Review Article

Role of Educational Mobile Game Applications in teaching and learning: A Review of Literature

Poonam panwar[1], Shreyas Pragya[2] & R K Roshni Raj Lakshmi [3]

[1]Research Scholar, Department of Yoga and Science of Living, Jain Vishva Bharati Institute, Ladnun, Rajasthan

[2]Professor, Department of Yoga and Science of Living, Jain Vishva Bharati Institute, Ladnun, Rajasthan

[3]Guest Faculty, Department of Yoga, Manipur

Email: roshnirajlakshmi@manipuruniv.ac.in

Abstract

Mobile learning is a novel way to use mobile devices to access learning content anywhere and anytime. Students are currently using mobile phones at a much younger age. They generally use them for playing games or accessing social media. The purpose of this study is to review the research that investigated the effects of educational mobile game applications on students' learning outcomes. At this time the world is facing a disastrous pandemic that has affected all aspects of life; health and education are the most. A review of papers on mobile learning published between 2010 and 2021 was conducted. We aim to analyze current literature about the impact of mobile games on student achievement and attitudes towards learning. Educational mobile games can stimulate a child's interest in learning and promote and increase language development, critical thinking, emotional development, intelligence, and imagination. Therefore, educational games could be seen as having an essential role in a child's development. We use the keywords "Mobile learning," "Mobile games for education," "M-learning," and "Educational mobile games" to find out the literature regarding this topic. After analyzing the previous studies, we made some conclusions. Mobile games can enhance the level of motivation. To overcome the hazardous effects of mobile games, we should develop age-specific games that must include moral values and personality developmental tasks.

Keywords: Educational game, Mobile learning, Mobile game applications, Teaching

Introduction

Mobile learning (m-learning) is a very prominent multidisciplinary study subject worldwide. It has attracted much interest from scholars across the board that has seen the possibility of using mobile technologies to improve learning. Gardner (1983), in his theory of multiple intelligences, proposed that a person could have various cognitive abilities. He identified eight intelligences that a person can have to help him understand and learn about the world, including spatial, linguistic, logical-mathematical, bodily-kinaesthetic, musical, interpersonal, intrapersonal, and naturalistic intelligences. As a result, one may claim that, as mobile technology can store audio, video, and text files, if incorporated into the learning environment, these tools can reach learners with various learning styles. Games are vital for children to socialise and significantly impact their development. Its purpose is to develop intelligence, senses, emotions, imagination, and creativity (Ni& Yu, 2015). Teaching and learning are no longer limited to traditional classrooms in the twenty-first century. As a result,

novel mobile technology applications are required to make education accessible to anybody, anywhere, at any time, and at a low cost worldwide.

Methodology

An exhaustive search is done on several databases like Google Scholar, PubMed and Cinahl using the keywords s "Mobile learning," "Mobile games for education," "M-learning," and "Educational mobile games". The timeline is set from 2010 to 2021. References with only abstracts, references in languages other than English, or references with matters not related to our topics were excluded from the review. Fourteen articles were selected for the review. A thorough analysis of the articles included in the review brings forth the conclusion that mobile games can enhance the level of motivation. To overcome the hazardous effects of mobile games, we should develop age-specific games that must include moral values and personality developmental tasks.

Theoretical framework

A new generation of kids has played computer games and interacted with mobile phones and other technology devices. They have developed different attitudes and abilities, which may have resulted in a misalignment between their expectations and the learning environment in classrooms (Oblinger, 2004).). Mobile devices are portable and adaptable to students' day-to-day activities; they can be exploited in the education industry (Mulatu et al., 2018). Mobile gadgets make the educational process more flexible and adaptable for students, school schedules, and the need of teachers (Klopfer, Sheldon, Perry, & Chen 2012). According to Marshall McLuhan, anyone who distinguishes between games and learning does not understand either of them. Innovatively developed games, unlike typical contexts such as classrooms, may produce a favourable environment in which children are more responsive (Shute et al., 2011). The mobile gaming industry will reach around $98 billion in revenue by 2024. Games can thrive in the area of motivation. School education standards may be improved by using cellphones because most people are familiar with digital technology (Papadakis & Kalogiannakis, 2017). Demirbilek revealed that in all countries, most adult educators (76 per cent) expressed their interest in using mobile devices and games in their teaching process. Many characteristics of good learning environments may be found in games, including elements of urgency, complexity, trial and error learning, and scoring points. They also provide rapid feedback and facilitate active learning, experiential learning, and problem-based learning. Teachers always desire to have motivated learners, which is associated with students' desire to participate in activities. According to Malone and Lepper (1987), curiosity, challenge, fantasy, control, cooperation, competitiveness, and recognition are seven variables that drive motivation, and many of them are present in games (Prensky, 2001). In a study by (Golchai et al., 2012), the educational game snakes & ladders were evaluated in anatomy course design. Samples were first-year medical students. All boxes on the board have questions related to trunk anatomy. Skiada et al. (2014) "EasyLexia" developed a mobile application that could foster learning and help children improve some of their fundamental skills, such as reading comprehension, orthographic coding, short-term memory, and mathematical problem-solving. Ni & Yu, 2015 stated that to stimulate children's interest in active learning, mobile games use cognitive development theory as a foundation, make reasonable use of the multimedia features and interactive characteristics of digital mobile platforms, and make image-identification activities more like

games through scene interaction. Su & Cheng, 2015 revealed the implications on motivation and student learning by using a context-aware mobile learning environment. Incorporating mobile and gamification technology into the botanical learning process should result in greater learning outcomes and motivation than non-gamified mobile learning or traditional training. Eder et al., 2016, developed a user-friendly, interactive, and easy-to-understand mobile application for autistic children. The focus of the application is basically on identifying the human body parts. It was concluded that the attention span of autistic children was increased by using this application. (Sutopo & Pamungkas, 2017) developed a multimedia application, particularly a mobile mathematics game. The App includes conceptual maps, tutorials, practice, and testing. In the practice section, they solve the problem of addition, subtraction, multiplication, and division. ChilDiBu is a picture-based program for children with specific educational needs that combine graphic pictures, texts, and audio recordings. It was created to teach the Bulgarian alphabets, numbers up to 20, basic colours, and daily activities (Kraleva, 2017). Edugames4all MicrobeQuest!, a mobile game that aims to teach microbiology and create awareness about important healthcare issues such as hygiene, infection prevention, and responsible antibiotic use among 9 to 12 years old (Molnar & Kostkova, (2018). Herodotou, 2018 shed light on the learning effects of the touch screen mobile game Angry Birds. Knowledge about projectile motion was enhanced among two groups of pre-schoolers (4 and 5 years old) for seven days. Effects were analysed by different pictures (5 questions), questionnaires, and screen recordings. The pre-schoolers showed a significant improvement in their understanding of how force affects them. To promote physical activity and incite the 6 – 12 years old children to eat the daily breakfast with healthy food, Saad et al., 2018, developed an Arabic-based game named "Grow Healthy." Jian, Mon & Subramaniam, 2020, used the concept of the Edutainment game to impart moral values among children. The mobile application has proved helpful for children to acquire moral education or values in a more engaging and fun way is enormous. Parents agreed to let their child/children use the application. To examine the impact of mobile games, innovative technology, and collaborative learning on students' motivation, a study was done on 250 university students of Tehran. The results explored a significant positive impact on students' motivation. Mobile games also improve flexible learning, problem-solving skills, excitement, and enthusiasm (Mivehchi & Rajabion, 2020). A mobile application called Azbuka is discussed in this review. This is an android application developed in the form of an interactive educational game for mobile touch screen devices and is intended to help young children to learn to write Cyrillic letters. The app has many colours, interesting sounds and familiar objects, which should attract children's attention and raise their curiosity. 20 children were selected as a sample and after using the application More than 80 per cent of the children answered affirmatively that this game is useful and easy to use, and expressed a wish to continue to learn to write the remaining letters. Duh, E. S., Koceska, N., & Koceski, S. (2017).

The reviewed study focuses on teaching mathematics in class 12 by using applications (available on mobiles, laptops, desktops, iPads etc.), namely Phone, Viber, WhatsApp and Messenger so as to provide an appropriate teaching environment. The sample sizes for both scientific and literary branches during the academic year 2019-2020 were 31 and 53, respectively. Pre and

post-tests were administered to check pupils' achievements. Videos were prepared and uploaded to the teaching groups in Viber and Messenger. Mobile applications experimented with have led to the enhancement of the mathematics teaching process outside normal classes and particularly during the COVID-19 lockdown periods and crisis (Hussin, F. K., & Aziz, S. Q, 2021).

How educational game applications can help incline students' interest in science, an educational game application was developed, and conducted user experience testing. A mobile application on Earth and Space Science has been developed for 10–11 year old school students. The project is based on the Rapid Application Development methodology considering the short development time frame (Wan Ahmad, W. F., & Ahmad Harnaini, A. F, 2022).

This study intends to develop an educational game application on the Android platform in order to teach earthquake disaster mitigation and the fundamentals of safety in the face of an earthquake disaster in a more engaging and enjoyable manner. In this educational game, there is a video explaining earthquake simulation and earthquake mitigation, along with a game with three stages: before, during, and after the earthquake. System Feasibility Testing was used to get a direct assessment of the feasibility of the system and the application was included in the excellent category application operation, display, and content of the application variables.

Table-1: Details of Games Used in the Study

S. No.	Name of the author	Aims/objectives of the study	Name of the game	Research design	Sample	Device type	Findings
	Skiada, Soroniati, Gardeli, &Zissis, 2014	To help dyslexic children improve some of their learning disabilities.	EasyLexia	Pilot study	5 students	Android	Students showed progress in their overall game performance over a short time usage
	Eder et al., 2016	Mobile application for autistic children to introduce them from basic parts of human body	FillMeApp	Survey	11 students	Android	The attention span of autistic children was increased by using this application.
	Molnar & Kostkova, (2018)	To teach microbiology and create awareness about important healthcare issues	Edugames4all Microbe-Quest	A pilot study, Survey	19 participants	Not mentioned	The game could teach, but the learning across all learning objectives was not statistically significant.

	Kraleva (2017)	A conceptual model of a mobile application for teaching children with intellectual disorders.	ChilDiBu	Pilot project	Not include	Android	
	Saad, Al-Maadeed, & AlJa'am, (2018).	Multimedia & video games enhance children's knowledge about healthy food and show the importance of exercising in life.	Grow Healthy	Survey	7 & 8 years old students	Multimedia based tutorials	most of the students intended to change their eating lifestyle after playing the game
	Sutopo & Pamungkas, 2017)	Mobile application for self-learning and motivation to learn mathematics among school children.	Mobile mathematics game		19 students	Android	89.5 per cent of students who could solve the problem in the specific time
	Herodotou, 2018).	To improve the understanding of projectile motion through the game.	Angry Birds	comparative study	32 students	Android	A significant difference was observed in the low-performing group activity.
	Ibrahim, Fatimah & Ahmad, 2015	To promote Malay folk stories to children	M-Folktales		15 students	Android	got the positive impression in user perception
	Rizky Maulana, Mujahidah, &Tryanti, 2018	To support EFL (English as a Foreign Language) learning, mainly listening skill	Learn English	Case study	8	Android	The mobile game is beneficial for learners for their English language skills improvement.

	Jian, Mon, & Subaramaniam, 2020	To provide a better understanding of moral values with the help of a mobile App.	Edutainment	Quantitative research	40	Android	Most of the participants strongly agree that App is interesting, easy, kid-friendly, and helpful in teaching moral values.
	Duh, Koceska & Koceski (2017)	To help children to learn writing Cyrillic letters	Azbuka	Experiment + survey method	20 students	Android	time required to draw a letter Using the Android application takes less time for writing the letter by classical method.
	Hussin,& Aziz (2021).	Teaching mathematics by using different mobile applications	Phone, Viber, WhatsApp and Messenger		13+53 students of class 12th	Mobiles, laptops, desk tops, iPadsetc	Average scores for pre and post tests for the scientific branch were 20 % and 63.33 %, respectively; while for the literary branch were 17.5 % and 50.83 %, respectively
	Wan Ahmad, W. F., & Ahmad Harnaini, A. F. (2022).	To create students' interest in science	Earth and Space Science based application	Interview and User experience testing	20 students of 10-11 years old	Smartphones	Experiment motivates students to be more inclined to science.
	Winarni, Purwandari, &Hervianti, (2018)	To provide a learning medium for earthquake disaster mitigation	Application of earthquake disaster mitigation	Usability testing data	Elementary school students	Android	this application was included in the excellent category for application operation, display, and content of the application variables

Discussion

Nowadays, students use mobiles for entertainment or online study through schools, but it should be explored more. Many studies have indicated that mobile games may improve students' learning motivation and make the study material exciting and easy to grasp. Suppose they are equipped with appropriate learning strategies. In that case, those games may significantly affect students' perceived enjoyment, perceived usefulness, perceived ease of use, and behavioural intention to use, compared with the same game without the learning strategy (Mulhem &Almaiah, (2021). Furió et al. compared the knowledge of the water cycle among two groups of students, one learned with the iPhone game method and the other with traditional classroom lessons. Even if the results showed that the iPhone method achieved higher knowledge results than the traditional classroom lesson, no statistically significant differences were found between the iPhone and the classroom group, but the motivational outcomes were found significant among the children who learnt with the iPhone game. Though the iPhone game achieved similar learning results as the traditional classroom lesson, it suggests that this kind of game could be used as a tool in primary schools to reinforce students' lessons (Furió et al., 2015). The results analysed using the MicrobeQuest game showed that the game could teach, but the learning across all learning objectives was not statistically significant. We cannot confirm the hypothesis in one direction because the sample size is so small. Traditional education is more effective for children/ young adults who do not usually play video games. The gaming profile could affect the interest and motivation towards learning a specific type of game (Molnar & Kostkova, 2018). According to a review about the use of mobile technologies in education done at the Futurelab (Naismith, Lonsdale, Vavoula, & Sharples, 2004), mobile wireless devices can be used by school teachers for managing their schedules, reviewing student marks, accessing central school data, attendance reporting, and providing course material. In the global educational setting, mobile technology's use, implementation, and design pose technological and socio-cultural obstacles. Online learning has its limitations; some games prove very violent and aggressive and are not suitable for some age groups. Such mobile games can have a very harsh effect on their minds. As a result of the popularity of mobile games, some anti-social forces have devised dangerous games that cause physical and mental harm to users. Children may use this digital technology in constructive as well as destructive ways. To prevent children from these adverse effects of technology, parents, and teachers should take care of the kind of games or apps they are using. The app developers should make content enriched with moral values for personality development.

Conclusion

From this literature review, we can conclude that due to pandemics in all countries, students and teachers are using m-learning. Most of the studies are based on educational content related to the school curriculum. Apart from this, mobile apps with content enriched with quality of life psychological and philosophical aspects should be developed so that children may have a new attitude toward life. Such applications may counter the adverse impact of un-appropriate digital content. Studies with robust study designs should be conducted to assess the effectiveness of mobile games for personality development and value education.

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