

# A Systematic Literature Review of Mobile Learning Applications in Environmental Education from 2011-2021

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**Abstract**—This systematic literature review aims to capture the trends in the use of mobile learning in environmental education from the Springer database. As inclusion criteria, all article journals should be written in English and published between January 2011 and September 2021. The categories to be analyzed were the distribution of annual publications, the number of publications by journal, the number of authors, research methods, the use of the terms mobile learning or environmental education in the title, and the most productive countries. A total of 378 research articles published in the last decade on mobile learning showed a gradual increase over the last ten years. The most published articles about mobile learning are in 2020. In addition, the most commonly used research method is research and development, the most frequently published articles in this field have 3 authors, the most productive journal is Education and Information Technologies, and the most productive country is the US.

**Keywords:** Mobile learning, environmental education, literature review

## 1. INTRODUCTION

The development of the 21st century in the use of technology is increasingly widespread. Mastery of science and technology is a mandatory requirement that must be mastered and used in various aspects of life to facilitate work, especially in the field of education in Indonesia. The ability to access, use various data and information has changed significantly, nowadays everything can be accessed anytime and anywhere by using a smart mobile device or smartphone (MobiThinking, 2015).

In essence, the use of media aims to create more communicative and meaningful learning for students. Along with the development of increasingly advanced technology, there are many alternative media that teachers can be used to learn, type of technologies that is being loved in Indonesian society is handphone and mobile learning (Ariffin, 2011).

Mobile learning is learning to use smartphone devices to get access and find information any time and everywhere (Martin & Ertzberger, 2013). Mobile learning can be defined as a facility that provides information and educational content to the audiences that can make students to interested in learning and improve academic achievement (Tamimuddin, 2007).

One of the things that started a lot of mobile learning development is flexibility in accessing content or learning materials any time and everywhere (Calimag et al., 2014). In terms of effectiveness in learning, smartphone technology based on mobile will provide a new experience for students because students will be directly involved (Kim et al., 2013).

Research of Aripin (2018) examines research activities in mobile learning, facilities for the use of mobile learning, research methods, and limitations of the study. This study states that research activities about databases and the number of annual publications. The largest database in searching for mobile learning articles is the Springer database from 11 other journal databases. The number of annual publications on mobile learning

research since 2005-2016, namely in 2011 as many as 11 articles. The number of attributes in the use of mobile learning is 9. The highest attribute is learnability. The most widely used research method is the lab experiment.

Research of [8] evaluated the literature on the number of annual publications from 2014 to 2019, the types of devices, and the sensor technology. The highest number of publications is in 2019, the type of device that is widely used is wearable electronic devices and the sensor technology that is widely used is accelerometry. From previous studies, this research will add different criteria from previous research, namely the trend of using the word mobile learning in the title, the number of publications by authors, and the most productive countries in mobile learning research.

The advantage of mobile learning is that it is well-designed and easy to use. The mobile facility is owned is a factor of interest in the smartphone. The application of mobile learning wants to be new trend research because smartphones have become one of the things that are important needs and are used by all people. Smartphone has facilities such as small screen sizes, limited input capabilities, camera, and other unique application (Harrison et al., 2013). The high interest in using smartphones proves user satisfaction and in learning to use smartphones which are very practical, effective, and easy to use (Kumar & Mohite, 2016).

This study reviews articles that describe the evaluation of the use of mobile learning. The method chosen to conduct this study is a systematic literature review. SLR is a research technique that gathers proof in a field of study. The proof is then analyzed and evaluated to obtain conclusions about the questions specified (Penzenstadler et al., 2012).

This study will investigate the following:

- RQ1 What is the trend of using the title using the word mobile learning or not which is the most used in mobile learning research?
- RQ2 What is the number of distributions of the most widely used annual publications in mobile learning application research?
- RQ3 What is the number of journal publications that are most widely used in mobile learning research?
- RQ4 What is the most used research methodology in mobile learning research?
- RQ5 How is the distribution of the number of authors used in mobile learning research?
- RQ6 What is the distribution of the most productive countries used in mobile learning research?

The research methods section explains how the article search process is designed and selected according to the specified criteria. The results will explain the data obtained in accordance with the research question. The results are summarized in the discussion section and the results will be presented in the conclusion section.

## 2. METHODS

### 2.1 Research Design

In this research, design is used to achieve the objectives to be studied. The purpose of this research is to review the literature on mobile learning on environmental literacy with certain variables. The researchers conducted a systematic literature search for all articles on mobile learning on environmental literacy from the Springer database (<https://link.springer.com/>) for the period 2011-2021. The search for documents was carried out on October 10-13, 2021. The research variables to be studied were the distribution of annual publications, the number of publications from journals, the number of authors, research methods, the use of mobile learning or environmental literacy titles, and the countries that contributed the most.

The stages of conducting a literature review (Kitchenham & Charters, 2007), are:

- Planning
- Conduction
- Reporting

## 2.2 Inclusion Criteria

Researchers set specific criteria for reviewing the literature in this study. Articles must be written in English and published between January 2011 and September 2021. The data to be analyzed are articles or journals.

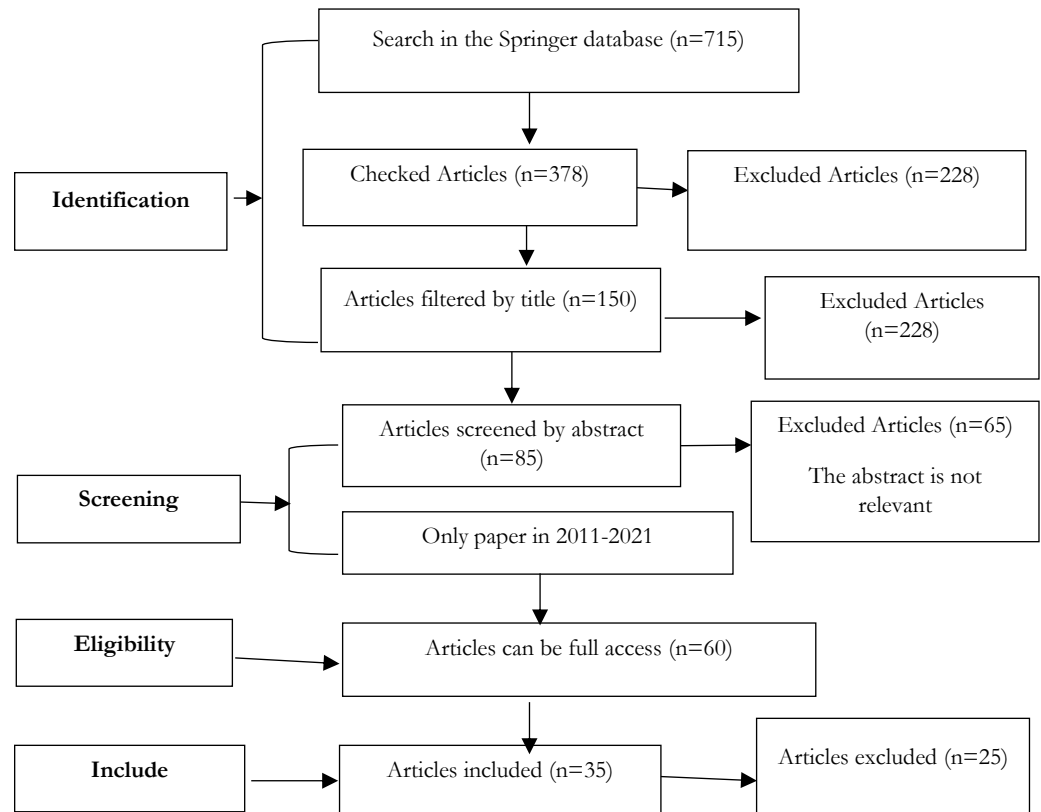


Figure 1. PRISMA flow diagram of literature review

## 2.3 Data Analysis

The term used in article search is mobile learning or environmental education and mobile learning or technology learning on environmental education. The articles must be confirmed are relevant to research purposes, the identify the title, abstract, and keywords of the articles manually.

In this research, the articles were just taken from the education subdiscipline. Based on the initial search, there were 715 articles in total spread across 90 disciplinary topics, for educational disciplines, there were 378 articles, and articles were selected through titles and abstracts that matched the research objectives is mobile learning in environmental education.

The researchers read each article and double-checks the articles to ensure that the articles meet the criteria. To include the reviewed articles, first, the researchers checked the title, abstract, keyword, and finally the full text. After selecting the samples, there were some articles are not suitable with the topic being analyzed and articles must be eliminated. In order to give a systematic review that is accurate and comprehensive, the

researchers discussed the relevance with the research question about qualify in the criteria or not. Researchers will conduct independent evaluations on articles that are less convincing. As a result, a total of 35 articles were selected for review.

### 3. RESULTS

Specifically, this section presents the results of the analysis of selected articles in springer databases from 2011 to 2021. The results presented include the number of publications, publication trends with and without include mobile learning in environmental education in the article title, research methods, number of authors, the most productive countries, and the most cited articles.

#### 3.1 Frequency of the Term “Mobile Learning in Environmental Education or Mobile Learning or Environmental Education” Used in the Title

This first research question is to identify the frequency of using the word mobile learning in environmental education or mobile learning or environmental education on titles. Figure 2 presents the use of article titles with and without mobile learning in environmental education or mobile learning or environmental education.

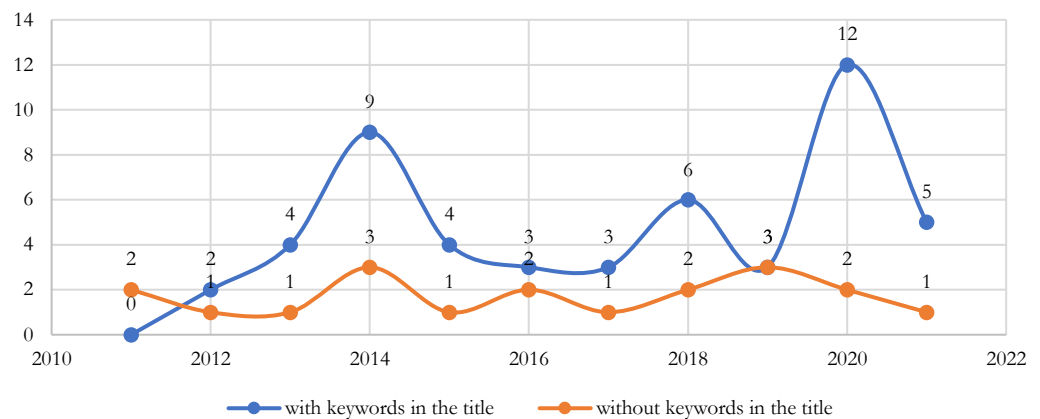


Figure 2. Frequency of the term “mobile learning in environmental education or mobile learning or environmental education” used in title

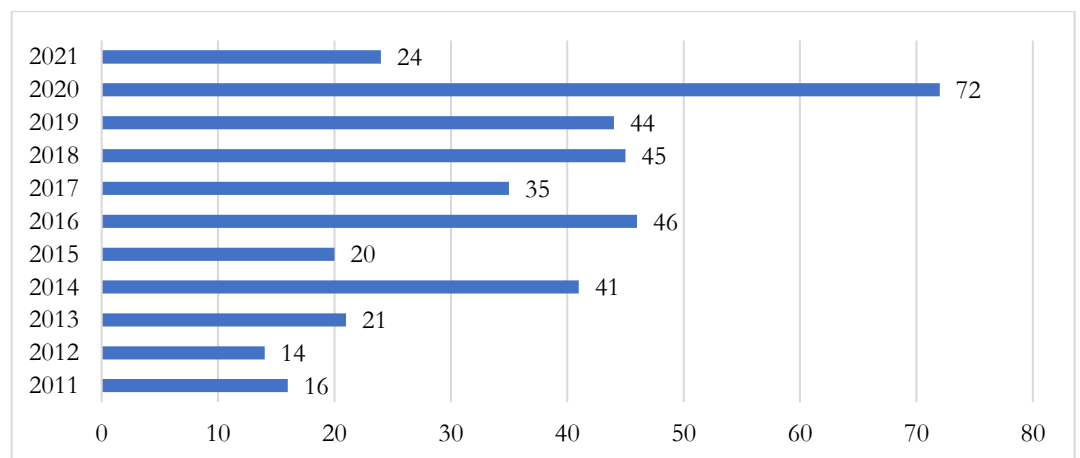


Figure 3. Distribution of publications

### 3.2 Distribution of Publications by Year

This study aims to identify the distribution of annual publications. Figure 3 reflects trends of publication mobile learning in environmental literacy in the period January 2010 to September 2021.

### 3.3 Number of Publications by Journal

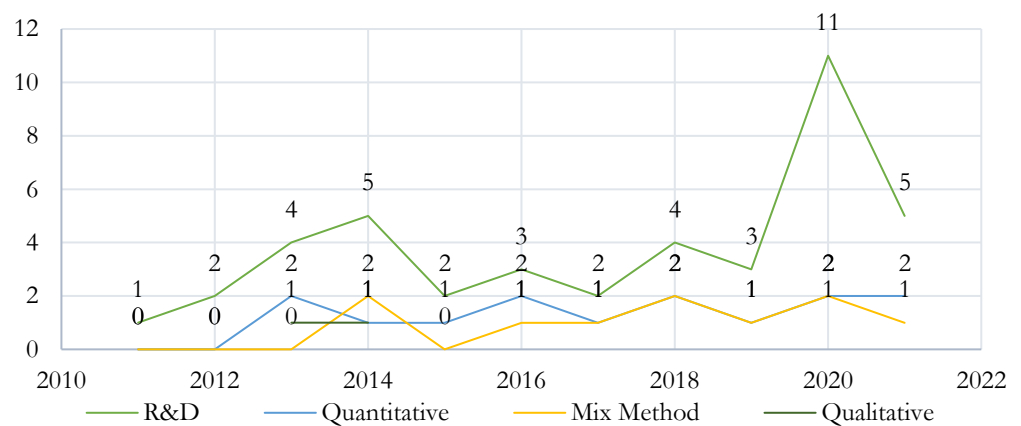
The study aims to identify the number of recent publications analyzed in Table 1. Table 1 below provides a summary of the top 5 academic journal websites with the highest number of articles from 2011 to 2021.

**Table 1.** The number of papers by journal

Journal	N of Papers
Education and Information Technologies	18
Educational Technology Research and Development	12
Encyclopedia of Education and Information Technologies	3
Asia-Pacific Education Researcher	1
SN computer science	1
Landscape research	1

### 3.4 Research Methods

The study aims to identify the research methods. Figure 4 presents the frequency of research methods in mobile learning in environmental education during the period 2011-2021.



**Figure 4.** Distribution of research methods

### 3.5 Number of Authors

Aims to identify the number of authors on mobile learning in environmental education. Figure 5 presents information on the number of authors on mobile learning in the environmental education period 2011-2021.

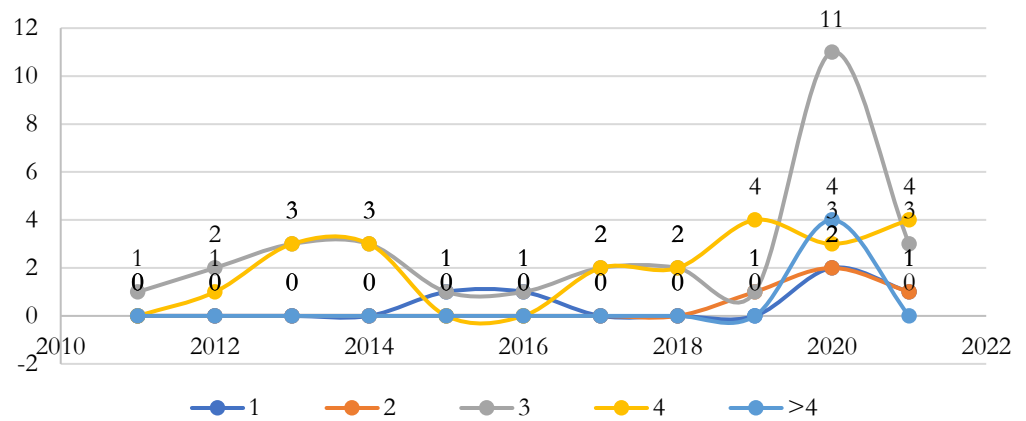


Figure 5. Number of authors

### 3.6 Most Productive Countries

Aims to identify the most productive countries in the mobile learning research according to the Springer database. Researchers assessed each article manually. Table 2 presents the most productive countries on mobile learning in environmental education in the Springer database in the period 2011-2021.

Table 2. Most Productive Countries

Country	N of Articles	%
US	24	34.6
Taiwan	17	26.92
Turkey	11	19.23
UK	6	19.23
German	3	11.53
Thailand	2	3.84
Switzerland	2	3.84
India	2	3.84
Denmark	1	3.84
China	1	3.84
Canada	1	3.84

## 4. DISCUSSION

This study will benefit researchers and educators to learn more about mobile learning from the existing literature. This is due to the increasing development and use of technology, including in Indonesia. Since the COVID-19 pandemic occurred, education at all levels in Indonesia must be carried out online, so that teachers must be innovative for chemistry learning, one of the things that can be done is the use of mobile learning. As a result, there is an increasing number of publications related to mobile learning from year to year. According to previous research (e.g., Akhlesh, 2017; Aripin, 2018; Asabere, 2013; Hernandez et al., 2020; Sobral, 2020; Syam et al., 2019), every year there are authors who are interested in conducting research on the effectiveness of using mobile technology in learning. In a bibliometric review, (Sobral, 2020) analyzed 450 articles on the web of science and Scopus about mobile learning in 2010-2020. This proves that from 2010 onwards the number of mobile learning publications began to be

of interest by researchers along with the development of technology and the use of smartphones in all activities in human life.

In relation to the variable of the use of mobile learning titles in environmental education or not in the 2011-2021 period, the trend has increased, especially in 2011-2014, and sharply increased in 2020. In the use of mobile learning in environmental education, many researchers use titles with the name mobile learning throughout 2011-2021 with 2020 being the year this topic was researched the most. Researchers are more interested in using the title of mobile learning in their articles. This increase occurred due to the growing use of technology and the widespread use of smartphones (Hernandez et al., 2020).

In relation to the distribution variable of the number of publications by year in mobile learning research, it was found that the most published articles in this field were in 2020. This proves that in 2020, research on mobile learning topics began to be of interest to many researchers, which may be due to the start of online learning that makes education practitioners create new innovations with mobile technology-based learning that can be accessed anywhere and anytime (Abidah et al., 2020).

In relation to the variable number of publications based on journals, Education and Information Technologies is very productive in publishing journals. A total of 18 papers were published in this journal. The second-largest journal is Educational Technology Research and Development as many as 16 papers. This is because in accordance with the theme of the two journals, namely research in the field of education and information technology development, so that the papers in these journals mostly discuss the field of technology development in education, one of which is the use of mobile learning.

In relation to research method variables, in this field, the research method R&D or research and development is the most preferred choice of researchers, namely 60% of articles, while quantitative research methods are 20% of articles. Qualitative research and mixed methods are each below 15%. Research on the manufacture of mobile learning products uses a lot of research and development or R&D methods, this is probably because mobile learning is a learning medium or a product, so development research must be carried out in making the product according to the Brog & Gall stages (Harianto & Yusran, 2017).

In relation to the variable number of publications by author, the highest number of articles that are researchers in this field is in 2020. The most authors in this field are with 3 authors as many as 46.2% articles, authors with 4 authors being the second largest with 33%. While the number of authors with 1 author, 2 authors, and more than 4 authors amounted to <10% of articles. It can be concluded that mobile learning research is mostly researched by 3-4 authors. This proves that researchers with the theme of mobile learning prefer to do research in groups or teams.

In relation to the variable number of the most productive countries, the most productive country in mobile learning research in Springer is the United States as much as 34.6%. This is because the number of publications from the United States may be related to the high budget for research and development (Irwanto, 2021). In the fiscal year 2021, the National Science Foundation received a budget of \$8.49 billion (a 2.5% increase from the previous year), of which about 80% of research and education funding is typically distributed to universities. The United States is a country that is at the center of all fields in the world, including technology. Many new technologies are coming from the United States so that technology-based research has become research that is often carried out in that country (Haris, 2021). The second most productive country is Taiwan with 26.92%. Taiwan is also one of the countries in East Asia where one of the most

famous and advanced smartphone brands in the world comes from that country (Hwang et al., 2017). Research of (Wei et al., 2013) states that East Asian countries are one of the countries interested in conducting research based on technological developments. Other countries conducting research in this field are Turkey, Japan, England, Germany, Switzerland, India, Denmark, China, and Canada.

## 5. CONCLUSION

In sum, a review of 378 articles published between 2010-2021 on the topic of mobile learning specifically in the field of environmental education shows that the research getting interested. The research variables to be studied were the distribution of annual publications, the number of publications from journals, the number of authors, research methods, the use of mobile learning or environmental education titles, and the countries that the most contributed. First, the most published article about mobile learning is in 2020. The articles found a lot that the word mobile learning was more often listed in the title or abstract or keywords. In the last 10 years, the most commonly used research methods in mobile learning are research and development, followed by quantitative, mix-method and qualitative methods. The most frequently published articles in this study have 3 authors. The most productive journal was Education and Information Technologies with more than 15 documents. Until now, studies related to mobile learning are often carried out in developed countries or countries that are actively innovating in the field of technology, where the US is ranked first among 11 countries.

## 6. LIMITATIONS AND RECOMMENDATIONS

This review provides an evaluation of the previous literature and some suggestions for future study. This study can provide deeper insights for teachers and lecturers to use mobile learning in planning professional development programs. There are limitations that must be considered. First, research is limited to the Springer database over the last decade. Second, this research is limited to environmental education topics.

Based on these limitations, the researchers suggest using more articles with a longer-term, more databases, and educational themes to be used in future studies. This is due to providing more detailed information about mobile learning.

## 7. REFERENCES

- Abidah, A., Hidaayatullaah, H. N., M., Fehabutar. D., Mutakinati, L & Simamora, R. (2020). The Impact of Covid-19 to Indonesian education and its relation to the philosophy of “merdeka belajar”. *Studies in Philosophy of Science and Education*, 1(1), 38-49.
- Akhlesh, B. (2017). Usability study of mobile learning application in higher education context: An example from Fiji National University. In A. Murphy et al. (eds.), *Mobile Learning in Higher Education in the Asia-Pacific Region*, 607-622. [https://doi.org/10.1007/978-981-10-4944-6\\_29](https://doi.org/10.1007/978-981-10-4944-6_29)
- Ariffin, S. A. (2011). Mobile learning in the institution of higher learning for Malaysia students: Culture perspectives. *International Journal on Advanced Science Engineering and Information Technology*, 1(3), 283-288.
- Aripin, I. (2018). Konsep dan aplikasi mobile learning dalam pembelajaran biologi. *Jurnal Bio Education*, 3(1), 1-9.
- Asabere, N. (2013). Benefits and challenges of mobile learning implementation: Story of developing nations. *International Journal of Computer Applications*, 73(1), 23-27.



- Calimag, J., Aquino, L., Miguel., & P. A. G., Conde, R. S. (2014). Ubiquitous learning environment using android mobile application. *International Journal of Research in Engineering and Technology*, 2(2), 119–128.
- Hariato, S. & Yusran. (2017). Pengembangan media pembelajaran kimia berbasis android untuk penumbuhan literasi sains siswa pada materi reaksi redoks dan elektrokimia. *Jurnal IKIP Mataram*, 5(2), 35-47.
- Haris, L. A. (2021). *The national science foundation: An overview*. <https://crsreports.congress.gov/product/pdf/R/R46753>
- Harrison, R., Flood, D., & Duce, D. (2013). Usability of mobile applications: Literature review and rationale for a new usability model. *Journal of Interaction Science*, 1(1).
- Hernandez, Y., De-la-Calleja, J., & Dominguez, S. (2020). Context-aware mobile learning system: Usability assessment based on a field study. *Education and Information Technologies*, 48.
- Hwang, G., Chu, H., & Lai, C. (2017). Prepare your own device and determination (PYOD): A successfully promoted mobile learning mode in Taiwan. *International Journal of Mobile Learning and Organisation*, 11(2), 87–107.
- Irwanto, I. (2021). Research trends in technological pedagogical content knowledge (TPACK): A systematic literature review from 2010 to 2021. *European Journal of Educational Research*, 10(4), 2045-2054.
- Kim, D., Rueckert, D., Kim, D. J., & Seo, D. (2013). Students perceptions and experiences of mobile learning. *Language, Learning and Technology*, 17(3), 52–7.
- Kitchenham, B. & Charters, S. (2007). *Guidelines for performing systematic literature reviews in software engineering*, Technical Report EBSE 2007-001, Keele University and Durham University Joint Report.
- Kumar, B. A., & Mohite, P. (2016). Usability guideline for mobile learning apps: an empirical study. *International Journal of Mobile Learning and Organisation*, 10(4), 223–237.
- Martin, F., & Ertzberger, J. (2013). Here and now mobile learning: An experimental study on the use of mobile technology. *Computers and Education*, 68, 76–85.
- MobiThinking. (2015). *Mobile hardware statistics 2014*, mobiForge. <https://mobiforge.com/author/mobiThinking>
- Penzenstadler, B., Bauer, V., Calero, C., & Franch, X. (2012). Sustainability in software engineering: A systematic literature review. *International Conference on Evaluation and Assessment in Software Engineering (EASE)*. <https://doi.org/10.1049/ic.2012.0004>
- Sobral, S. R. (2020). Mobile learning in higher education: A bibliometric review. *International of Journal Interactive Mobile Technology*, 14(11), 153–17.
- Syam, H., Basri, M., Abduh, A., Patak, A., A. & Rosmaladewi. Hybrid e-learning in industrial revolution 4.0 for Indonesia higher education. *International Journal on Advanced Science Engineering and Information Technology*, 9(4), 1183-1189, 2019.
- Tamimuddin, H., M. (2007). *Pengenalan media pembelajaran berbasis mobile (mobile learning)*. <http://p4tkmatematika.org/>
- Wei, J., Zhang, H., & Zhuo, J. (2013). Mobile learning usability comparison between the US and Chinese online education. *International Journal of Innovation and Learning*, 13(1), 96–120.

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