



Applications Multiplatform in the Education Sector : A Literature Review

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ABSTRACTS

This paper aims to discuss the role of multiplatform applications in the field of education. A literature review method was employed, analyzing several relevant journals published between 2015 and 2019. The objective of this study is to describe multiplatform applications as effective learning media within educational environments. With the rapid growth of digital technologies, multiplatform applications have emerged as a popular and essential tool in facilitating online learning, providing students with access to educational content across various devices and platforms. These applications also support the concept of heutagogy, or self-determined learning, which focuses on developing students' ability to manage their own learning processes and preparing them to become lifelong learners. The findings from the literature review show that the use of multiplatform applications can make the learning process easier, more engaging, effective, and efficient. They enable greater flexibility, allowing students to learn anytime and anywhere, thus enhancing their learning experiences. Furthermore, multiplatform applications can stimulate student motivation and foster more interactive and dynamic educational activities. As education continues to evolve alongside technological advancements, the integration of multiplatform applications offers significant opportunities to improve the quality of learning, support personalized learning approaches, and meet the diverse needs of students. In conclusion, multiplatform applications have the potential to become a vital component of modern education, promoting more independent, innovative, and sustainable learning.

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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 prominent example of such applications is multiplatform applications, also known as cross-platform applications (Nidhom et al., 2017). The increasing accessibility and sophistication of web-based tools have significantly influenced various sectors, including education (Tondeur et al., 2017). In today's digital era, technological integration into the education system is no longer optional but has become a necessity to meet the demands of modern learning environments.

The presence of multiplatform technology in education is closely linked to the widespread use of smartphones, tablet computers, and various smart devices that support the learning process. Factors such as practicality, personalization, modernization, and cost-efficiency in providing educational facilities are major considerations behind the growing adoption of these technologies (Domingo et al., 2016). Multiplatform applications have played a key role in transforming traditional teaching and learning practices, offering opportunities for more interactive, flexible, and engaging educational experiences. They have enabled students and teachers to interact with learning materials seamlessly across various digital devices, regardless of the operating system or hardware used.

The influence of multiplatform applications on teaching and learning behavior is profound. Learning becomes more innovative (Forsström, 2019), enjoyable (Schüler and Anne, 2019), dynamic (Kasatkina et al., 2018), and promotes critical thinking skills among students (Ataie et al., 2018). Students are no longer passive recipients of knowledge but are encouraged to explore, interact, and create through various digital learning tools. This shift reflects a broader pedagogical movement towards student-centered learning approaches, which emphasize active participation, autonomy, and real-world application of knowledge.

A multiplatform application is defined as multimedia software that supports multiple operating systems and hardware devices (Widiaty et al., 2020). These applications are typically web-based and can be accessed through smartphones, personal computers, and other mobile gadgets (Ataie et al., 2018). Popular operating systems compatible with multiplatform applications include Android OS, iOS, Blackberry OS, and Windows Phone OS (Gede et al., 2016; Nidhom et al., 2017). The development of these applications often involves the integration of various computing technologies such as web-based frameworks, hybrid development approaches, and native application design (El-Kassas et al., 2017; Mulatu et al., 2018; Rodriguez-Gil et al., 2017), allowing for a more versatile and user-friendly learning experience.

The implementation of multiplatform applications in education has introduced new learning models known as multiplatform learning or cross-platform learning (Jiang et al., 2019; Widiaty et al., 2020). These learning models support various innovative educational methods such as mobile learning, blended learning, self-study or independent learning, and distance learning (Klein et al., 2020; Lytridis et al., 2018). Multiplatform learning emphasizes flexibility, accessibility, and the empowerment of students to take control of their own learning paths, aligning closely with modern educational trends like heutagogy.

In conclusion, the integration of multiplatform applications into education offers transformative opportunities to enhance the teaching and learning process. By leveraging the power of technology, educators can create more inclusive, accessible, and engaging learning environments that cater to diverse student needs. As education continues to evolve in

response to technological advancements, the role of multiplatform applications will become even more significant in fostering a culture of lifelong learning and preparing students for the challenges of the 21st-century knowledge society.

2. METHODS

The literature review in this paper is conducted to describe multiplatform applications as learning media in education. The literature review method is a systematic technique used to interpret a number of selected documents on a particular topic through summarizing, analyzing, and evaluating the contents of those documents. This method is employed to understand the scope of the topic, identify research relationships, and support the development of theoretical frameworks. In this study, the literature review was conducted through several structured stages: identification of research questions; identification of journals containing relevant studies; selection of journal articles based on inclusion and exclusion criteria; and the collection, summarization, and reporting of findings from selected journal articles related to multiplatform applications in education. Journal article selection inclusion and exclusion criteria in Table 1.

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 was based on a systematic search for journal articles relevant to the use of technology, particularly multiplatform applications, in educational settings. The search for articles was carried out using several well-known academic databases and digital libraries, including Google Scholar, ScienceDirect/Elsevier, Taylor and Francis, IEEE Xplore Digital Library, Springer, Emerald, CrossRef Metadata Search, and ERIC. The keywords employed in the search process included combinations such as "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." Boolean operators (AND, OR) were also utilized to refine search results and ensure comprehensive coverage.

After the initial identification of articles, a screening process was conducted by reviewing titles, abstracts, and keywords to assess the relevance of each article to the study objectives. Articles that met the initial relevance criteria were subjected to a full-text review to determine their eligibility based on the defined inclusion and exclusion criteria. In addition to the database search, a snowballing method was applied—tracing references cited in the selected

articles—to capture additional relevant studies that might have been overlooked during the keyword search.

Once relevant articles were identified and collected, content analysis was conducted to systematically interpret and extract key information. This involved categorizing articles based on several dimensions, such as the research objectives, methodologies applied, types of multiplatform applications discussed (e.g., mobile apps, web apps, hybrid apps), and the educational impacts reported (e.g., student motivation, engagement, independent learning development). This categorization aimed to facilitate thematic analysis, allowing the identification of common patterns, emerging trends, and research gaps in the existing body of literature.

The findings from the content analysis were then organized and summarized in a tabular format for easier comparison and synthesis. The use of tables helped visualize the distribution of studies across various criteria such as year of publication, technological approach, educational setting (formal, informal, blended), and reported outcomes. This systematic presentation ensures that the literature review not only captures a wide range of perspectives but also highlights the evolving role of multiplatform applications in transforming educational practices.

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 2. 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 et al., 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 and Levent, 2017; Klein et al., 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 et al., 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 et al., 2016; Gede et al., 2016).

Table 2. Examples of multi-platform applications in education

Form	Journal Article	Type	Features
<i>e-book /e-textbook</i>	(Davis, 1989; Edmondson et al., 2016; Uygurer et al., 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 Instan Messaging (MIM) and Social Media</i>	(Barry et al., 2015; Klein et al., 2020; Lee et al., 2017; Oghuma et al., 2016; Tang et al., 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 and Majid, 2015; Adinugroho et al., 2015; Ateş Çobanoğlu and Alev, 2018; Miao et al., 2017; Mtebe and Joel, 2015; Nidhom et al., 2017; Salamah et al., 2017; Yahia et al., 2016)	Web application Contoh: E-Learning Center E-learning FUOLC Cross Platform Mobile Learning System 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 et al., 2016; Gede et al., 2016)	Software for smartphones, tablets and desktops Example: Balinese Traditional Ornament Education UMIGO for children's math learning.	2D images, learning materials, paint, puzzle games, multitouch, sound, music videos, liveaction crafts segments, image file storage and so on.
<i>Educational software</i>	(Abarghooei and Majid, 2015; Dubovi et al., 2017; Jiang et al., 2019; Lytridis et al., 2018; Rodriguez-Gil et al., 2017; Rosmansyah et al., 2019; Widiaty et al., 2017, 2018, 2019)	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

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 and

Zarina, 2016; Domingo et al., 2016; Johnston et al., 2015; Klein et al., 2020; Uygarer et al., 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 and Marie, 2018; Domingo et al., 2016; Fisch et al., 2016; Narayan et al., 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 et al., 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 and Zarina, 2016).

4. CONCLUSION

This literature review discusses several previous studies that raised the topic of multiplatform applications, also known as cross-platform applications, in education. Several databases were selected to obtain relevant journal articles published between 2015 and 2019. To achieve the purpose of this paper, content analysis was conducted on a number of sorted journals. 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 with lifelong learning skills. Multiplatform applications as learning media are currently developed in various types, with Instant Mobile Applications being the most frequently discussed in previous studies. Furthermore, it can be concluded that the integration of multiplatform applications provides not only practical benefits such as flexibility, accessibility, and interactivity, but also plays a strategic role in transforming educational practices towards more student-centered learning environments. By enabling seamless access across devices

and fostering self-determined learning, multiplatform applications have the potential to bridge educational gaps, personalize the learning process, and prepare students to adapt to the dynamic demands of the 21st century knowledge economy. Thus, their adoption and further development should be considered a crucial aspect of educational innovation moving forward.

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