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Development Trend Physics Mobile Learning In 21St Century: A Systematic Literature Review

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Abstract: This study aims to analyze the development of the design and implementation of mobile learning in physics learning. This research has been conducted via a systematic literature review research. The research subjects consisted of fifty journal articles selected from the Scopus Index database, Web of Science (WOS), Google Scholar, or ERIC from 2012 to 2022. The data have already been analyzed related to the year of publication, research objectives, and physics concepts used. The results of this study showed that the number of studies has increased over the years. In addition, the use of Physics Mobile Learning can have a positive impact on increasing students' various abilities. Most of the concepts that have been utilized are in the material of sound waves, Newton's laws, physical quantities and measurements, heat, momentum impulses, and gas laws. As a consequence, the learning media can be textbooks inter-actively. Thus, the development of Physics Mobile Learning needs to facilitate in complex and modern ways.

Keywords: Literature review; Physics application; Physics mobile learning

Introduction

The rapid development of mobile technology has provided more opportunities to design and develop innovative learning methods with mobile devices to prepare schools and students for the future (Khaokhajorn et al., 2020). Now is the age of mobile devices where mobile is considered the most important technology. The year, early 1970s was the age of computers, then the age of laptops in the 2000s, and now the age of mobile devices.

Mobile devices are increasingly integrated into many different aspects of our daily lives. One of them is in the education sector, where mobile phones are used as both an educational platform and a tool for teaching and learning. Mobile devices and services have the potential to enhance learning and education. As a result, computer learning applications are gradually becoming unsuitable for use due to the rapid development of mobile technology, which means that all activities are performed using mobile devices. With the continuous development of mobile learning, the price of mobile devices is decreasing day by day e.g. (Caudill, 2007; Demir et al., 2018; Husna et al., 2018).

Every education system around the world needs mobile learning in improving its quality. In the education system, these devices provided educators with the opportunity to transform and acquire knowledge to accommodate the learning environment of the 21st century. This modified guidance creates a more flexible version of learning, accessing multiple datasets, from a completely dominant form of authority base to a form primarily based on the ideas of the learner's network that enliven transitional college students e.g. (Herwinarso et al., 2020; Khaokhajorn et al., 2020; Kim et al., 2019; Wan et al., 2022). Educators have also the opportunity to interact with learners in a variety of ways using devices that they use regularly e.g (Khaokhajorn et al., 2020; Ng et al., 2013; Ward et al., 2013).

The use of devices used in learning is facilitated by mobile learning. There is consensus that mobile learning facilitates access to education, and some features of mobile learning help us transform the way we teach and

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learn. A key feature of mobile learning is that one of the goals that set it apart from traditional teacher-to-student knowledge transfer goals is to allow students to actively participate in their learning design.

Mobile learning can only succeed as an educational platform when future research in the field of mobile learning includes an effective discussion of all aspects of its capabilities and usability such as learnability, understandability, ease of use, efficiency, effectiveness, etc. of mobile applications e.g (Mkpojiogu et al., 2018; Skiada et al., 2014; Zhang, 2009).

Mobile learning has the potential to reorganize science teaching and learning. Mobile learning offers learners new possibilities, such as personalized and contextual learning, unencumbered by time and environmental constraints. There has been much interest in the research community investigating the benefits of mobile her learning in education, and academia is one area that has benefited from this research.

Science consists of an interconnected network of concepts and inquiry processes, and the Next Generation Science Standards (NGSS 2013) challenge science educators to rethink how science education is delivered and to integrate science content into science practice. Researchers are studying the use of mobile learning in science education. However, no focused effort was made to collect and synthesize these studies. Avaamidou (Chiang et al., 2016) points out the need to comprehensively integrate research on mobile learning in science education to better understand the interaction between mobile technology and science education. Such efforts enable researchers to gain a deeper understanding of areas where research is already taking place and to build that body of knowledge. These efforts will help science educators better understand how mobile learning is being used in science classrooms. This understanding empowers students to assess their teaching in the light of research on the use of mobile learning in science education and take action to incorporate new understandings into practice.

In addition, mobile learning facilitates real learning design by targeting problems of interest to learners e.g. (Hussain et al., 2015; Traxler, 2007) and supports lifelong learning by supporting learning that occurs during many activities in daily life. In the classroom context, teacher involvement occupies a fundamental position in mobile learning in a formal educational environment (Prieto et al., 2014). For physics learning, Mobile Physics Learning (PML) is a learning medium used as a new learning strategy to provide interesting transformational experiences e.g. (González et al., 2016; Khaokhajorn et al., 2020; Ma'ruf et al., 2020; Ramganesh, 2012; Wijaya et al., 2021; Zahorec et al., 2014; Zhai et al., 2020). The PML process supports higher learning outcomes and makes it easier to inform students about the difficulties of classroom physics materials through student involvement in the use of technology, especially mobile learning in critical thinking processes. e.g. (Crompton et al., 2018; Mkpojiogu et al., 2018; Tuada et al., 2021).

In addition, it enables students to learn in their lifestyles, especially in increasing the likelihood of chart-based expressions and critical questions, to help them acquire a better knowledge of language and subculture. Make it possible (Astuti et al., 2020).

Method

A systematic literature review (SLR) approach was used to obtain reliable results for this study, e.g. (Kitchenham, 2014; Kumar et al., 2018; Zaza et al., 2000). This article describes good usability dimensions and measurements related to mobile learning applications for physics education. This approach is applied by collecting and analyzing previous studies of other researchers. The research uncovered key factors and measurements that can be used when evaluating mobile learning applications for education. To facilitate a systematic review process, the following were performed: definition of exploratory strategies, selection of primary studies, data extraction, and execution of synthetic strategies.

Search Strategy

Many journal articles in this area of study were searched and only relevant articles were selected. For search and study selection, we performed literature searches using both electronic searches of databases and manual searches of specific journal articles to ensure more comprehensive coverage.

These journal articles were retrieved from an electronic search of educational databases Scopus Index database, Web of Science (WOS), Google Scholar, or ERIC from 2012 to 2022 by searching for the publications whose titles, abstracts, or keywords met the logical conditions. Manual searches were conducted in journal articles that include a focus on mobile learning. In both the electronic and manual searches, the following search terms were used: "physics," "mobile learning," "application," and "mobile application," These search terms were used as they are the terms most frequently used when describing mobile learning.

Selection of Primary Studies

This section describes the selected journal articles for this study. A total of 136 journal articles were reviewed based on the keywords. Only 50 out of 136 journal articles were selected for further review for obtaining guidelines for the development trend of physics mobile learning.

Extraction of Data

The data extraction process was primarily defined by the design of a data extraction form that accurately collects information from selected studies. The contents of the data extraction form contained the following information: (a) the title of the journal, (b) the publisher journal, and (c) the journal index database.

Implementation of Synthesis Strategy

After applying inclusion and exclusion criteria to this study group, 50 of them were selected for the review process. In addition to being analyzed manually, selected journal articles were analyzed using a VOS viewer. The data have already been analyzed related to (1) the year of publication, (2) research objectives, and (3) physics concepts used.

Result and Discussion

Year of Publication

There have been 50 journal articles on this study. The journal articles have been labeled and reviewed primarily based totally on the coding scheme with the aid of using VOSviewer. Figure 1 shows the journal articles on the improvement of physics mobile learning getting to know seeing that 2012 to 2022.

Figure 1. Journal articles published per year

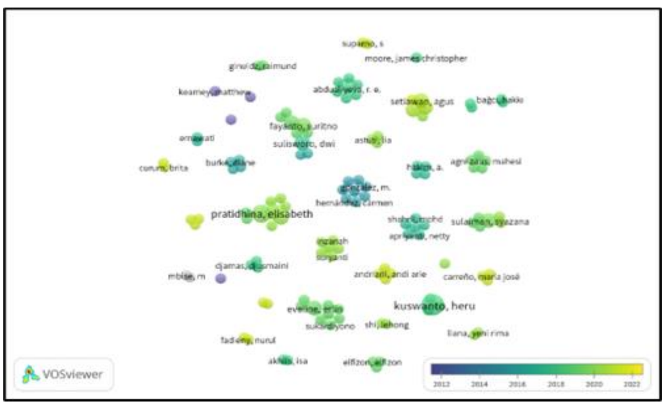

Figure 2. Analysis journal articles published per year carried out using VOSviewer

Based on Figure 1, there are 3 journal articles on physics mobile learning in 2012, but no journal articles in 2013. Then, two kinds of journal articles were published in 2014, one journal article in 2016, and again two kinds of journal articles were published in 2016. After 2016, the number of published journal articles increased to 5 journal articles in 2017, 9 journal articles in 2018, and 10 kinds of journal articles in 2019 and 2020. Then reduced in 2021 only 8 published journal articles. These results are from the analysis carried out using VOSviewer which is presented in Figure 2.

In figure 2, it can be seen that the dominant color is green, where the green color indicates the year of publication of the journal articles from 2018 to 2021. The relationship between literacy is shown in figure 3.

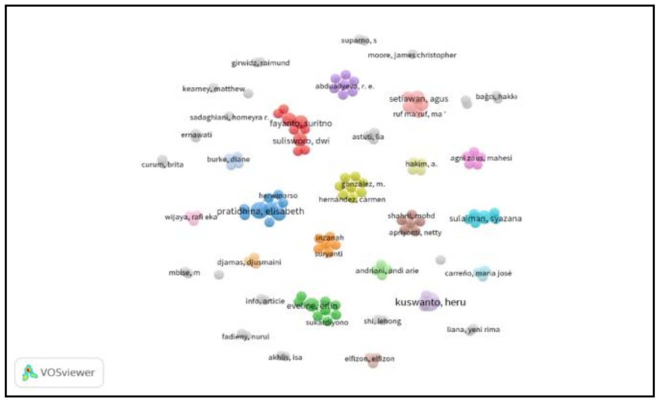

Figure 3. The relationship between papers by VOSviewer

Figure 3 shows the relationship of research between journal articles, where there are several interrelated research groups indicated by red, blue, yellow, green, purple, and brown circles, etc.

Research Objectives

Based on the results of the analysis, there are three groups of journal articles based on the research objectives, namely the journal articles group which aims to analyze the development of mobile learning, the journal articles group which aims to produce mobile learning, and the journal articles group which aims to determine the effectiveness of mobile learning in learning physics.

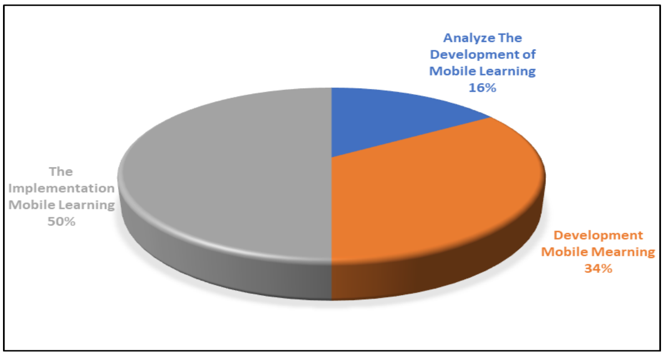

Figure 4. Journal articles based on the research objectives

Figure 4 shows the percentage of each group of journal articles, where most of the journal articles aims to determine the effectiveness of mobile learning in learning physics. Meanwhile, for other purposes, only 34% of the literature group aimed at developing mobile learning, and 16% aimed at analyzing the development of mobile learning.

Physics Concepts Used

The distribution of physics concepts used in mobile learning from 2012 to 2022 is shown in Figure 5.

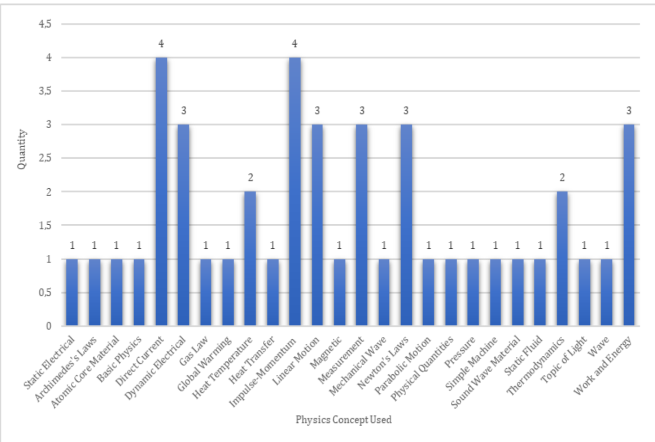

Figure 5. Distribution of physics concepts used in mobile learning from 2012 to 2022

Based on Figure 5, 26 physics concepts have been applied in physics mobile learning. There are 4 mobile learning that applies the concept of direct current and impulse-momentum, each 3 mobile learning applies dynamic electricity, linear motion, measurement, Newton's laws, and work & energy, and each 2 mobile learning that applies the concepts of heat temperature, and thermodynamics. For other concepts, as shown in Figure 5, each concept is only developed once.

Conclusion

This study shows the results of a systematic literature study on the development of mobile learning in physics learning from 2012 to 2022. The search strategy was designed and implemented, and the analysis was performed according to the identified survey questions. The results of this study showed that the number of studies has increased over the years. In addition, the number of publications that integrate mobile technology into physics learning has been found to have increased significantly over the decades. It was also pointed out that many studies use new system development for learning activities. This means that many researchers are considering developing physics mobile learning in other physics concepts used.

Author Contribution

Conceptualization, Sisda Ferlianti, Ridwan Effendi and Selly Feranie; Methodologi, Sisda Ferlianti; Software, Sisda Ferlianti; review and editing, Ridwan Effendi and Selly Feranie. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

References

Astuti, L., Wihardi, Y., & Rochintaniawati, D. (2020). The Development of Web-Based Learning using Interactive Media for Science Learning on Levers in Human Body Topic. *Journal of Science Learning*, *3*(2), 89–98. https://doi.org/10.17509/jsl.v3i2.19366

Caudill, J. G. (2007). The growth of m-Learning and the growth of mobile computing: Parallel developments. *International Review of Research in Open and Distance Learning*, *8*(2). https://doi.org/10.19173/irrodl.v8i2.348

Chiang, C. L., & Lee, H. (2016). The Effect of Project-Based Learning on Learning Motivation and Problem-Solving Ability of Vocational High School Students. *International Journal of Information and Education Technology*, *6*(9), 709–712. https://doi.org/10.7763/IJIET.2016.V6.779

Crompton, H., & Burke, D. (2018). The use of mobile learning in higher education: A systematic review. *Computers and Education*, *123*(25), 53–64. https://doi.org/10.1016/j.compedu.2018.04.007

Demir, K., & Akpınar, E. (2018). The effect of mobile learning applications on students' academic achievement and attitudes toward mobile learning. *Malaysian Online Journal of Educational Technology*, *6*(2), 48–59. https://doi.org/10.17220/mojet.2018.02.004

González, M., González, M. A., Esther Martín, M., Llamas, C., Martínez, Ó., Vegas, J., Herguedas, M.,

& Hernández, C. (2016). Teaching and learning physics with smartphones. *Blended Learning: Concepts, Methodologies, Tools, and Applications*, *4*(1), 866–885. https://doi.org/10.4018/978-1-5225-0783-3.ch044

Herwinarso, H., Untung, B., Wirjawan, J. V.D., & Pratidhina, E. (2020). Development of android app to assist high school students in learning physics quantities and measurement principles. *TEM Journal*, *9*(1), 292–295. https://doi.org/10.18421/TEM91-40

Husna, M., & Kuswanto, H. (2018). Development of physics mobile learning based on local wisdom to improve vector and diagram representation abilities. In *International Journal of Interactive Mobile Technologies* (Vol. 12, Issue 6, pp. 85–100). https://doi.org/10.3991/ijim.v12i6.8746

Hussain, A., Mkpojiogu, E. O. C., & Hussain, Z. (2015). Usability evaluation of a web-based health awareness portal on smartphone devices using ISO 9241-11 model. *Jurnal Teknologi*, *77*(4), 1–5. https://doi.org/10.11113/jt.v77.6035

Khaokhajorn, W., Thongsri, P., Panjaburee, P., & Srisawasdi, N. (2020). Mobile learning technology in STEM education: A systematic review from 2010 to 2019. *ICCE 2020 - 28th International Conference on Computers in Education, Proceedings*, *2*, 432–437. Retrieved from https://repository.li.mahidol.ac.th/entities/publication/769d780e-48eb-4fe3-a627-633a772d038a

Kim, S. Y., & Hamdan Alghamdi, A. K. (2019). Female Secondary Students' and Their Teachers' Perceptions of Science Learning Environments Within the Context of Science Education Reform in Saudi Arabia. *International Journal of Science and Mathematics Education*, *17*(8), 1475–1496. https://doi.org/10.1007/s10763-018-09946-z

Kitchenham, B. (2014). Procedures for Performing Systematic Reviews. *Keele University Technical Report*, *33*(2004), 1–26. Retrieved from https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=29890a936639862f45cb9a987dd599dce9759bf5

Kumar, B. A., & Mohite, P. (2018). Usability of mobile learning applications: a systematic literature review. *Journal of Computers in Education*, *5*(1), 1–17. https://doi.org/10.1007/s40692-017-0093-6

Ma'ruf, M., Setiawan, A., Suhandi, A., & Siahaan, P. (2020). Investigation of Student Difficulties in Basic Physics Lectures and Readiness to Implement Physics Problem Solving Assisted by Interactive Multimedia Android in Indonesia. *European Online Journal of Natural and Social Sciences*, *9*(4), 820–827. Retrieved from http://www.european-science.com

Mkpojiogu, E. O. C., Hussain, A., & Hassan, F. (2018). A systematic review of usability quality attributes for the evaluation of mobile learning applications for children. *AIP Conference Proceedings*, *2016*, 20092. https://doi.org/10.1063/1.5055494

Ng, S. C., Lui, A. K., & Ngao, S. H. (2013). An Interactive Mobile Learning Platform for Teaching and Learning Chinese Language in Secondary School Environment. *Communications in Computer and Information Science*, *407 CCIS*, 135–147. https://doi.org/10.1007/978-3-642-45272-7_13

Prieto, J. C. S., Migueláñez, S. O., & García-Peñalvo, F. J. (2014). ICTs integration in education: Mobile learning and the technology acceptance model (TAM). *ACM International Conference Proceeding Series*, 683–687. https://doi.org/10.1145/2669711.2669974

Ramganesh, E. (2012). Effect of Self-regulatory Strategies with Interactive Multimedia on Problem solving ability of Higher secondary students in Physics. *Shodh Sanchayan*, *9180*(2), 1–5. Retrieved from https://journalcra.com/article/effect-self-regulatory-strategy-interactive-multimedia-problem-solving-ability-higher

Skiada, R., Soroniati, E., Gardeli, A., & Zissis, D. (2014). EasyLexia: A mobile application for children with learning difficulties. *Procedia Computer Science*, *27*, 218–228. https://doi.org/10.1016/j.procs.2014.02.025

Traxler, J. (2007). Defining, Discussing and Evaluating Mobile Learning: The moving finger writes and having writ. *The International Review of Research in Open and Distributed Learning*, *8*(2), 1–12. https://doi.org/10.19173/irrodl.v8i2.346

Tuada, R. N., & Suparno, S. (2021). Increasing Student's Hots Using Mobile Technology and Scaffolding Approach on Sound Wave Material. *Jurnal Pendidikan Fisika Indonesia*, *17*(2), 160–174. https://doi.org/10.15294/jpfi.v17i2.26949

Wan, D., & Lee, Y. J. (2022). Coherence of Topics from Middle-School Integrated Science Textbooks from Taiwan and Korea. *International Journal of Science and Mathematics Education*, *20*(5), 881–899. https://doi.org/10.1007/s10763-021-10187-w

Ward, N. D., Finley, R. J., Keil, R. G., & Clay, T. G. (2013). Benefits and limitations of iPads in the high school science classroom and a trophic cascade lesson plan. *Journal of Geoscience Education*, *61*(4), 378–384. https://doi.org/10.5408/13-008.1

Wijaya, R. E., Mustaji, M., & Sugiharto, H. (2021). Development of Mobile Learning in Learning Media to Improve Digital Literacy and Student Learning Outcomes in Physics Subjects: Systematic

Literature Review. *Budapest International Research and Critics Institute (BIRCI-Journal): Humanities and Social Sciences*, *4*(2), 3087–3098. https://doi.org/10.33258/birci.v4i2.2027

Zahorec, J., Haškova, A., & Bilek, M. (2014). Impact of multimedia assisted teaching on student attitudes to science subjects. *Journal of Baltic Science Education*, *13*(3), 361–380. https://doi.org/10.33225/jbse/14.13.361

Zaza, S., Wright-De Agüero, L. K., Briss, P. A., Truman, B. I., Hopkins, D. P., Hennessy, M. H., Sosin, D. M., Anderson, L., Carande-Kulis, V. G., Teutsch, S. M., & Pappaioanou, M. (2000). Data collection instrument and procedure for systematic reviews in the Guide to Community Preventive Services. *American Journal of Preventive Medicine*, *18*(1 SUPPL. 1), 44–74. https://doi.org/10.1016/S0749-3797(99)00122-1

Zhai, X., & Shi, L. (2020). Understanding How the Perceived Usefulness of Mobile Technology Impacts Physics Learning Achievement: a Pedagogical Perspective. *Journal of Science Education and Technology*, *29*(6), 743–757. https://doi.org/10.1007/s10956-020-09852-6

Zhang, R. U. I. (2009). *Using Mobile Phones To Assist Children's Learning In Universeum*. Retrieved from https://gupea.ub.gu.se/handle/2077/20520