The use of smartphone on learning activities: Systematic review

R O Firmansyah, R A Hamdani and D Kuswardhana

1 Study Program of Technological and Vocational Education, Universitas Pendidikan Indonesia, Bandung, Indonesia
2 Department of Mechanical Engineering Education, Universitas Pendidikan Indonesia, Bandung, Indonesia
3 Department of Electrical Engineering Education, Universitas Pendidikan Indonesia, Bandung, Indonesia

*rianoktariana@gmail.com

Abstract. This article aims to analyze the use of smartphone technology in education field, with a focus on exploring the effects of smartphone and its software application use in learning activities. This study was conducted using the method of systematic literature review through 3 stages, namely: searching related journals through an online database of several publishers, analyzing the search results journals and dividing them into 3 groups according to the research objectives, and describing the results of the analysis in the form of scientific and logical arguments. From the results of the study it can be concluded that smartphone is significantly useful in student-centered learning, can be used in various disciplines, and at all levels of education, and there are various smartphone applications that can be used for learning needs.

1. Introduction

Smartphone is a mobile device that people use to communicate with each other which is capable of carrying out various activities, such as internet access, social media applications, and document processing with good screen resolution [1,2]. Nowadays smartphones are used as learning facilities in almost all fields, such as health, languages, engineering and education [3,4]. Indonesia is a developing country with a very large number of smartphone users and occupies the 2nd largest social network user in the world [5].

The development of smartphone technology is very fast. Almost all activities can be carried out and accessed using a smartphone [6]. In the education field, for example, almost all students have smartphones so they can use them to support the learning process. Several studies reveal the importance of integrating smartphone technology into the learning environment [1]. Smartphones can facilitate students in finding learning resources and use learning applications at any time and anywhere [7,8]. In this case, the achievement of learning objectives is inseparable from the teacher's role in determining the right strategy in utilizing smartphones in the learning process [1]. The negative impact of smartphone usage, such as game addiction, must be anticipated [8].

This article aims to analyze the development of learning using smartphone technology, with a focus on exploring the use of types of application software on smartphones and their influence in learning activities at various levels of the education unit.
2. Theoretical framework of smartphone for learning

In mobile learning, it is assumed that students can use smartphone devices, with various applications in them to support learning activities, wherever they are [9].

2.1. Conceptualization of mobile learning

The concept of mobile learning is a learning process that is centered on students in learning various materials so that they gain experience when they learn through mobile devices. Mobile learning is part of the new conception of society. Research and reflection on mobile learning must stimulate multidisciplinary and interdisciplinary thinking and methods in education [10].

2.2. Mobile device application on knowledge management

Implementation of mobile applications must be able to create a different learning environment, and increase student motivation. A teacher must know the experiences of students while learning and find strategies to improve the learning process [11]. Mobile learning can encourage students to acquire, store, share, apply, and create knowledge [12].

2.3. Mobile device application on language learning

Language is the main thing in social life, because people who are proficient in language will be able to communicate and socialize well. Smartphones with adequate internet network support can be good language learning media [13,14].

2.4. Existing learning environment

The current learning environment aims to integrate learning activities on the spot so students can interact appropriately with each other and the environment [15]. The use of mobile technology continues to grow, including in the field of education. Smartphones can facilitate and enhance learning interactions by accessing, discussing and sharing related information through social networks at anytime and anywhere [16].

3. Methods

The focus of this article review is the use of smartphones in learning. Studies related to this article are e-learning and e-module learning which are currently developing into m-learning [17]. Election focuses on studies based on the rapid development of smartphone technology that resembles computer capabilities, with prices that are relatively cheap and can be utilized in learning [18]. Taking this theme is considered interesting because almost all individuals have a smartphone, and in this article we will analyze how smartphones are used in learning, in terms of application usage, the benefits provided and the population of learning media use at various levels of education.

The method used in writing this article is a systematic literature review. This method was chosen because it can identify, evaluate, and interpret research data and results in accordance with research questions [19]. In addition, a systematic literature review can be used to minimize bias, disseminate the literature search framework, and allow for comprehensive analysis [20].

The systematic literature review in this article aims to explore the benefits and effects of smartphone implementation in learning, the type of application software used, and its application at the education unit level. This method of systematic literature review is carried out through 3 stages [21], namely searching and filtering literature, analyzing search results in accordance with the purpose of writing articles, and pouring the results of analysis in the form of scientific and logical arguments. The literature search process is carried out from various online sources. Some of the literature databases used are Google Scholar, Scopus, and Thomson. The publishing houses used are science direct, springer and taylor and francis [22-24]. The keywords used for the literature search process are smartphones, smartphones for lerarning, m-learning, study on smartphones, learning using smartphones, smartphone apps for learning and smartphone utilities for learning. In addition to keywords, there are criteria for filtering the literature traced, i.e. published articles in the last five years, in the form of
journals, and are research articles. Each article is reviewed by researchers with reference to the use of smartphones in learning in terms of the benefits provided, the type of application software used and the application of learning media at various levels of education unit. The last stage of the literature review is to provide a review of argumentation theory and logical argument writing.

4. Results

The research topics identified were grouped into three groups, namely: a) smartphone utilization in learning, b) types of software applications used for learning, and c) the application of learning media at various level of educational units. Data analysis uses the literature review which is divided into three stages with the aim of getting relevant journals according to the needs of the article.

The first stage is searching, filtering and collecting initial data from predefined databases and publishing houses, which obtained 100 journals based on the keywords: smartphone for learning, m-learning, study on smartphones, learning using smartphones, smartphone app for learning and smartphone utilities for learning. The second stage is analyzing the search results in accordance with the focus of article writing, which is carried out by the translation and analysis of each journal. The analysis is outlined in a tabular form containing the title, author, participant (to find out the level of education of the respondent), context (knowing the activities and applications used in research), type of data and basic finding (knowing the results or usefulness of the smartphone in learning), as shown in table 1.

Table 1. Decomposition of each journal at the data analysis stage.

| No | Sub | Description |
|----|-----|-------------|
| 1 | Title | Explore patterns of use of mobile applications for education for undergraduate students |
| Author | Iris Shuk Han Wai, Sara Sze Yan Ng and Dickson K. W. Chiu Kevin K. W. Ho Patrick Lo |
| Year | 2016 |
| Participant | 150 undergraduate students in business, education and engineering |
| Context | This study aims to examine the use of cellular applications in higher education |
| Type Of Data | Quantitative and qualitative methods were used to collect data from 150 students |
| Basic Finding | The results show undergraduate students often use mobile applications to engage in learning activities related to their academic studies |
| 2 | Title | Use of smartphones and smartphone addiction in middle school students in Korea: Prevalence, social networking services, and use of games |
| Author | Seong-Soo Cha and Bo-Kyung Seo |
| Year | January-June 2018: 1 – 15 |
| Participant | 1,824 middle school students using smartphones |
| Context | This study aims to examine smartphone usage patterns, smartphone addiction characteristics, and smartphone addiction prediction factors in middle school students in South Korea |
| Type Of Data | Face to face interview |
| Basic Finding | According to the Smartphone Addiction Scale score, 563 (30.9%) were classified as risk groups for smartphone addiction and 1261 (69.1%) were identified as normal user groups. Teenagers use cellular messenger for a long time, followed by surfing the internet, playing games, and using social networking services |
| 3 | Title | Midwifery: smartphone use by students, midwifery technology as a mediated educational tool in the clinical environment |
| Author | Annemarie DeLeo and Sadie Geraghty |
| Year | (Received 9 January 2017; accepted 5 December 2017) |
| Participant | 76 midwifery students |
| Context | Survey of midwifery students using a questionnaire that facilitates both qualitative and quantitative responses |
| Type Of Data | Mixed methodology |
| Basic Finding | The participants were asked whether they intended to work in rural/remote areas or in the metropolitan area after graduation; 85% (n = 25) of participants intended to work in metropolitan hospitals at graduation and 15% (n = 4) said they intend to work in rural/remote areas of Western Australia |
| 4 | Title | Factors that influence teacher decisions to use smartphone clicker applications to improve teaching interaction in university classrooms in Saudi Arabia |
| Author | Abdalaziz Aljaloud, William Billingsley & Paul Kwan |
| Year | Received 16 February 2017; Accepted 26 March 2018 |
| Participant | 33 teachers from the computer science faculty |
| Context | 33 teachers and 14 were interviewed |
| Type Of Data | Descriptive of the interview |
| Basic Finding | The main implication of this finding is that smartphone clicker application developers and user training coordinators must consider the teacher's perceptions of the suitability of technology and their desire to design learning assignments to facilitate students' participation and involvement |
After describing each journal, the next step is to select and group journals in accordance with the focus of writing, with the scheme as shown in figure 1.

Figure 1. The journal grouping scheme in accordance with the focus of the discussion.

Data analysis aims to assess the suitability of the journal with the focus of the discussion in this article. The results of the data analysis found that group 1, 33 journals, contained aspects of benefits and education units, group 2, 19 journals, contained aspects of benefits and application software, and group 3, 48 journals, contained aspects of benefits, application software and applications to the education unit, as shown in figure 2.

Figure 2. Grouping the results of data analysis.

5. Discussion
The last stage is to provide an overview of argumentation theory and logical arguments on the results of the analysis in the second stage. The overview focused on the benefits of smartphones in learning, the type of application software used and the application of instructional media in educational units.

5.1. Use of smartphones in learning
The application of smartphone technology in the learning process analyzed from relevant journals shows that the use of technology in learning can produce significant benefits if properly managed by the teacher [25,26]. Learning uses a smartphone with a student center strategy, is facilitated by teachers to achieve learning goals in the classroom [27].

Smartphone technology is applied not to complicate the learning process but rather to facilitate the mobile learning process. To create innovative learning opportunities, their usefulness and rationality need to be considered [28].

There are two converging functions that are influenced by cellular technology: (1) convergence between cellular technology as a learning media and learning design, and smartphone marketing that combines communication and computer functions in one device, (2) convergence between new personal and mobile technologies and a new conception of learning as a privately managed lifelong activity [29].
5.2. Smartphone applications used in learning

Smartphone application plays an important role in supporting learning activities, because it will determine the learning patterns and stages. Based on the results of analysis on relevant journals, it shows that there are several applications in smartphone that have been used in various disciplines, e.g. effective questionnaire applications [30], effective lesson schedulers [31], social networks for learning [32], language learning [26], and information in the health field [33].

5.3. Learning implementation using a smartphone

Learning by using a smartphone has been widely applied in various fields and levels of education. In this article smartphone users are grouped into 6 groups, namely kindergartens, elementary schools, junior high schools, senior high schools, colleges and the public consisting of various communities and informal institutions.

As shown in figure 3, smartphones are used at all levels of the education unit, with the most users in universities, which is 40%.

Figure 3. Smartphone usage at various education unit level.

6. Conclusion

From this study it can be concluded that the use of smartphones in learning facilitates significantly the achievement of student learning goals with student-centered learning models in various disciplines. Teachers can utilize various applications on smartphones for learning needs, such as applications for effective questionnaires, lesson schedulers, social networking, language learning and practice guidance applications. Smartphone applications in learning activities are used at all levels of education from elementary school to college.

References

[1] Jeng Y L, Wu T T, Huang Y M, Tan Q and Yang S J 2010 The add-on impact of mobile applications in learning strategies: A review study *Educational Technology & Society* 13(3) 3-11
[2] Yu Chen L, Chuang Yu and Wen Tzy T 2018 Why not be “smarter”? Examining the factors that influence the behavioral intentions of non-smartphone users 20(3) 1-20
[3] Tossell C C, Kortum P, Shepard C, Rahmati A and Zhong L 2015 You can lead a horse to water but you cannot make him learn: Smartphone use in higher education *British Journal of Educational Technology* 46(4) 713-724
[4] Buck J L, McInnis E and Randolph C 2013 The new frontier of education: The impact of smartphone technology in the classroom *American Society for Engineering Education* 1 1 1-11
[5] Poushter J 2016 Smartphone ownership and internet usage continues to climb in emerging economies *Pew Research Center* 22 1-44
[6] Chen H R and Huang H L 2010 User acceptance of mobile knowledge management learning system: Design and analysis *Educational Technology & Society* 13(3) 70-77
[7] Lan Y J, Sung Y T, Tan N C, Lin C P and Chang K E 2010 Mobile-device-supported problem-based computational estimation instruction for elementary school students Journal of Educational Technology & Society 13(3)

[8] Seong-Soo Cha and Bo-Kyung Seo 2018 Smartphone use and smartphone addiction in middle school students in Korea: Prevalence, social networking service, and game use. 1, 1-15.

[9] El-Hussein M, Osman M and Cronje J C 2010 Defining mobile learning in the higher education landscape Journal of Educational Technology & Society 13(3)

[10] 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)

[11] Yau J Y K and Joy M 2010 A context-aware personalized m-learning application based on m-learning preferences 2010 6th IEEE International Conference on Wireless, Mobile, and Ubiquitous Technologies in Education (pp. 11-18) IEEE

[12] Chen H R and Huang H L 2010 User acceptance of mobile knowledge management learning system: Design and analysis Educational Technology and Society 13(3) 70-77

[13] Huang Y M, Hwang W Y and Chang K E 2010 Guest Editorial-Innovations in Designing Mobile Learning Applications Educational Technology and Society 13(3) 1-2

[14] De Jong T, Specht M and Koper R 2010 A study of contextualised mobile information delivery for language learning Journal of Educational Technology and Society 13(3) 110

[15] Patten B, Sánchez I A and Tangney B 2006. Designing collaborative, constructionist and contextual applications for handheld devices Computers and Education 46(3) 294-308

[16] Martin F and Ertzberger J 2013 Here and now mobile learning: An experimental study on the use of mobile technology Computers and Education 68 76-85

[17] Kim Y and Shon J G 2011 A Study on Design of K-12 e-learning system for utilization smartphone Journal of Internet Computing and Services 12(4) 135-143

[18] Kafyulilo A 2014 Access, use and perceptions of teachers and students towards mobile phones as a tool for teaching and learning in Tanzania Education and Information Technologies 19(1) 115-127

[19] L García-Borgoñón 2014 Software process modeling languages: A systematic literature review Inf. Softw. Technol., 56 2 103–116

[20] J K Roehrich 2014 Are public-private partnerships a healthy option? A systematic literature review Soc. Sci. Med. 113 pp. 110–119

[21] Crossan M M and Apaydin M 2010 A multi-dimensional framework of organizational innovation: A systematic review of the literature Journal of management studies 47(6) 1154-1191

[22] Jacsó P 2005 Google Scholar: the pros and the cons Online information review 29(2) 208-214

[23] Mongeon P and Paul-Hus A 2016 The journal coverage of Web of Science and Scopus: a comparative analysis Scientometrics 106(1) 213-228

[24] Bernstein B 2018 On the classification and framing of educational knowledge. In Knowledge, education, and cultural change (pp. 365-392). Routledge.

[25] Chan N N, Walker, C, and Gleaves A 2015 An exploration of students' lived experiences of using smartphones in diverse learning contexts using a hermeneutic phenomenological approach Computers and Education 82 96-106

[26] Aljaloud A, Billingsley W, and Kwan P 2018 Factors that influence teachers’ decisions to use smartphone clicker apps to enhance teacher-student interactions in university classrooms in Saudi Arabia Learning: Research and Practice 1-20.

[27] Sandholtz J H 1997 Teaching with technology: Creating student-centered classrooms Teachers College Press, Teachers College, Columbia University, 1234 Amsterdam Ave., New York, NY 10027

[28] Jeng Y L, Wu T T, Huang Y M, Tan Q and Yang S J 2010 The add-on impact of mobile applications in learning strategies: A review study. Educational Technology and Society 13(3) 3-11
[29] Antoun C, Katz J, Argueta J and Wang L 2017 Design Heuristics for Effective Smartphone Questionnaires *Social Science Computer Review* 0894439317727072.

[30] Yau J Y K, Joy M and Dickert S 2010 A Mobile Context-aware Framework for Managing Learning Schedules-Data Analysis from a Diary Study *Journal of Educational Technology and Society* 13(3)

[31] Huang J J, Yang S J, Yueh-Min H and Hsiao I Y 2010 Social learning networks: Build mobile learning networks based on collaborative services *Journal of Educational Technology and Society* 13(3) 78

[32] De Jong T, Specht M and Koper R 2010 A study of contextualised mobile information delivery for language learning *Journal of Educational Technology and Society* 13(3) 110

[33] DeLeo A and Geraghty S 2017 iMidwife: midwifery students’ use of smartphone technology as a mediated educational tool in clinical environments *Contemporary Nurse* 1-10