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Mobile Learning Research Trends in Indonesia: A Systematic Literature Review

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Abstract: The existence of mobile devices and advances in technology has made mobile learning one of the learning trends in schools ranging from elementary to high school and even college in Indonesia. This content analysis research aims to systematically analyze trends in the development of mobile learning in Indonesia based on analysis of articles found in international and national journals. Based on the search results obtained 61 articles. Article analysis uses the Paper Classification Form (PCF) instrument which has been tested for validity and reliability. Based on the results of the analysis, the most widely used research method for mobile learning is Quasi-Experiment (44%) by testing the results of Research and Development (82%) of mobile learning products. Most mobile learning is for high school students (57%). Android Mobile Learning Apps (52%) are the most widely used mobile learning products in research. Learning outcomes (19%) are the most dominant bond variables related to mobile learning. This result can be used as a reference for research on the development of mobile learning media using the Android platform in science learning in schools.

Keywords: Mobile learning; Research trends; Systematic literature review

Introduction

The world has entered the era of the industrial revolution 4.0 and the era of society 5.0. Therefore, in the era of the industrial revolution 4.0, it needs to be carried out in accordance with the characteristics and development of student learning culture (Suyatna, 2019). Technology has penetrated all areas including retail, advertising, health care, finance, manufacturing, and education is no exception (Matyushok et al., 2021). Technological developments demand an adjustment of resources that are ready to compete with the times (Ahmad, 2018). Humans believe that the development of 21st century technology has changed the conditions and quality of human life for the better (Li & Perkins, 2007). The rapid development of technology must be followed by developments in education and can give birth to a digital culture in Indonesian education (Sari et al., 2020).

Indonesia is one of the countries with the largest population of smartphone and internet users in the world. Based on a report from research company Data Reportal, the number of connected mobile devices in Indonesia has reached 370.1 million (Kemp, 2022). According to the We Are Social report, there are 204.7 million internet users in Indonesia as of January 2022 (Annur, 2022). Smartphones and the internet are an inseparable unit because they have the ability to access various multimedia and mobile applications both online and offline (Nuryantini & Yudhiantara, 2019).

Technological developments have an impact on students' digital culture at school, which is shown by the intensity of students using smartphones and gadgets at school. Mobile learning is defined as a learning process that can be carried out mobile that occurs through the use of mobile devices such as smartphones, tablets or tablet computers (Almaiah et al., 2022). The use of smartphones for students according to the goodstats report based on the Aptika IKP Kominfo research center in 2022, in the age range 9-19 years the number of smartphone users reaches 65% of the total smartphone users in the same age range (Adisty, 2022). Students use smartphones and various kinds of devices at their

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disposal to support teaching and learning activities (Sari et al., 2020). Learning using technology can increase the learning process from teacher-centered to student-centered in learning activities (Suyatna, 2019).

Mobile learning is learning where the dominant technology used is a mobile device or laptop and is able to present interactive learning (Crompton et al., 2016). Mobile learning offers students freedom of time and place in learning (Sonmez et al., 2018). Learning using mobile devices is felt to be more efficient in increasing learning activities (Sari et al., 2020), and must continue to develop to meet student learning needs (Nabella & Dwiningsih, 2022). Mobile Learning as an option in learning activities distance (Mehdipour & Zerehkafi, 2013). The use of mobile learning has increased with the Covid-19 pandemic, because learning has changed its direction to be based on digital technology (Fahyuni et al., 2020). The adoption of mobile learning has increased and is shown by the performance of development of various kinds of learning media (Mohiuddin et al., 2022).

Based on the background regarding the use of technology in the form of mobile learning in Indonesia as a source of student learning, both primary and additional sources. This study aims to analyze mobile learning research trends in Indonesia based on searches of articles published in international and national journals. The questions that guide this research are: 1) What are the most common research methods for mobile learning? 2) What level of education is most implemented using mobile learning? 3) What mobile learning products are most widely used in research? 4) What is the most dominant dependent variable associated with mobile learning?

Method

The research method used is "a systematic literature review". A systematic literature review is a research method for finding, evaluating, and interpreting findings in primary research to write about in secondary research (Ibda et al., 2022; Ardwiyanti et al., 2021). This qualitative research uses an approach to analyze mobile learning research trends in Indonesia.

This study adopts the review process by Ardwiyanti et al. (2021), which is explained as follows: (1) formulate research questions; (2) determination of inclusion criteria (Table 1); (3) searching for articles in various databases (Google Scholar, ERIC, DOAJ, journal websites) by typing the keywords "Mobile Learning" and "Indonesia"; (4) article coding using Paper Classification Form (PCF); (5) identify patterns across articles; (6) synthesize these patterns to answer research questions. The screening stage produced 61 articles that met the inclusion criteria.

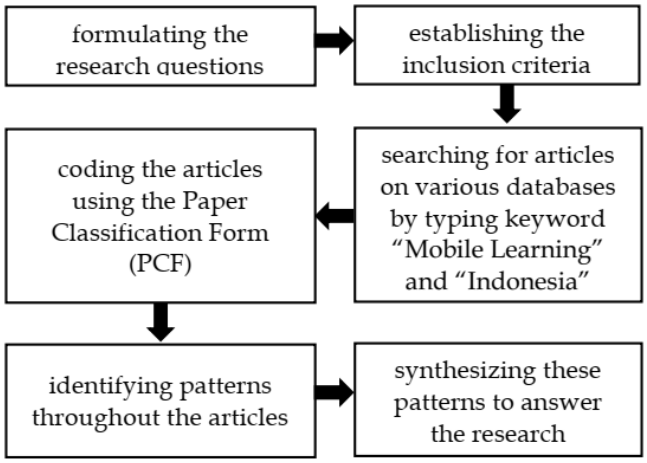

Figure 1. Review process by Ardwiyanti et al. (2021)

The coding instrument resulted from the PCF adaptation in the research report developed by Kızılaslan et al. (2012). Research analysis by analyzing and integrating research results using content analysis to analyze data (Krull & Duart, 2017). Instrument classification can be used because it meets the validity and reliability requirements. The collected data were analyzed using percentage calculations.

Table 1. The Inclusion Criteria

Category	Inclusion Criteria
Type of publication	Scientific articles published in journals
Journal specifications	National peer-reviewed journal accredited minimum grade 3 (Sinta 3); international peer-reviewed journal indexed minimum ERIC
Publication year	2010-2022
Research setting	Indonesia
Researcher's nationality	Indonesian and foreigners
Independent variable	Mobile Learning
Field	Natural Science, physics, chemistry, and biology
Type of study	Empirical and theoretical
Research subject	Students and teachers at all level (elementary, junior high school, senior high school, college)

Table 2. Distribution of Articles Based on the Journals' Identity

Journal Type	Status	Journal Name	Qt	Author
International	Scopus Q2 Indexed and ERIC indexed	International Journal of Instruction	1	Wahyu et al. (2020)
		Turkish Online Journal of Distance Education-Tojde	1	Sulisworo et al. (2017)
	Scopus Q3 Indexed and ERIC indexed	Cypriot Journal of Educational Sciences	1	Athithibby et al. (2021)
	Ebsco and ERIC Indexed	International Journal on Social and Education Sciences	1	Pambayun et al. (2019)
National	Grade 1 (Sinta1) accredited and Scoups Q2 Indexed	Jurnal Pendidikan IPA Indonesia	4	Taufiq et al. (2016) Ngabekti et al. (2019) Fahyuni et al. (2020) Riza et al. (2020)
	Grade 2 (Sinta 2) accredited	Biosfer: Jurnal Pendidikan Biologi	3	Fitriani et al. (2018) Hidayati et al. (2019) Suryanda et al. (2016)
		Jurnal Penelitian dan Pengembangan Pendidikan Fisika	2	Simanjuntak et al. (2018) Astuti et al. (2017)
		Jurnal Ilmiah Pendidikan Fisika Al-Biruni	1	Abdillah et al. (2020)
		Jurnal Inovasi Pendidikan IPA	3	Yosimayasari et al. (2021) Muhimmatin et al. (2021) Puspitasari et al. (2018)
		Jurnal Pendidikan Fisika dan Keilmuan	1	Pratama et al. (2016)
		Jurnal Pendidikan Fisika Indonesia	2	Rif'ati (2015) Tuada & Suparno (2021)
		Jurnal Pendidikan Kimia Indonesia	1	Putra et al. (2020)
		Jurnal Pendidikan Sains Indonesia	8	Malik & Ubaidillah (2021) Zulherman et al. (2021) Sari et al. (2021) Latifa et al. (2022) Munzil et al. (2022) Rasmawan & Erlina (2021) Nazar et al. (2020) Iqbal et al. (2016)
		Jurnal Penelitian dan Pembelajaran IPA	1	Nuryantini & Yudhiantara (2019)
		Jurnal Penelitian Pendidikan IPA	3	Firdawati et al. (2021) Nabella & Dwiningsih (2022) Susanto et al. (2022)
	Grade 3 (Sinta 3) accredited	Berkala Ilmiah Pendidikan Fisika	5	Sari et al. (2019) Aufa et al. (2021) Polonia & Yuliati (2019) Ngurahrai et al. (2019) Alkautsar & Anggaryani (2022)
		Bioeduscience: Jurnal Pendidikan Biologi & Sains	1	Hardinata et al. (2018)
		Bioedusiana: Jurnal Pendidikan Biologi	2	Arifin et al. (2020) Alimah & Putra (2018)
		EduSains Jurnal Pendidikan Sains & Matematika	1	Marsandi et al (2016)
		Edubiotik: Jurnal Pendidikan, Biologi dan Terapan	1	Lestari & Cintamulya (2022)
		Gravity: Jurnal Ilmiah Penelitian dan Pembelajaran Fisika	1	Saputra et al. (2021)
		Jurnal Pendidikan IPA Veteran	2	Lestari & Saputra (2020) Affriyenni et al. (2020)
		Jurnal Pendidikan Fisika FKIP UM Metro	1	Milinia et al. (2022)
		Jurnal Inovasi Pendidikan Kimia	1	Alfiantara (2016)
		Jurnal Pendidikan Biologi	2	Sari & Ma'rifah (2020) Diwanata et al. (2021)

Journal Type	Status	Journal Name	Qt	Author
		Jurnal Pendidikan Fisika	2	Wati et al. (2021) Liana et al. (2020)
		Jurnal Pendidikan Matematika dan Sains	1	Sumari & Aminatun (2020)
		Jurnal Pendidikan Sains	1	Saefi et al. (2017)
		Jurnal Penelitian Pembelajaran Fisika	2	Zulham & Sulisworo (2016) Zulham (2020)
		Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika Dan IPA IKIP Mataram	2	Warsa & Kholiq (2022) Cecep et al. (2019)
		Scientiae Educatia: Jurnal Pendidikan Sains	1	Ferywidyas-tuti & Wuryanto (2020)
		Spektra: Jurnal Kajian Pendidikan Sains	3	Kurniawan & Murni (2020) Fadlianto et al. (2022) Dewi et al. (2019)
		Total	62	

Result and Discussion

Research Method

Determination of the research method studied by using descriptive analysis on the basis of research. This classification is based on Yıldız et al. (2020). Mobile learning research generally uses quantitative, qualitative, or mixed research methods (Bozkurt et al., 2015). In this review, mobile learning research uses the most quantitative research (85%), while qualitative research is not used at all, mixed research (13%) and others (2%). This is in accordance with the research of Yidzid et al. (2020) and Krull et al. (2017) that mobile learning research is dominated by quantitative research. Quasi experimental (44%) and survey (39%) as well as mixed triangulation research (13%) are the most popular in mobile learning research trends used in Indonesia.

Table 3. Distribution of Studies According to Research Method

Model	Research Design	Percentage (%)
Quantitative	True Experimental	2
	Quasi Experimental	44
	Ex Post Facto	
	Survey	39
	Correlation	
Qualitative	Basic Interpretative Studies	
	Case Studies	
	Document or Content Analysis	
	Ethnography	
	Grounded Theory	
	Historical Research	
	Narrative Inquiry	
	Phenomenonological Studies	
Mixed Method	Triangulation	13
Other	Classroom Action Research	2

The most used research is research and development research. Research and development is a process used to develop and validate learning products that not only develop products but also find new understandings or answer problems in education (Borg & Gall, 1974). Research and development is research that is widely used on the topic of mobile learning (82%) along with the development of smartphones and the Covid-19 pandemic in 2020-2021 so as to increase independent learning.

Table 4. Development Method

Development Method	Percentage (%)
Research and Development	82
Non Research and Development	18

Year of Publication

The graph in figure 2, groups articles based on the year the article was published. In 2010-2014 no articles were found, 2015 (2%), 2016 (11%), 2017 (5%), 2018 (8%), 2019 (13%), 2020 (25%), 2021 (20%), and 2022 (16%). The development of mobile learning research is in comparison to the Covid-19 pandemic, which requires online learning and improves mobile learning media. Mobile learning development research developed during the Covid-19 pandemic to support online learning (Saikat et al., 2021).

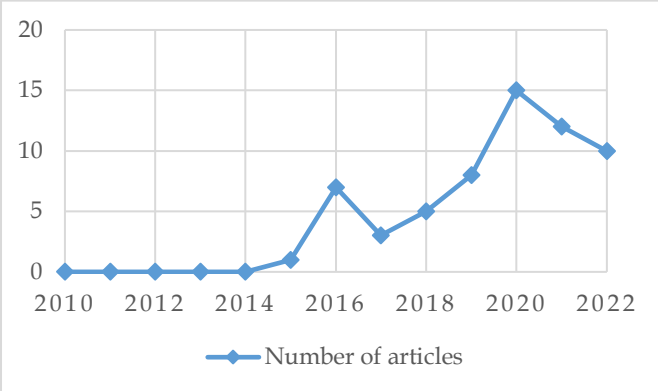

Figure 2. Distribution of studies by publication year

Sample Level

Descriptive analysis for the sample level in research related to mobile learning based on the classification of Yildiz et al. (2020). Most research was conducted at the High School level (57%), followed by Undergraduate (21%) and Junior High School (15%). For research on Elementary school is still low with 2%. This is related to mobile learning which must be used using a smartphone, where Elementary School students in Indonesia do not use smartphones much.

Table 5. Distribution of Studies According to Sample Level

Sample Level	Percentage (%)
Undergraduate	21
Elementary School	2
High School	57
Junior High School	15
Student in general	3
Not specified	2

Use of Mobile Media Types

The descriptive analysis carried out is to determine the type of mobile media used in learning. Electronic devices used for mobile learning include smartphones, laptops, tablets, and internet-connected media players (Park, 2011). The most used type of media in mobile learning research is mobile learning apps based on Android (52%). E-Student Worksheets (8%), Learning Management Systems (7%) and Virtual Laboratory (7%) are also widely used. In Yildiz et al. (2020) the use of smartphones as mobile learning devices is more than other devices, this is comparable to the development of learning media based on Android smartphones.

Table 6. Distribution of Studies According to Mobile Learning Media

Mobile Learning Media	Percentage (%)
Animation	2
Mobile Learning Apps (Android)	52
Virtual Reality	2
Augmented Reality	3
E-Book	2
E-Student Worksheet	8
Comic Based Android	2
E-Module	5
Edmodo	3
Learning Management System	7
Game	2
Virtual Laboratory	7
Mobile Dictionary	1
Video	1
Website	2
Social Media	1

Data Collection Tool

Data collection tool analysis based on the classification of Krull & Duart (2017); Yildiz et al (2020) modified based on research needs. In this research, experimental measurement by comparing pretest-posttest results (46%) is the most widely used. The use of Questionnaire (39%) is also widely used, especially in validating mobile learning media followed by mixed methods (13%).

Table 7. Distribution of Studies According to Data Collection Tool

Data Collection Tool	Percentage (%)
Questionnaire	39
Interview	
Mixed	13
Observation	2
Measurement (pretest-posttest)	46

Data Analysis Technique

Data analysis technique based on research by Yildiz et al. (2020) with slight changes. The most frequently used data analysis technique in research is descriptive (64%). Manova is also used in research with more than 1 variable with a percentage of 10%. There is another data analysis technique with a percentage of 16%, which cannot be classified in the data analysis technique in Yildiz et al. (2020). The use of a descriptive approach is suitable for researchers who want to use a relatively low level of interpretation and can solve many research problems (Kheirabadi et al., 2019).

Table 8. Distribution of Studies According to Data Analysis Technique

Technique	Percentage (%)
Descriptive	64
t-Test	3
Content analysis	
ANOVA	3
ANACOVA	2
MANOVA	10
Other	16
Chi-Square	
Correlation	2

Dependent Variable

The dependent variables that are often used in mobile learning research are learning outcomes (19%), motivation (10%), understanding of concept (8%), and critical thinking (7%). Learning outcomes in the cognitive, affective and psychomotor domains, critical thinking and problem solving skills, are lifelong skills obtained from learning activities (Ming & Manaf, 2014). In this analysis, there are many studies that do not have a dependent variable (32%) because many studies only reach the expert validation stage.

Table 9. Distribution of Studies According to Dependent Variable

Dependent Variable	Percentage (%)
Learning outcomes	19
Motivation	10
Understanding of concept	8
Critical Thinking	7
Science process skill	4
HOTS	3
Independence	3
Problem solving skill	3
STEM	3
Scientific Literacy	3
Collaboration	1
Natural disaster preparedness	1
Communication skill	1
Satisfaction	1
Social Skill	1
Not available	32

Conclusion

Mobile learning research trends in Indonesia are dominated by quantitative research using the Quasi-Experimental method by testing the results of Research and Development of mobile learning products. Most mobile learning research is intended for high school students. Mobile Learning Apps (Android) are the most dominant mobile learning products used in research. The most dominant dependent variable used in mobile learning research is learning outcomes. This can be used as a reference for research on the development of mobile learning media using the Android platform in science learning in schools.

Author Contributions

Ichwan Restu Nugroho contributed to the writing ideas, original draft preparation, introduction, methods, results, and discussion and conclusions in this article. Insih Wilujeng and Zuhdan Kun Prasetyo were involved in the analysis, interpretation, writting –review, supervision and editing.

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Conflicts of Interest

The authors declare no conflict of interest.

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