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Issue V, 22 November 2022

e-ISSN 2707-9481

ISBN 978-601-323-288-1

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<https://doi.org/10.31643/2022.17>

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Meta-analysis study: Analysis of the Effect of Digital Platforms on Learning Outcomes

Abstract: Learning media are required to use digital platforms to maintain online learning. The Covid-19 pandemic stimulates technological developments in the era of the industrial revolution 4.0, especially in the education sector. Utilization of various digital platforms is carried out to support the learning process. Various digital media platforms are used in the online learning process. This study aims to analyze the effects of digital platforms on the impact of learning. The digital platforms used are Zoom Meeting, WhatsApp, Google Classroom, Schoology, and Edmodo. This type of research is meta-analysis. The steps in determining this research according to Borenstein: (1) formulating a dilemma, (2) searching the literature, (3) collecting issues and findings from individual studies, (4) evaluating the quality of the study, (5) analyzing and interpreting the results of the study, and (6) interpreting what will happen or evidence. The data collection technique is done by browsing the journals using Publish or Perish. Thirteen journal articles met the appropriate inclusion criteria and concluded that the digital platform had an effect on student learning outcomes.

Keywords: Covid-19, digital platform, learning outcomes, industrial revolution era 4.0.

Cite this article as: Rugaya Tuanaya, Andi Abdurrahman Manggaberani, Rina Safitri, Syahri Ramadan (2022). Meta-analysis study: Analysis of the Effect of Digital Platforms on Learning Outcomes. *Challenges of Science*. Issue V, 2022, pp. 129-134. <https://doi.org/10.31643/2022.17>

Introduction

Covid-19 has hit almost all parts of the world, making technological developments faster. One of the impacts of technological developments and Covid-19 is that the modern learning environment is getting stronger (Syafii and Heri, 2021). Learning media is required to use digital platforms to maintain online learning. In the era of the industrial revolution 4.0, technology has become a separate catalyst for education today. Utilization of various digital platforms is carried out to support learning. There are various types of digital platforms as media in implementing online education.

Several platforms that can be used in the implementation of online learning include Google Classroom, Edmodo, Rumah Belajar, Ruang Guru, Sekolahmu, Kelas Pintar, Zenius, Google Suite for Education, Microsoft Office 365 for Education (Daheri et al., 2020; Hasbi & Woro, 2020). Many studies have documented the global development of online learning. The results of a review of several scientific articles

conducted by Ayu et al. (2020) included that the use of digital platforms such as Zoom, WhatsApp, Google Classroom, Schoology, and Edmodo had a positive impact on students and was effective in improving the quality of online lectures during the Covid-19 pandemic.

Research has shown that integrating learning management systems in higher education environments can improve teaching and experiential learning. According to Coates et al. (2005), e-learning platforms such as Moodle, WizIQ, Blackboard, and Docebo offer advanced tools that provide course administration and pedagogical functions. Smirnova and Deutsch (2014) state that online learning through a course management system allows students to become independent lifelong learners. According to Dilani et al. (2013), the tools and features available from e-platforms increase engagement, achievement, and motivation.

Windhiyana (2020) said that Zoom Meeting is a digital platform that sees the ability and willingness of students in the learning process by directing the learning process themselves according to their wishes and needs. Using Zoom Meetings for online lectures can significantly increase student engagement and make it easier to collect qualitative data because it is more cost-effective (Kusnayat et al., 2020). The process of delivering lecture material by lecturers to students through Zoom Meetings takes place as usual lecture flow (Bustomi, 2020), and is not boring because it is accompanied by varied methods (Farida et al., 2020; Astini, 2020). The Zoom Meeting platform obtains the highest level of effectiveness, especially in its function as a medium for face-to-face discussion.

The WhatsApp platform, which is being loved by the wider community, has facilities for text messages and phone calls in audio and video. There are exciting features on WhatsApp in its designation as a means of online lectures. WhatsApp is equipped with the WhatsApp Group feature, so this platform is often used as a medium to send information and documents related to online lectures. WhatsApp Group is suitable for delivering teaching materials and assignment documents (Windhiyana, 2020; Nadeak, 2020).

Google Classroom is an application in the form of an LMS (Learning Management System) provided by Google and can be connected to email, thus providing easy access. Google Classroom can be accessed free for academic and other needs using a Google account. Google Classroom is used to deliver lecture material, submit assignments, collect assignments, and evaluate assignments that have been collected by students (Suhada, 2020). There are several interesting features found in Google Classroom. One of the interesting features often used by lecturers is creating an assignment and topic features.

Students often experience constraints during online lectures, unstable internet signals, and running out of quota during learning, which can hamper the online lecture process. However, these problems can be overcome by combining online learning with various more quota-efficient platforms. This is in line with Sutrisno (2020), who stated that the use of the Google Classroom platform for online lectures during the Covid-19 pandemic was quite effective, but it would be better if it could be combined with other platforms. There are constructive suggestions for improving this platform, namely the need to add live conference features and lecture video attachments so that learning can take place in Google Classroom (Mulatsih, 2020)

Schoology is a free web-based educational platform that allows lecturers to conduct online lectures to students. The advantages of Schoology are that its use is simpler, allows it to be accessed by anyone, and is a management system that frees lecturers to provide material, manage processes, and evaluate the lecture process (Nadeak, 2020). Schoology allows collaboration and discussion between individuals, groups, and classes discussions (Mulatsih, 2020).

There are many ways to prepare teachers and students from time to time to be able to keep up with existing developments. The government has also tried and played an active role in helping the continuity of the education process with digital platforms. A digital-based learning media was developed to answer the challenges of digital-based learning to improve student learning performance. Therefore, this study aims to investigate the relationship between digital platforms and student learning outcomes through systematic reviews and meta-analyses worldwide.

Method

This research is a type of meta-analysis research (Retnawati et al., 2018). Meta-analysis is a quantitative statistical method for compiling and analyzing descriptive data from various published and unpublished relevant research results that explore and test the same research problems and hypotheses

(Glass, 1976). According to Borenstein et al., (2009) the stages of meta-analysis consist of (1) formulating the problem, (2) searching the literature, (3) collecting information and findings from individual studies, (4) evaluating study quality, (5) analyzing and interpreting study results, and (6) interpreting results or evidence. In this study, the meta-analysis used research data related to digital platforms on student learning outcomes in Indonesia. Through a meta-analysis study, it is expected to comprehensively summarize the findings of previous studies related to digital platforms.

Inclusion criteria used to screen publications: (1) Issue years range from 2013 to 2022; (2) Articles published in international, national, or international journals or proceedings, or others; (3) The research article has at least one experimental class that uses the digital platform and the other is a conventional class or the other as a control class., and (4) Articles should report sufficient data to change the effect size.

Statistical Analysis Hypothesis

The hypotheses in this meta-analysis study are:

H0: There is no significant influence between digital platforms and student learning outcomes.

H1: There is a significant influence between digital platforms and student learning outcomes.

Data analysis was conducted with the help of OpenMEE software. The meta-analysis scheme used in this article consists of several steps, namely: (1) calculate the effect size of each study; (2) test for heterogeneity; (3) calculate the combined effect size; (4) evaluate publication bias. The interpretation of effect size in this study uses the classification proposed by Thalheimer and Cook (2002). The effect size classification is presented in Table 1.

Table 1. Effect Size of the Experimental Study

Classification	Interval
No Effect	$-0.15 \leq \text{Effect Size} \leq 0.15$
Low Effect	$0.15 < \text{Effect Size} \leq 0.40$
Moderate Effect	$0.40 < \text{Effect Size} \leq 0.75$
High Effect	$0.75 < \text{Effect Size} \leq 1.10$
Very High Effect	$1.10 < \text{Effect Size} \leq 1.45$
Excellent Effect	$\text{Effect Size} > 1.45$

The heterogeneity test in this study was conducted using the Q parameter approach. If the p-value < 0.05 , the suitable estimation model to calculate the summary effect is the random effect model. If the p-value > 0.05 , the fixed effect estimation model is used. τ^2 is used to calculate the effect size weight using a fixed-effect model or random-effect model (Retnawati et al., 2018). Furthermore, according to (Lipsey & Wilson, 2001), the p value is lower than the significance level, then it meets the heterogeneity test, which indicates that the set of research studies has more than one distribution.

The publication bias test uses the File-Safe N (FSN) approach. If the File-Safe N value $> (5K+10)$, where k is the number of studies included in the meta-analysis, then the study does not have a publication bias problem and can be scientifically justified (Borenstein et al., 2009).

Results and Discussion

Effect Size of Each Study

The first step is to calculate the effect size of each study. To be more accurate, the effect size of each study in this research was calculated using OpenMEE software. Table 2 summarizes the effect size and variance values for each study and country. The effect size values ranged from -0.124 to 1.444. Of the total 13 effect sizes, four effect sizes (n = 4) were classified as no effect, one effect size (n = 1) was classified as low effect, two effect sizes (n = 2) were classified as moderate effect, three effect sizes (n = 3) were classified as high effect, and three effect sizes (n = 3) were classified as the very high effect.

Table 2. Effect Size and Variance of Each Study

Author	Country	Effect Size	Varians
Sipon, S. (2021)	Indonesia	-1.038	0.083
Ahmed, A. M., et al. (2020)	Oman	1.140	0.114
Pambudi, R., et al. (2019)	Indonesia	0.473	0.059
Irwan, I., et al. (2019)	Indonesia	0.911	0.074
Hikmah, H., et al. (2022)	Indonesia	0.777	0.102
Hikmah, H., et al. (2022)	Indonesia	0.746	0.095
Falode, M. E., et al. (2021)	Nigeria	0.141	0.019
Putri, S. E., et al. (2020)	Indonesia	0.337	0.077
Falode, M. E., et al. (2019)	Nigeria	-0.124	0.018
Falode, M. E., et al. (2019)	Nigeria	-0.279	0.018
Yensy, N. A., et al. (2020)	Indonesia	1.223	0.079
Muniroh, S. H., et al. (2020)	Indonesia	0.754	0.071
Khamidah, N., et al. (2019)	Indonesia	1.444	0.103

Heterogeneity Test of Effect Size

The second stage is to test for heterogeneity and select an appropriate estimation model. Heterogeneity test is conducted to prove whether the effect size of each study is different. The heterogeneity test in this study was conducted using the Q parameter approach with degrees of freedom (df = 12). Table 3 shows the results of the heterogeneity test for fixed and random effects using OpenMEE software.

Table 3. Heterogeneity Test Data Summary

Q	Df	p	I ²
92.163	12	< 0.001	86.98

The analysis showed that the Q value = 92.126 and $p < 0.001$. The degree of variation in effect size between studies is reflected in the I-Squared value ($I^2 = 86.98$) which indicates that 87% of the observed effect sizes reflect the percentage of variability due to true heterogeneity. So, it can be concluded, the distribution of effect sizes in the analyzed studies is heterogeneous. Since each effect size is heterogeneous, the model used to calculate the combined effect size is a random effects model.

Overall Effect Size Using the Random Effect Model

The third step was to calculate the combined effect size of the experimental studies. Based on the search using OpenMEE software, the combined effect size ($g = 0.469$; $k=13$) was obtained. The lower limit of the confidence interval ($LBg = 0.130$), while the upper limit value ($UBg = 0.808$). This combined effect size is classified as moderate effect. Table 4 presents the results of the combined effect size estimation in this study.

Table 4. Combined Effect Size using Random Effect

Effect Size (g)	Lower Bound	Upper Bound	Std. error	p-Value
0.469	0.130	0.808	0.173	0.007

Furthermore, to find out whether the hypothesis is accepted or not, it can be seen from the coefficient of p value. Based on table 5, the p value is found to be less than 0.01. Because the p value < 0.01 , the H_0 hypothesis is rejected, so it can be concluded that there is a positive and significant influence between the Digital Platform and student learning outcomes.

Evaluation of Publication Bias

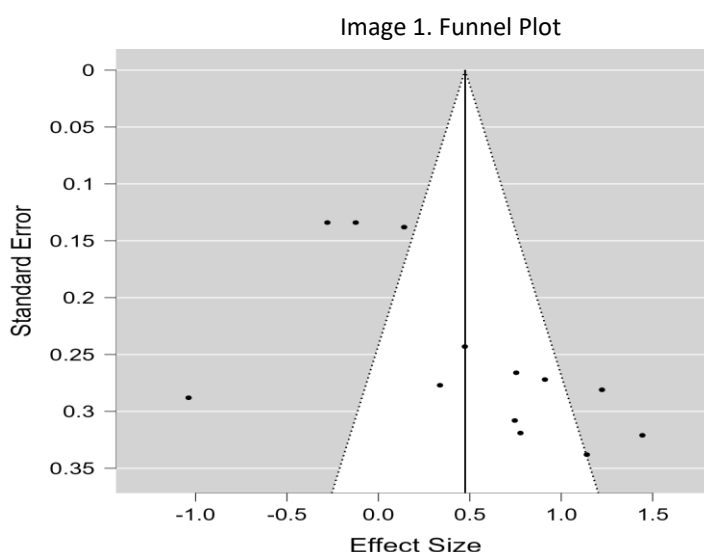
The last step in meta-analysis is to detect publication bias. Evaluation of publication bias is carried out to show that the meta-analysis conducted is truly objective, in the sense that the articles that are the

material of the meta-analysis are correct and show results that match the reality in the field. There are many methods that can be used to analyze publication bias. In this study, publication bias was evaluated using calculate the Rosenthal fail-safe N (FSN) value, forest plots, and funnel plots and (Borenstein et al., 2009; Tamur & Juandi, 2020; Retnawati et al., 2018). Table 5 presents the results of Rosenthal's fail-safe N-value diagnosis.

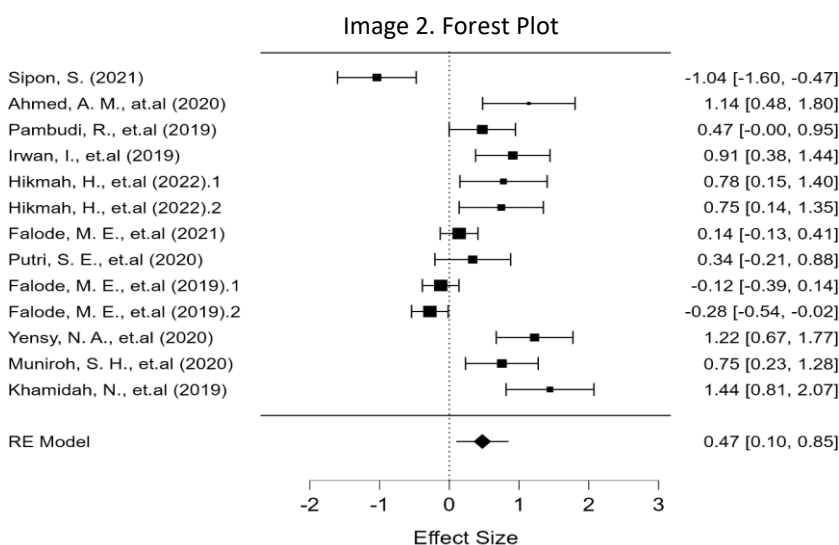
Table 5. File-Safe N

	File-Safe N	Target Sig.	Observed Sig.
Rosenthal	148	0,05	<,0001

Based on the analysis results in table 5, since the value of $k = 13$, $5k + 10 = 5(13) + 10 = 75$. The File-Safe N value obtained was (FSN = 148) with target significance ($\alpha = 0.05$) and $p < 0.001$. Since the FSN value found is greater than $(5k+10)$, this indicates that the meta-analysis conducted does not have a publication bias problem. Thus the meta-analysis test conducted was truly objective and scientifically justified.



The funnel plot picture shown in Image 1. illustrates that there is no visible publication of bias. If the research indicates publication bias, then there is an open loop in the plot. So it can be concluded that in 13 research publications about the effect of Digital Platforms on Learning Outcomes, there is no evidence of publication bias.



The next stage in the meta-analysis is to create a forest plot. The results of the analysis obtained forest plots for each research result marked with a square mark along the x-axis. The order of each study

result is displayed according to the order of the data from 2019 to 2021. The estimated effect size of the combined meta-analysis is indicated by the symbol (diamond) below the plot line and comprehensively visualized, as well as the potential heterogeneity of the study results (image 2). Based on the summary effect of the forest plot above, it is known that the diamond width is 0.47 at the 95% confidence interval. Meanwhile, the confidence interval for each research sample is indicated by their respective plots. Image 2 shows that there is no publication bias because there is no additional sample size.

Conclusions

The distribution of effect size in the analyzed study is heterogeneous, so the calculation of the summary effect size uses the random effect method. Overall, the effect size in this meta-analysis study is between -1.038 to 1.444 (table 2) with the criteria for effect size being no effect, low effect, moderate effect, high effect and very high effect (tabel 1). This meta-analysis has no publication bias so it can be justified scientifically. The results of the analysis show that the application of digital platforms in learning has a positive influence on student learning outcomes with an effect size of 0.469 (table 4), which is a moderate effect. Although these findings provide a summary of effect sizes with moderate effect categories, these findings are based on only 13 studies. There are also other studies that cannot be meta-analyzed due to limited access. So we suggest for further research to expand the data collection process in order to get more data for future meta-analyses.

Acknowledgment. This study is supported by Yogyakarta State University. We thank Prof. Heri Retnawati, S.Pd., M.Pd. (Our Lecturer), who provided insights that helped us in compiling this study.

Cite this article as: Rugaya Tuanaya, Andi Abdurrahman Manggaberani, Rina Safitri, Syahri Ramadan (2022). Meta-analysis study: Analysis of the Effect of Digital Platforms on Learning Outcomes. *Challenges of Science*. Issue V, 2022, pp. 129-134. <https://doi.org/10.31643/2022.17>

References

- Astini, N. K. S. (2020). Tantangan Dan Peluang Pemanfaatan Teknologi Informasi Dalam Pembelajaran Online Masa Covid-19. *Cetta: Jurnal Ilmu Pendidikan*, 3(2), 241-255.
- Borenstein, M., Hedges, L. V, Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to Meta-analysis*. Wiley & Sons Ltd.
- Bustomi, A. (2020). Implikasi Covid 19 Terhadap Pembelajaran di Perguruan Tinggi. *Jurnal Tawadhu*, 4(1), 1007-1017
- Farida, I., Rahmawati, R., Aisyah, R., & Helys, I. (2020). Pembelajaran kimia sistem daring di masa pandemi Covid-19 bagi generasi Z. *KTI Massa WHF Pandemi Covid-19*.1-11
- Glass, G. V. (1976). Primary, secondary, and meta-analysis of research. *Educational researcher*, 5(10), 3–8.
- Kusnaty, A., Muiz, M. H., Sumarni, N., Mansyur, A. S., & Zaqiah, Q. Y. (2020). Pengaruh Teknologi Pembelajaran Kuliah Online di Era Covid-19 dan Dampaknya Terhadap Mental Mahasiswa. *EduTeach: Jurnal Edukasi dan Teknologi Pembelajaran*, 1(2), 153-165.
- Lipsey, M. W., & Wilson, D. B. (2001). *Practical Meta-Analysis: Applied Social Research Methods Series*. SAGE publications, Inc.
- Mulatsih, B. (2020). Application of Google Classroom, Google Form and Quizizz in Chemical Learning During the Covid-19 Pandemic. *Ideguru: Jurnal Karya Ilmiah Guru*, 5(1), 16-26
- Nadeak, B. (2020). The Effectiveness of Distance Learning Using Social Media during the Pandemic Period of COVID-19: A Case in Universitas Kristen Indonesia. *International Journal of Advanced Science and Technology*, 29(7), 1764-1772
- Retnawati, H., Apino, E., Kartianom, K., Djidu, H., & Anazifa, R. D. (2018). *Pengantar Analisis Meta (Edisi 1)*. Parama Publishing, Yogyakarta
- Study, A. M., & Tamur, M. (2020). The Effectiveness of the Application of Mathematical Software in. *International Journal of Instruction*, 13(4), 867–884.
- Suhada, I., Kurniati, T., Pramadi, A., & Listiawati, M. (2020). Pembelajaran daring berbasis Google Classroom Mahasiswa Pendidikan Biologi pada Masa wabah Covid-19. *Digital Library UIN Sunan Gunung Djati*, 1-10
- Windhiyana, E. (2020). Dampak Covid-19 terhadap kegiatan pembelajaran online di sebuah perguruan tinggi kristen di Indonesia. *Perspektif Ilmu Pendidikan*, 34(1), 1-8.