



Applications Multiplatform in the Education Sector : A Literature Review

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ABSTRACTS

This paper aims to discuss multiplatform applications in education. Literature review is used to examine several relevant journals published from 2015 to 2019. The method used in this research is literature review analysis which is carried out to describe multiplatform applications as learning media in the world of education. The results can be reported that multiplatform applications, which are currently a trend in the field of education, can be an effective tool to facilitate online learning and support the concept of heutagogy learning for the realization of students who have lifelong learning skills. The findings of this literature review show that the use of multiplatform applications in education can enable the learning process to be easier, more interesting, effective and efficient.

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1. INTRODUCTION

Currently, the development of information and communication technology, especially web-based internet applications, is happening quite rapidly (Mulatu et al. 2018). One example of such applications is multiplatform applications or also known as crossplatform (Nidhom and Hammad 2017). The use of multiplatform technology has undeniably become an important inseparable part in various sectors of life, including in the field of education (Tondeur et al. 2017).

It seems that the presence of multi-platform technology in education cannot be separated from the existence of smartphones and tablet computers that assist in the learning process, as a result of considerations of practicality, personalization, modernization

and minimizing the cost of providing learning facilities (Domingo and Garganté 2016). Multiplatform applications have changed patterns of learning and teaching behavior to be more innovative (Forsström 2019), fun (Schüler 2019), dynamic (Kasatkina, Polyakov, and Vlasov 2018) and help students to think critically (Ataie, Shah, and Ali 2018).

A multiplatform application is a multimedia software, which supports several operating systems and several different hardware devices (Widiaty et al. 2020). Multiplatform applications are web-based applications that can be executed on several devices such as smartphones, PCs, and gadgets (Ataie, Shah, and Ali 2018). Operating systems that support this application include Blackberry OS, Andrid OS, IOS, and Windows Phone OS (Gede et al. 2016; Nidhom and Hammad 2017). These applications are developed by integrating several computing technologies such as web, hybrid and native (El-Kassas et al. 2017; Mulatu et al. 2018; Rodriguez-Gil et al. 2017). Learning using multiplatform applications is also known as multiplatform learning or crossplatform learning (Jiang, Min, and Mei 2019; Widiaty et al. 2020). Multiplatform applications can facilitate learning innovations in the digital era such as mobile learning, blended learning, self-study/independent learning/self determined learning, and distance learning (Klein and Baldasso 2020; Lytridis, Tsinakos, and Kazanidis 2018).

2. METHODS

Literature review in this paper is conducted to describe multiplatform applications as learning media in education. The literature review method is a method for interpreting a number of selected documents on a particular topic through summarizing, analyzing and evaluating documents (Wee and Banister 2016). This method is used to understand the topic and identify the relationship of research on a topic and develop a theory (Tondeur et al. 2012). Literature review in this paper was conducted in several stages, namely identification of research questions; identification of journals with relevant studies; selection of journal articles; collecting, summarizing and reporting findings from journal articles related to multi-platform applications in education.

Table 1. Journal article selection inclusion and exclusion criteria

Category	Inclusion	Exclusion
<i>Language</i>	English and Indonesian	Journals written in other languages
<i>Year</i>	Starting in 2015	Before 2015
<i>Type</i>	Empirical research published in national and international journals	theses, short articles and non-empirical research reports
<i>Content</i>	Relating to multi-platform applications or multi-platform learning or technology integration in education	All disciplines that are not related to multi-platform or cross-platform technology.

The literature review used to complete the presentation in this paper was conducted on several journal articles relevant to the topic of technology or multiplatform applications in education. The selected journal publication years are limited to 2015 to 2019. The literature review used to complete the presentation in this paper was conducted on several journal articles relevant to the topic of technology or multiplatform applications in education. The selected journal publication years are limited to 2015 to 2019. The collection of journal articles begins with a search on several search engine databases such as: Google scholar,

Scientific Direct/Elsevier, Taylor and Francis, IEEE Xplore Digital Library, Springer, Emerald, Crossref meta data search, and ERIC. The keywords used to search for journal articles included "multi-platform", "cross-platform", "multi-platform technology", "cross-platform technology", "multi-platform learning", "cross-platform learning", "multi-platform technology in education", "cross-platform technology in education", "technology uses in education", "technology integration in education", "social media learning", "multi-platform application development", and "software architecture".

Journal articles that have met the criteria, then at the next stage, content analysis is carried out. In simple terms, content analysis is conducted to interpret what is actually discussed in the text of a journal article. The results of the article analysis are presented in the form of a table.

3. RESULTS AND DISCUSSION

Multi-platform applications that are currently used as learning media in the field of education are developed in various forms. Examples can be seen in the following table.

Table 2. Examples of multi-platform applications in education

Form	Journal Article	Type	Features
<i>e-book / e-textbook</i>	(Davis 1989; Edmondson and Ward 2016; Uygurer and Uzunboylu 2017; Widiaty et al. 2019, 2020)	Web application: e-botik mobile libraries digital libraries	Audio, video, in text linking, full text searching, note sharing, quizzes, augmented reality, etc.
<i>Mobile Instant Messaging (MIM) and Social Media</i>	(Barry, Tierney, and O'Keeffe 2015; Klein and Baldasso 2020; Lee et al. 2017; Oghuma et al. 2016; Tang and Hew 2017; Widiaty et al. 2019)	Facebook®, Twitter®, Line®, Whatsapp® dan Youtube®.	Messaging, grup, video, video call, grafis, voice note, file/document sharing, status of user, maps, etc.
<i>Learning Management System (LMS)</i>	(Abarghooei 2015; Adinugroho, Reina, and Gautama 2015; Ateş Çobanoğlu 2018; Miao et al. 2017; Mtebe 2015; Nidhom and Hammad 2017; Salamah and Ganiardi 2017; Yahia and Ahmed 2016)	Web application Contoh: E-Learning Center E-learning FUOLC Cross Platform Learning System Mobile Microlecture Mobile Learning System Blackboard Edmodo Sakai Moodle KEWL	Video lectures, quiz test, chat room, speech recognition, forum discussion forum, assignments, learning materials, send/return assignment mechanism, peers discussion platform, immediate feedback on the online quizzes, timeless access to the learning materials, communication with peers and lecturer, collaborative group work, calendar as a reminder, news announcement, and performance dashboard and other features.
<i>Educational games and video games</i>	(Fisch, Damashek, and Aladé 2016; Gede et al. 2016)	Software for smartphones, tablets and desktops Example:	2D images, learning materials, paint, puzzle games, multitouch,

Form	Journal Article	Type	Features
Educational software	(Abarghoeei 2015; Dubovi, Levy, and Dagan 2017; Jiang, Min, and Mei 2019; Lytridis, Tsinakos, and Kazanidis 2018; Rodriguez-Gil et al. 2017; Rosmansyah, Achiruzaman, and Hardi 2019; Widiaty et al. 2017, 2018, 2019)	Balinese Traditional Ornament Education	sound, music videos, live-action crafts segments, image file storage and so on.
		UMIGO for children's math learning.	
		Online laboratory, virtual reality, augmented reality, user interface design pattern, programming, visual geo-localization, mobile learning dan berbagai jenis lainnya.	3D graphics, communication, video, sound, augmented, 3D virtual environment, moodle, technical features, multi-user collaboration, gamification

Users of e-books and e-textbooks, based on previous studies, are generally secondary and tertiary level students. In addition, electronic books are also used for specific academic purposes. Another interesting finding is that students prefer to use print books rather than e-books or e-textbooks for reading activities that require longer time (Edmondson and Ward 2016).

Still in a similar study, it turns out that the multi-platform applications that are now most popularly used in the field of education as learning media, are Mobile Instant Messaging (MIM) and Social Media. This type of multi-platform application is generally more in demand. Apart from practicality considerations and being able to add friends, it is also more flexible in terms of appearance. This type of application is quite current because its appearance is always up to date and can even be modified according to the user's wishes. MIM and Social Media are also quite supportive of the learning process that allows it to occur naturally, both in formal, non-formal, informal and workplace education (Cetinkaya 2017; Klein and Baldasso 2020).

Other research also suggests that currently the Learning Management System (LMS) is starting to become one of the multi-platform applications that are widely developed and implemented as learning media in the field of education. Through LMS, various learning media can be integrated into one software ecosystem, so that access to learning resources becomes easier and simpler (Adinugroho, Reina, and Gautama 2015). Furthermore, in a similar study, it was reported that the multi-platform applications that are currently developed with the target of students at the primary and secondary education levels are educational games and video games. It seems that this multi-platform application is indeed quite in accordance with the characteristics of primary and secondary level students who are still imaginative and cheerful (Fisch, Damashek, and Aladé 2016; Gede et al. 2016).

The use of multi-platform applications as learning media in education, on the one hand, does have many advantages, but on the other hand it also has weaknesses (Abd Rashid 2016; Domingo and Garganté 2016; Johnston et al. 2015; Klein and Baldasso 2020; Uygarer and Uzunboylu 2017). Some of these advantages include, among others, being able to save the cost of organizing learning facilities, which previously required a lot of tools to deliver learning materials now become more practical, because it is enough to rely on just one tool with the availability of media variants in it. Another advantage is accessibility, because learning activities can be held anywhere and anytime not limited by space and time.

In addition, learning media that are multi-platform applications are also easy to use and support learning activities that are more communicative and interactive, because they facilitate interaction activities between users. Previous research also mentioned that the implementation of multi-platform applications in learning makes it possible to facilitate distance learning activities, support student centered learning, train high order thinking skills, train problem solving skills, save time, increase student motivation and improve lifelong learning skills. Students can determine independently what they need and want in learning activities. This is certainly in accordance with the learning model that is currently developing, namely heutagogy learning (Blaschke 2018; Domingo and Garganté 2016; Fisch, Damashek, and Aladé 2016; Narayan, Herrington, and Cochrane 2019).

As for the shortcomings or weaknesses of using technology or multi-platform applications as learning media in education, the most dominant is internet access, because basically multi-platform applications are internet-based applications, if internet access is available, the facilitation of learning activities can be done well. Conversely, if there is no internet access, it will actually be an obstacle in the learning process, this often happens generally in rural areas. Another disadvantage is that it can cause eye fatigue, because the most dominant sense is forced to work is the eye, which takes a long time to stare at the device screen. Then, in multi-platform applications there are also often difficulties in controlling or monitoring messages conveyed by users, so it is not uncommon to raise doubts about the validity of the information received (Johnston et al. 2015; Klein and Baldasso 2020).

It is also alleged that the use of multi-platform applications as a medium of learning can be a factor in the moral or ethical decline of users in interacting or sharing information. In addition, sometimes the content on multi-platform applications becomes biased due to the lack of balance between educational content and entertainment content (Abd Rashid 2016).

4. CONCLUSION

This literature review discusses several previous studies that raised the topic of multi-platform applications or also known as cross-platform in education. Several databases have been selected to obtain relevant journal articles with publication years ranging from 2015 to 2019. To achieve the purpose of this paper, content analysis was conducted on a number of journals that have been sorted. The results can be reported that multi-platform applications, which are currently a trend in the field of education, can be an effective tool to facilitate online learning and support the concept of heutagogy learning for the realization of students who have lifelong learning skills. Multi-platform applications as learning media are currently developed in various types. The type that is most often the topic of previous studies is Instant Mobile applications.

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