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The Effectiveness of Edmodo- Based Project Based Learning on Students HOTS

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Abstrak

Abad-21 memberikan dampak yang signifikan terhadap perkembangan dunia pendidikan. Pendidikan abad-21 mengarahkan siswa untuk mempunyai keterampilan berpikir tingkat tinggi atau Higher Order Thinking Skills (HOTS). Selanjutnya, project based learning merupakan salah satu model pembelajaran yang sangat dianjurkan untuk mendorong keterampilan HOTS Siswa. Banyak penerapan model project based learning belum ditemukan efek size project based learning berbasis edmodo terhadap keterampilan HOTS siswa. Penelitian ini bertujuan untuk mengetahui pengaruh model project based learning berbasis edmodo terhadap Higher Order Thinking Skills (HOTS) siswa. Jenis penelitian ini adalah jenis penelitian meta-analisis. Sumber data berasal dari analisis 10 jurnal nasional yang terindeks SINTA. Pencarian sumber data melalui Researcgate, Google Scholar, DOAJ dan Mendeley. Kriteria inklusi yaitu penelitian berasal dari jurnal terindeks SINTA, Penelitian harus eksperimen, Penelitian diterbitkan pada tahun 2021-2023 dan melaporkan data yang lengkap untuk menghitung effect size. Analisis statistik menggunakan bantuan JASP. Hasil penelitian menyimpulkan bahwa model project based learning berbasis edmodo memberikan pengaruh signifikan terhadap HOTS siswa dengan nilai rata-rata effect size sebesar 1.097 kriteria effect size yang tinggi. Temuan ini menjelaskan model projet based learning berbasis edmodo efektif meningkatkan keterampilan berpikir tingkat tinggi (HOTS) siswa dengan nilai $z = 6.474$; $p < 0.001$.

Kata Kunci: *Project Based Learning; Edmodo; HOTS ; Meta-analysis*

The Effectiveness of Edmodo- Based Project Based Learning on Students HOT

Abstract

Abstract *The 21st century has a significant impact on the development of education. 21st century education directs students to have higher order thinking skills (HOTS). Furthermore,*

project-based learning is one of the learning models that is highly recommended to encourage students' HOTS skills. Many applications of project-based learning models have not found the effect of edmodo-based project-based learning on students' HOTS skills. This study aims to determine the effect of edmodo-based project-based learning model on students' Higher Order Thinking Skills (HOTS). This type of research is a meta-analysis. The data source comes from the analysis of 10 national journals indexed by SINTA. Data sources were searched through Researcgate, Google Scholar, DOAJ and Mendeley. Inclusion criteria are that the research comes from SINTA indexed journals, the research must be experimental, the research was published in 2021-2023 and reports complete data for calculating effect size. Statistical analysis using JASP assistance. The results concluded that the edmodo-based project-based learning model had a significant effect on students' HOTS with an average effect size of 1.097 with high effect size criteria. This finding explains that the edmodo-based project-based learning model is effective in improving students' higher order thinking skills (HOTS) with a z value = 6.474; $P < 0.001$

Keywords: Project Based Learning; Edmodo; HOTS; Meta-analysis

Introduction

Higher Order Thinking Skills (HOTS) is a very important ability for students to master in this 21st century. HOTS includes critical, logical, reflective, metacognitive, and creative thinking skills in dealing with complex problems (Amin & Ikhsan, 2021; Razak et al., 2021). With higher order thinking skills students can analyze incoming information, make generalizations or conclusions based on patterns found, to evaluate and create new ideas (Acharya, 2021; Putra et al., 2023; Anderson et al., 2023). These skills involve more complex mental processes than simply remembering information or searching facts. Basically, higher order thinking skills require individuals to be able to manage information carefully, identify patterns, and make in-depth analysis of certain situations or problems (Sadijah et al., 2021; Singh et al., 2023).

Furthermore, Higher order thinking skills allow a person to evaluate arguments, craft appropriate questions, and make informed decisions (Zain et al., 2022; Obeidat & Saleh, 2022). By developing these higher-order thinking skills, individuals can not only tackle complex problems more effectively, but are also able

to face new challenges and situations with an innovative mindset (Hariadi et al., 2021). Furthermore, current learning emphasizes that students have HOTS so that they can face the complexity of the modern world that continues to grow (Syafri & Azrul, 2023; Saepuzaman et al., 2022), where the challenges faced require more deep and skilled thinking.

But in fact, students' higher-order thinking skills (HOTS) in the learning process are still relatively low (Kurniawan et al., 2021; Widyaningsih et al., 2019; Ramadhanti et al., 2022). The low ability of HOTS students is caused by learning that is more centered on teachers than students (Suharyat et al., 2022; Rahman et al., 2023; Elfira et al., 2023; Oktarina et al., 2021; Ichsan et al., 2022; Supriyadi et al., 2023), thus making it difficult for students to understand the subject matter (Nurtamam et al., 2023; Rahman et al., 2023). In addition, the low HOTS of students can be seen from the results *Programme Internationale for Student Assessment* (PISA) conducted by the OECD In 2018 students' HOTS ability was ranked 71 out of 78 countries (Rahman et al., 2023; Suryono et al., 2023; Utomo et al., 2023; Ichsan et al., 2022). Furthermore, teachers still use the

lecture method so as not to encourage students' HOTS skills such as critical thinking, analysis and creative learning (Primary et al., 2020; Alpindo & Amir, 2014). Therefore, there is a need for an effective model to encourage students' HOTS abilities.

Project-Based Learning (PBL) is a learning model that places projects as the main focus in supporting the understanding of concepts and the application of skills in students (Marnewick, 2023; Santos et al., 2023). Learning with a project-based learning model students not only learn through the absorption of information, but also actively engage in real projects that require critical thinking, collaboration, and creativity (Zen et al., 2022; Gomez et al., 2022). Furthermore, the project-based learning model allows students to experience contextual and relevant learning (Wanglang & Chatwattana, 2023).

One of the main advantages of Project-Based Learning is that it can increase student motivation and engagement in learning directly (Lim et al., 2023). By providing more challenging and meaningful assignments, students feel more actively involved in the learning process (Posada et al., 2022). Project-based learning stimulates students' natural curiosity and motivates them to delve deeper into the material (Lu & Fan, 2023; Aranzabal et al., 2022; Kuppuswamy & Mhakure, 2020). In addition, through Project-based learning students can build a more analytical understanding of certain concepts in the context of real-world situations (Sirisrimangkorn, 2021).

Furthermore, project-based learning can be combined with edmodo. Edmodo is a digital education platform designed to facilitate communication, collaboration, and content distribution between teachers and students (Prasatyo & Gustary, 2023; Ulfa et al., 2022). Edmodo allows teachers to create online classes, assign assignments,

and share course materials with students (Alsmari, 2019). In addition, the platform allows students to interact through discussion forums, post assignments, and participate in various collaborative activities (Sefriani, 2021; Reem, 2020). Edmodo also allows parents to be involved in their child's learning process by providing access to see the progress of assignments, exam results, and follow the overall progress of the class. So, the edmodo-based project based learning model is effective for encouraging students' HOTS thinking skills.

Previous research on the project-based learning model can improve students' HOTS skills in the learning process (Jatiriska, 2020; Eliyasni et al., 2019; Santoso et al., 2021; Kadarwati et al., 2022). The number of studies on the project based learning model has not been found that illustrates the effect of the size of the edmodo-based project based learning model on students' HOTS thinking skills. Therefore, it is necessary to conduct meta-analysis research to draw a deep and accurate conclusion about the effect size of the edmodo-based learning project model. Based on these results, this study aims at the influence of edmodo-based project based learning models on students' Higher Order Thinking Skills (HOTS).

Method

Research Design

This study is a type of meta-analysis research. Meta-analysis is a type of research that collects and analyzes previous research quantitatively to get a more accurate conclusion (Zulkifl et al., 2022; Suparman et al., 2020; Santosa et al., 2021; Chamdani et al., 2022; Oztotop, 2023; Smith et al., 2023). This meta-analysis serves to determine the effect of the edmodo-based project based learning model on students' HOTS skills.

Eligibility Criteria

To obtain relevant data in meta-analysis research, it is necessary to determine eligibility criteria (Diah et al., 2022). The criteria for data eligibility in this study are research derived from SINTA indexed journals, Research must be related to edmodo-based project-based learning and students' HOTS abilities, Research published in 2021-2023 and reports complete data to calculate effect size. The data selection process through the PRISMA method consists of identification, screening, eligibility and included.

Data Analysis

Data analysis in this study by calculating the effect size value of the study. According to Borenstein etn al., (2009) The statistical data analysis procedure in meta-analysis consists of 1) calculating the effect size value of each study, 2) testing the hypothesis and determining the estimation model, 3) checking publication bias and 4) determining the p-value to test the hypothesis. Data analysis in this study with the help of JASP application. Furthermore, the effect size criteria are guided by the effect size criteria Cohen et al., (2007) can be seen in Table 1.

Table 1. Cohen's Effect Size Criteria

Effect Size	Category
$0.00 \leq ES \leq 0.20$	Low
$0.20 \leq ES \leq 0.80$	Moderate
$ES \geq 0.80$	High

Result and Discussion

Hasil Based on the results of searching the Researchgate, Google Scholar, DOAJ and Mendeley databases related to the effectiveness of edmodo-based project-based learning on students' HOTS skills, 290 journals were obtained. Furthermore, journals were selected according to predetermined inclusion criteria, so 10 journals were included in the

analysis data. The results of the data selection can be seen in figure 1.
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(Albadri, et.al.)

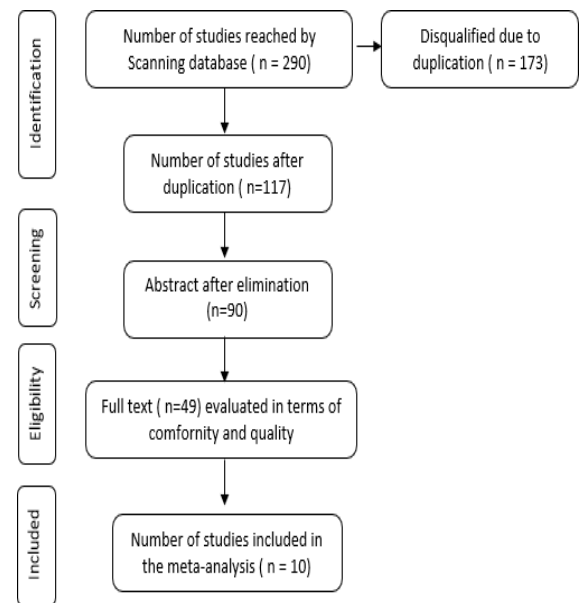


Figure 1. Proses Seleksi Data Melalui PRISMA

Next, analyze the effect size values of 10 journals included in the meta-analysis which can be seen in Table 2.

Table 2. Effect Size Value

Journal Code	Year	Effect Size	Standard Error	Journal Index
Study 1	2020	0.82	0.32	Sinta 1
Study 2	2021	0.67	0.28	Sinta 2
Study 3	2022	1.19	0.42	Sinta 3
Study 4	2022	0.90	0.35	Sinta 4
Study 5	2023	0.48	0.12	Sinta 4
Study 6	2022	1.64	0.30	Sinta 5
Study 7	2021	1.72	0.27	Sinta 3
Study 8	2020	0.86	0.41	Sinta 4
Study 9	2021	1.04	0.37	Sinta 3
Study 10	2023	2.08	0.45	Sinta 2

Based on Table 2, the effect size values of the 10 journals included in the meta-analysis data ranged from 0.48 to 2.08. According to the effect size criterion Cohen et al., (2007) Of the 10 journals analyzed, 2 journals had medium criteria effect size values and 7 journals had high

criteria effect size values. Next, conducting heterogeneity testing and determination of estimation models from 10 journals analyzed. The results of heterogeneity tests with random and fixed effect models can be seen in Table 3.

Table 3. Heterogeneity Test Results

	Q	Df	P
Omnibus test of Coefficients Model	41.908	1	< 0.001
Test of Residual Heterogeneity	35.622	9	< 0.001

Note :p-value are approximate

Based on Table 2, the results of the heterogeneity test obtained nilia Q = 41,908 greater than the value of 35,622 then the data in this study are heterogeneous contributed. Furthermore, the model used in this study is the rando effect model to analyze 10 journals included in the meta-analysis. The next step is to check publication bias through funnel plot analysis and Rosenthal fail safe N test (Tamur et al., 2020; Hariyadi et al., 2023; Chamdani et al., 2022; Chen et al., 2023). The results of checking publication bias with funnel plots can be seen in figure 2.

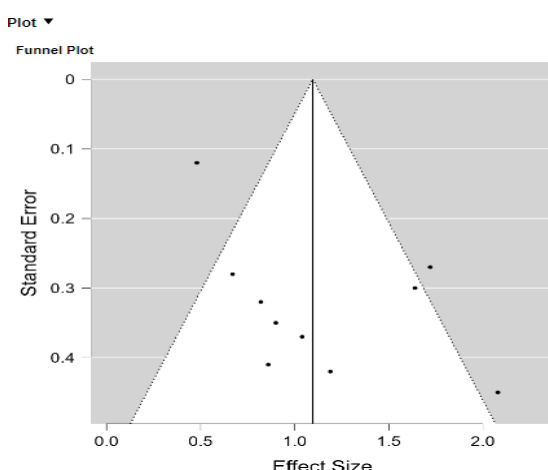


Figure 1. Funnel Plot Standard Error

Figure 1. The results of checking publication bias through the funnel plot are not yet clearly known whether the curve points are symmetrical or asymmetrical, so

it is necessary to carry out the *Rosenthal Fasil Safe N* (FSN) test. Rosenthal *Fasil Safe N* (FSN) Test Results can be seen in Table 4.

Table 4. Rosenthal Fasil Safe N (FSN) Test Results

File	Fail: Safe-N	Target Significance	Observed Significance
Rosenthal	462	0.050	< 0.001

Based on Table 4. Rosenthal fail safe N test result of 462. Furthermore, the FSN value was calculated with $5k + 10 = 462 / (5.10) + 10 = 462 > 60 = 7.7 > 1$, then the 10 journals analyzed in this study did not have publication bias. The last step calculates the p-value to test the hypothesis. Calculation of p-value by calculating the value of summary effect size or mean effect size from 10 journals included in the meta-analysis. The results of the summary effect size test can be seen in Table 5.

Table 5. Summary or mean effect size

	Estimated	ONE	Z	P
Intercept	1.097	0.169	6.474	<

Table 4, shows a Z value of 6.474; $P < 0.001$ and the standard error is 0.169. Furthermore, the summary effect size value (ES = 1,097), then the application of the edmodo-based project based learning model has a significant influence on the HOTS ability of students with high ketagori. This finding implies an effective edmodo-based project based learning model to encourage students' HOTS ability in learning.

This research is in line with Niswara et al., (2019) The project-based learning model has a significant influence on students'

higher-order thinking skills. These results are corroborated by research Khoiriyah et al., (2016) Project based learning has a positive impact on growing students' HOTS thinking skills in learning. Edmodo-based project-based learning has proven effective in improving students' higher-order thinking skills (HOTS). This is shown by the increase in the average HOTS score of students in the experimental group using the Edmodo-based project based learning model much higher than the control group. Project-based learning is a learning model that focuses on collaborative and authentic projects where students engage in project-oriented activities that require problem solving and in-depth application of knowledge (Mujib, 2020). Edmodo-based project based learning as a forum to measure the extent to which interaction between students, teachers, and learning materials in a virtual environment can facilitate the development of students' higher-order thinking skills (Wati et al., 2021).

Furthermore, Edmodo-based project-based learning can increase motivation and creativity that can encourage students' HOTS. By analyzing student learning outcomes data before and after the implementation of Edmod-based Project-based learning can provide valuable insights for the development of technology-based learning strategies that can advance students' cognitive potential and support efforts to improve the quality of education in the digital era (Reisoglu, 2018; Baharun et al., 2019). The improvement in HOTS skills is due to the fact that in the Edmodo-based project based learning model students are trained to explore information, formulate questions and problems, plan projects, implement projects to evaluate project results (Yunkul, 2017). These activities are able to train and hone students' critical and creative thinking skills. Meanwhile, the use of Edmodo as a supporting medium makes

it easier for students to collaborate, discuss, and share information without being limited by space and time (Nabli, 2018). Team collaboration and interaction in working on projects also train students to think from various perspectives in solving problems in learning.

Conclusion

From this meta-analysis research, it can be concluded that the edmodo-based project based learning model has a significant influence on students' HOTS with an average effect size value of 1,097 high effect size criteria. This finding explains that the edmodo-based projet based learning model effectively improves students' higher-order thinking skills (HOTS) with a value of $z = 6,474$; $P < 0.001$. Edmodo-based Project Based Learning model helps students learn more independently and creatively in solving a problem in life. This model of students learning more actively and can improve students' HOTS thinking skills in learning

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