



## Effect Size Mobile Learning on Student's 21 st Century Skills

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### Abstrak

Penelitian ini bertujuan untuk mengetahui efek size mobile learning terhadap keterampilan abad-21 siswa. Jenis penelitian ini adalah penelitian meta-analisis. Sampel penelitian berasal dari 13 jurnal nasional dan internasional. Sumber data berasal dari database google scholar, ScienceDirect, Eric, Wiley dan ProQuest. Teknik pengumpulan data dalam penelitian ini adalah observasi langsung dan dokumentasi. Proses penyeleksian sumber data dilakukan dengan teliti dan sistematis. Kriteria inklusi yakni jurnal nasional dan internasional terindeks SINTA dan Scopus, Penelitian harus menggunakan metode eksperimen atau kuasi eksperimen, Penelitian harus mempunyai kelas eksperimen dengan model mobile learning dan kontrol konvensional dan penelitian mempunyai data yang lengkap nilai n, f dan t. Teknik analisis data adalah analisis statistik kuantitatif dengan bantuan aplikasi JSAP. Hasil penelitian ini menyimpulkan Dari hasil penelitian dapat disimpulkan bahwa nilai rata-rata effect size (ES = 0.853) dan nilai N-gain sebesar 0.60 Temuan ini menunjukkan model mobile learning memberikan pengaruh yang tinggi terhadap keterampilan berpikir abad-21 siswa.. Temuan ini menunjukkan model mobile learning memberikan pengaruh yang tinggi terhadap keterampilan berpikir abad-21 siswa.

**Kata Kunci:** Pembelajaran, Mobile Learning, Berpikir Abad-21

### *Preparing Effect Size Mobile Learning on Student's 21 st Century Skills*

#### Abstract

*This study aims to determine the effect size of mobile learning on students' 21st century skills. This type of research is a meta-analysis research. The research sample came from 13 national and international journals. Data sources came from google scholar, ScienceDirect, Eric, Wiley and ProQuest databases. Data collection techniques in this study were direct observation and documentation. The process of selecting data sources was carried out carefully and systematically. Inclusion criteria are national and international journals indexed by SINTA and Scopus, research must use experimental or quasi-experimental methods, research must have experimental classes with mobile learning models and conventional controls and research has complete data on the value of n, f and t. The data analysis technique is quantitative statistical analysis with the help of the JSAP application. The results of this study concluded that the average effect size value (ES = 0.853) and the N-gain value of 0.60 These findings indicate that the mobile learning model has a high influence on students' 21st century thinking skills. This finding shows that the mobile learning model has a high impact on students' 21st century thinking skills.*

**Keywords:** Learning, Mobile Learning, 21st Century Thinking

## Introduction

21st century thinking skills are an ability that provides an important influence for students in facing the industrial revolution 4.0 (Munawwarah et al., 2020; Zainil et al., 2023; Suherman et al., 2021). 21st century skills lead students to think critically and problem solving, creatively, collaboratively and communicatively, better known as 4C skills (Rahardjanto et al., 2019; Karim, 2023; Suryono et al., 2023; Supriyadi et al., 2023; Umam & Jiddiyah, 2021). 21st century thinking skills help students in solving a problem in life (Nahar et al., 2022; Hujjatusnaini et al., 2022). Purwanti et al., (2022) 21st century thinking skills encourage students in dealing with globalization. Furthermore, 21st century thinking skills train students in mastering technology that is useful in learning activities (Rahman, 2019; Mutohhari et al., 2021).

The reality is that in schools, Indonesian students' 21st century thinking skills are still relatively low (Uyun et al., 2021). It can be seen from the 2018 PISA survey that Indonesian students' literacy scored 396, ranked 71 out of 78 participating countries (Rahman et al., 2023; Oktarina et al., 2021; Nurtamam et al., 2023; Razak et al., 2021; Elfira et al., 2023). These results explain the science literacy of Indonesian students in thinking is still relatively low. Survey results from the Trend In International Mathematics and Science Study (TIMSS) in 2015 the critical thinking skills of Indonesian students in the fields of science and mathematics were also low, only obtaining a score of 392 far from the international average score of 500 (Fitriyah & Ramadani, 2021). In addition, learning activities do not involve students so that learning is centered on the teacher (Rahman, 2023; Luciana et al., 2023). Students' critical and creative thinking skills are still in the low category so that students are less active in learning (Umam & Jiddiyah, 2021; Suharyat et al., 2022; Habibah et al., 2022). Selection of

learning models and methods that do not encourage students' 21st century skills (Widiawati & Joyoatmojo, 2018; Hujjatusnaini et al., 2022).

Mobile learning is a learning model that is conducted online through PCs, computers, cell phones, and tablets (Muyaroah, 2017). Mobile learning can increase students' creativity in learning (Ardiansyah, 2020). Not only that, the application of mobile learning can create a more interesting variation of learning so that students are more active and easy to understand the lesson (Yu et al., 2022; Santosa et al., 2021; Wijaya & Sugiharto, 2020). Research results (Syamsuddin, 2022) Mobile learning can improve students' collaboration skills in learning. Mobile learning helps students' learning process faster and without time limit (Suprianto et al., 2019; Wang et al., 2009; Wu et al., 2012).

Previous research by (Pillena et al., 2019) stated that the application of mobile learning has a significant effect on students' science process skills. (Hamdani, 2021) stated that the mobile learning model trains students to foster students' interest and motivation to learn. Research results (Amin et al., 2022) the application of the mobile learning model can improve student learning outcomes. Research by (Suana et al., 2019) The application of online learning models can encourage students' critical thinking skills. But in reality, there are many studies on mobile learning and still few studies on the size effect of mobile learning on students' 21st century thinking skills. Based on the above problems, this study aims to determine the size effect of mobile learning on students' 21st century skills.

## Methods

This research is a type of meta-analysis research. Meta-analysis is a type of research that analyzes previous research that can be analyzed statistically (Rahman, 2023; Suhaimi et al., 2022; Santosa et al., 2021; Fadillah et

al., 2021; Suparman et al., 2020). The data sources in this study came from 11 national and international journals. The process of searching for data sources through Google Scholar, ProQuest, Wiley and ERIC. The data collection technique in this research is through observation and documentation through the journal database. The inclusion criteria in this study are 1) research must be national and international journals indexed by SINTA and Scopus; 2) The research has an experimental class and a control class; 3) The research must be an international national journal published in 2019-2023 and 4) the research has complete data to calculate the effect size value.

Furthermore, data analysis in this study is quantitative analysis by calculating the effect size value of each study. The formula for calculating the effect size value using Cohen's formula is as follows:

$$ES = \frac{M_{Posttest} - M_{Pretest}}{\sqrt{\frac{SD^2_{Posttest} - SD^2_{Pretest}}{2}}}$$

Description :

ES : Effect Size

M : average test score

SD : Standard Deviasion

Furthermore, the effect size criteria for the influence of mobile learning on students' 21st century thinking skills can be seen in Table 1.

**Table 1.** Effect Size Criteria

Effect Size	Criteria
≤ 0.15	Ignored
0.15 ≤ 0.40	Low
0.40 ≤ 0.75	Medium
0.75 ≤ 1.10	High
1.10 ≤ 1.45	Very High

Source :(Handayani & Koeswanti , 2021;Ichsan et al., 2022; Rahmanet al., 2023)

## Result and Discussion

From the analysis of 178 national and international journals on mobile learning on students' 21st century skills, only 11 research journals have met the inclusion criteria. The research journals that have met the inclusion criteria calculated the effect size values which can be seen in Table 2.

**Table 2.** Effect Size of Research Journal

Kode Jurnal	Tahun	Tipe Jurnal	Effect Size	Kriteria
P1	2020	Nasional	0.81	Medium
P2	2020	Nasional	0.72	Medium
P3	2019	Internasional	0.95	High
P4	2021	Internasional	1.40	High
P5	2023	Nasional	0.68	Medium
P6	2021	Nasional	0.84	High
P7	2019	Internasional	1.25	Very High
P8	2020	Internasional	0.94	High
P8	2023	Nasional	0.59	Medium
P10	2022	Nasional	0.72	Medium
P11	2022	Nasional	0.49	Medium
Nilai rata-rata effect size			0.853	High

Based on Table 2. It shows that 6 studies have an effect size in the medium category, 4 studies have a criterion effect size value and 1 study has a high criterion effect size value. Furthermore, the overall average effect size value of all studies was 0.853 with high criteria. This result shows that the mobile learning model has a high effect on students' critical thinking skills. This result is in line with (Dewi et al., 2021) Mobile learning has a high impact on students' creative thinking skills in learning. 21st century skills lead students to have 4 skills namely critical thinking and problem solving, creative, communication and collaboration skills (Puspitasari, 2020; Zulkifli et al., 2022; Ichsan et al., 2023). So, mobile learning trains students to learn to have a 21st century mindset so that they can be competitive (Kuloğlu & Karabekmez, 202); Jamaludin et al., 2022). The application of mobile learning in teaching helps students

more quickly access information (Astuti et al., 2022; Lestari et al., 2019).

Next, we analyzed the effect size of the mobile learning model on students' 21st century thinking skills based on education level. The results of the effect size analysis based on education level can be seen in Table 3.

**Table 3.** Effect Size of Research Based on Education Level

Journal Code	Education Level	SE	Mean	Criteria Effect Size
P1	SD	0.61	0.73	Medium
P2	SD	0.85		
P3	SMP	0.82	1.12	High
P4	SMP	0.52		
P5	SMP	2.04	1.23	High
P6	SMA	0.94		
P7	SMA	1.19	2.61	
P8	SMA	0.68		
P10	SMA	1.29	0.70	
P11	SMA	0.70		

Table. 3 shows that the average effect size value at the elementary school level is 0.73 with moderate criteria, the effect size value at the junior high school level is 1.12 with high criteria and the effect size value at the high school level is 1.25 with high criteria. These results explain that the application of the mobile learning model has a high effect on 21st century thinking skills at the junior and senior high school education levels. The results of this study are in line with (Dahri et al., 2023) stated that the application of mobile learning has a significant effect on students' 21st century thinking skills. Mobile learning helps students' learning process to be more creative and innovative by utilizing technology (Franklin, 2011; Bray & Tangney, 2015; Pogrebinskaya, 2021). Research results (Mariani & Marzal, 2021) the application of the mobile learning model can improve students' critical thinking skills at the high school level.

Furthermore, the effect size analysis was conducted on the achievement of 21st century

skills. The results of the effect size analysis on 21st century skills can be seen in Table 4.

**Table 4.** Effect Size Analysis Based on 21st Century Thinking Skills

Ketrampilan Abad-21	Average Effect Size	Kriteria	N-gain
Critical Thinking	1.07	Hight	0.60
Creative	0.89	Hight	
Callaborative	1.19	High	
Communicative	0.76	Medium	

Table 4. Shows that the effect size value of the 21st century thinking skills component consisting of the effect size value of critical thinking of 1.07 high criteria, Creative of 0.89 high criteria, callaborative of 1.19 high criteria and communicative value of 0.76 medium criteria. Furthermore, the N-gain value is 0.60, so the application of the mobile learning model effectively improves students' 21st century thinking skills compared to conventional learning. the application of mobile learning can foster student activeness so as to encourage students' 21st century critical thinking skills (Pappas et al., 2017). Rumengan et al., (2019) Mobile learning can be done face-to-face and online so that students are more independent and creative in learning. Research results Kurniasih et al, (2020) It shows that the utilization of mobile learning helps students learn anytime without any time limit. Therefore, mobile learning becomes one of the solutions in encouraging students' thinking skills -21.

### Conclusion

From the results of the study, it can be concluded that the average effect size value (ES = 0.853) and N-gain value of 0.60. These findings indicate that the mobile learning model provides a high influence on students' 21st century thinking skills. Furthermore, mobile learning model is effective to improve students' 21st century thinking skills compared to conventional learning model. The mobile learning model can be conducted

by teachers and students offline or online through the internet network.

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