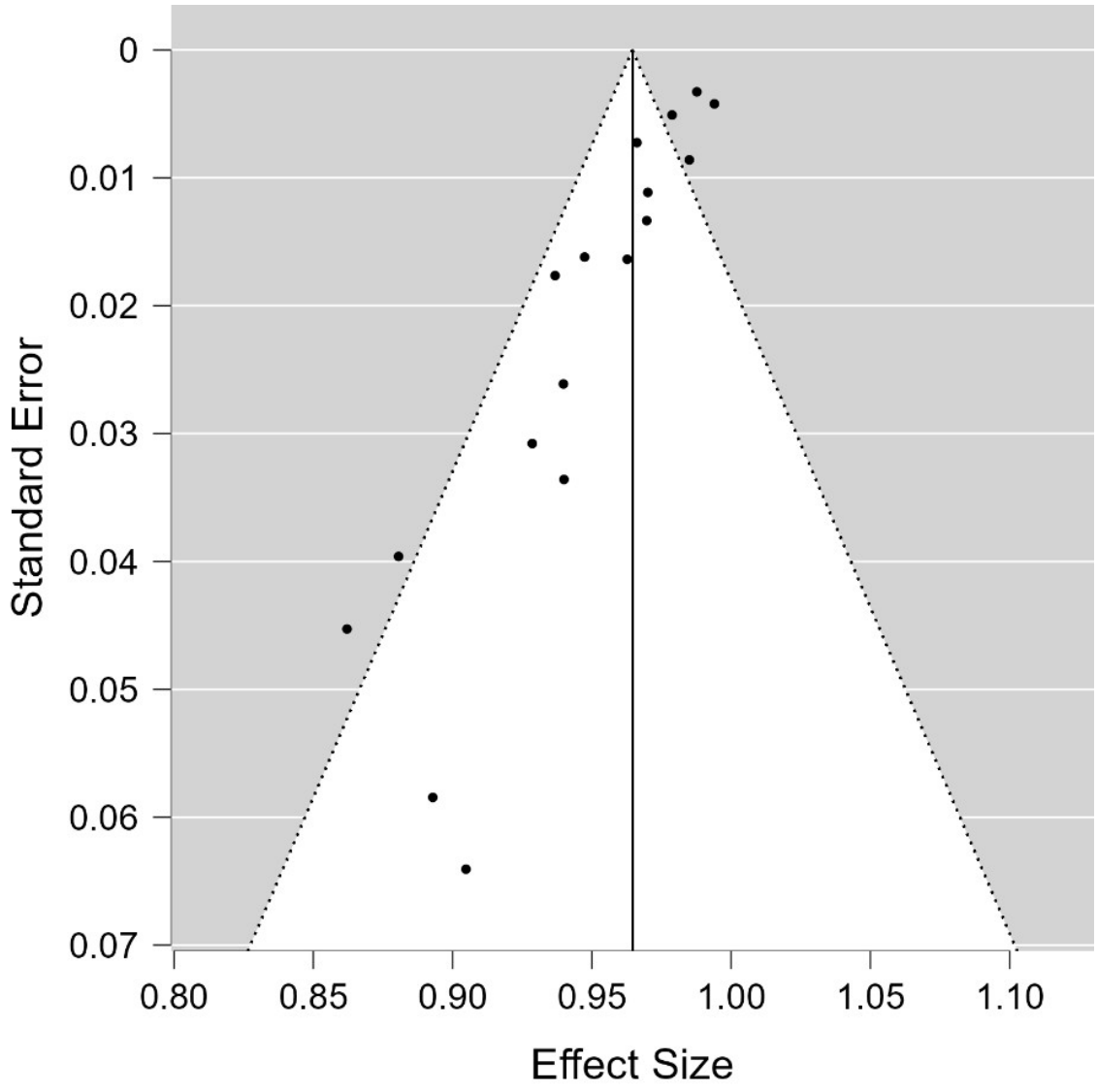
Forest Plot



From the forest plot, it can be observed that the size effect of the analyzed studies varies between 0.86 and 0.99.

3.1.2 Publication Bias Evaluation

Funnel Plot



The results of the plot funnel are difficult to conclude whether the plot funnel is symmetrical or not, so an Egger Test is needed to test whether the plot funnel is symmetrical or not.

Egger's Test

Regression test for Funnel plot asymmetry ("Egger's test")

	z	p
sei	-5.889	< .001

$p < 0.05$ informs that the plot funnel is not symmetrical. Thus, it can be concluded that there is a problem of publication bias in the meta-analysis study.

Fail-Safe-N

File Drawer Analysis

	Fail-safe N	Target Significance	Observed Significance
Rosenthal	800489.000	0.050	< .001

Since K = 17, so 5K + 10 = 5(17) + 10 = 95 (Rosenthal). The Fail-safe value of N obtained is 800489,000, with a target significance of 0.050 and $p < 0.001$. Because the Fail-safe value of $N > 5K + 10$. 800489 > 95, it can be concluded that there is no publication bias problem in this meta analysis study.

3.2 Discussion

Schools are educational institutions that have a very important role in improving the quality of human resources in a country. Therefore, schools as educational institutions must always adapt and adapt to existing dynamics and developments, both in terms of technology, human resources such as teachers and students as well as learning. Learning is a teaching and learning process in which there is a positive interaction between teachers and students in an effort to achieve the learning goals themselves.

Schools are educational institutions that have a very important role in improving the quality of human resources in a country. Therefore, schools as educational institutions must always adapt and adapt to existing dynamics and developments, both in terms of technology, human resources such as teachers and students as well as learning. Learning is a teaching and learning process in which there is a positive interaction between teachers and students in an effort to achieve the learning goals themselves [7]

Every teaching and learning process must certainly use certain media to run effectively and smoothly. The learning media functions to distribute, convey, and connect learning resources,

which in turn can lead to better communication in learning and behaviour change because learning objectives can be achieved.

Media as a connecting tool (communication medium) in the process of teaching and learning interaction to improve the effectiveness of student learning outcomes. The educator are required to be able to use the tools that can be provided by schools, and it is also possible that these tools are under the development and demands of the times.

Educational innovation inherently involves educator training and learning of students and educators [10]. The use of instructional media is the most effective way to be used so that all learning objectives can be achieved. Innovative learning media is a solution so that all learning objectives can be implemented. The use of innovative media can also increase students' interest in the learning processThis happens because innovative media will create a more effective and efficient learning atmosphere. [11]

Furthermore, the application of multimedia technology has been accelerated in the fields of economy, science, technology, education, health, culture, media, entertainment, music and other fields. Multimedia technology has become one of the dominant technologies in the information society, and the combination of media technology and network communication technology has resulted in video, telephone, and so on. The application of this technology has changed people's lifestyles and habits, and will continue to have an impact on people's lives, studies, and work, as well as in the field of education [12]

4 CONCLUSION

The analysis showed that there was a significant difference between the learning outcomes of groups that used learning media and non-learning media in the learning process, groups of students who learned by utilizing learning media had better learning outcomes than those who did not use learning media. Forrest's plot data shows that there is a summary effect of 1.05, so it can be interpreted that the learning outcomes using learning media are 105% higher than students who use conventional learning models. In addition, with a confidence of 0.96%, there is a summary effect interval ranging from 0.95 to 0.98 so it does not contain zero.

This shows a significant difference between students who learn using learning media and conventional. To test publication bias, it can be done by using the Trim and Fill method which shows that there is no publication bias in the meta-analysis conducted. Thus, the conclusion that learning using learning media innovations is more effective compared to conventional learning is free from bias. Based on the results of the analysis, it is very clear the urgency of

implementing learning media in supporting the evaluate the influence of innovative learning media in distance education on learning motivation, learning activities, and learning achievement of distance learners. Thus, the quality of the learning process and students' technological literacy has increased

REFERENCES

D. P. Parlindungan, G. P. Mahardika, and D. Yulinar, "Efektivitas Media Pembelajaran Berbasis Video Pembelajaran dalam Pembelajaran Jarak Jauh (PJJ) di SD Islam An-Nuriyah," Pros. Semin. Nas. Penelit. LPPM UMJ, pp. 1–8, 2020.

T. I. Prasasti, M. Solin, and W. Hadi, "The Effectiveness of Learning Media Folklore Text of North Sumatera Based on Blended Learning by 10th Grade Students of Vocational High SchoolHarapan Mekar-1 Medan," Budapest Int. Res. Critics Linguist. Educ. J., vol. 2, no. 4, pp. 480–490, 2019, doi: 10.33258/birle.v2i4.548.

M. M. E. I. Bali, "Implementation of learning media based on information and communication technology in distance learning," Tarbiyatuna J. Islam. Educ. Stud., vol. 3, no. 1, pp. 29–40, 2019.

L. V Hedges, "Distribution Theory for Glass ' s Estimator of Effect Size and Related Estimators Author (s): Larry V . Hedges Published by : American Educational Research Association and American Statistical Association Stable URL : http://www.jstor.org/stable/1164588," vol. 6, no. 2, pp. 107–128, 2011.

E. Zarzycka, J. Krasodomska, A. Mazurczak-Mąka, and M. Turek-Radwan, "Distance learning during the COVID-19 pandemic: students' communication and collaboration and the role of social media," Cogent Arts Humanit., vol. 8, no. 1, 2021, doi: 10.1080/23311983.2021.1953228.

I. P. A. A. Payadnya, I. M. Wena, P. S. Noviantari, I. M. P. K. Palgunadi, and A. D. C. Pradnyanita, "Development of RME Learning Media Based on Virtual Exhibition to Improve Students' High Order Thinking Skills (HOTS)," Math. Teaching-Research J., vol. 15, no. 5, pp. 129–156, 2023.

W. W. W. P. Net et al., "The Effect of Innovative Learning on Student Achievement in Indonesia: A Meta-Analysis," Pegem J. Educ. Instr., vol. 13, no. 3, pp. 159–167, 2023, doi: 10.47750/pegegog.13.03.17.

G. S. Santyadiputra, Purnomo, W. Kamdi, S. Patmanthara, and D. Nurhadi, "Vilanets: An advanced virtual learning environments to improve higher education students' learning

achievement in computer network course," Cogent Educ., vol. 11, no. 1, p., 2024, doi: 10.1080/2331186X.2024.2393530.

K. Langfield-Smith, "Management control systems and strategy: A critical review," Accounting, Organ. Soc., vol. 22, no. 2, pp. 207–232, 1997, doi: 10.1016/S0361-3682(95)00040-2.

R. Wadmany and O. Melamed, "'New Media in Education' MOOC: Improving Peer Assessments of Students' Plans and their Innovativeness," J. Educ. e-Learning Res., vol. 5, no. 2, pp. 122–130, 2018, doi: 10.20448/journal.509.2018.52.122.130.

N. Guan, J. Song, and D. Li, "On the advantages of computer multimedia-aided English teaching," Procedia Comput. Sci., vol. 131, pp. 727–732, 2018, doi: 10.1016/j.procs.2018.04.317.

Q. Mao, "Mode seeking generative adversarial networks for diverse image synthesis," 2019. doi: 10.1109/CVPR.2019.00152.