Mobile Apps for educational purposes

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Abstract

Abstract— Mobile learning is an educational strategy that leverages mobile devices such as smartphones and tablets to facilitate access to knowledge anytime, anywhere (Ally, 2009). This article explores both the benefits and limitations of mobile learning, highlighting key areas where it can be implemented. Among these areas, its application in language learning and STEM (Science, Technology, Engineering and Mathematics) disciplines are mentioned, with a special emphasis on programming. In addition, it should be noted that mobile learning is closely related to gamification, making it a powerful tool in education.

Keywords

Mobile Learning, E-Learning, Interactive Learning, Gamification.

I. Introduction

Within the field of learning there are different methods for the acquisition of knowledge in different areas (Alaneme et al., 2010, p. 187). Traditional teaching methods can be mentioned as well as more modern methodologies that encourage self-learning (Alaneme et al., 2010, p. 187). One that has become quite popular is mobile learning. Since the introduction of mobile phones and tablets, they have been tools that help the field of education (Morales Salas & Rodríguez Pavón, 2021).

There are multiple methods for knowledge acquisition that vary according to context, educational goals and learner needs (Alaneme et al., 2010, p. 187-188). These methods include traditional teaching approaches, such as face-to-face lectures and the use of textbooks, as well as more modern methodologies designed to encourage self-learning and adapt to the demands of the 21st century (Alaneme et al., 2010, p. 187-188). Among these modern methodologies, one that has gained significant popularity in recent years is mobile learning.

It is important to note that mobile learning is not limited to the use of technological devices, but also incorporates pedagogical strategies such as gamification, which combines game elements to motivate and engage students. Wei & Hiung (2012) highlight that gamification can be an effective tool for improving participation and learning outcomes in educational contexts.

II. Mobile Learning

Mobile learning has established itself as a key tool in education thanks to the development of devices such as smartphones and other devices, which have transformed the way people access knowledge. Ahmadi et al (2013) characterise mobile learning by its ability to 'provide access to educational materials anytime, anywhere' (p.36), fostering more flexible and personalised learning. These technologies allow students to learn autonomously, overcome geographical barriers and adapt content to their pace and learning style.

Mobile learning, or m-learning, supports autonomous and ubiquitous skill development using portable devices. Morales Salas & Rene Rodriguez Pavon (2021) cite Brazuelo and Gallego, noting that m-learning fosters knowledge construction, problem-solving, and independent skill development (p. 99-128).

Mehdipour & Zerehkafi (2013) view mobile learning as an evolution of traditional e-learning, aiming to address the limitations of earlier digital education methods.

Benefits and possibilities

Mehdipour & Zerhenkafi(2013) outline several advantages of mobile learning.

1. Flexibility: Enables learning beyond fixed
2. <u>Immediate communication:</u> Facilitates quick feedback between students and instructors.
3. <u>Personalization:</u> Allows for more learner-centred content and instruction
4. <u>Accessibility:</u> Improves educational access.
5. <u>Collaboration:</u> Supports interactive and group learning activities.
6. <u>Integration:</u> Compatible with many existing e-learning systems and resources.

Drawbacks and limitations

Mehdipour & Zerhenkafi(2013) outline on the other hand some disadvantages of mobile learning.

1. <u>Technical constraints</u>: small screens, limited input, battery issues, and connectivity problems.
2. <u>Distraction potential:</u> Multipurpose devices may divert focus from educational content.
3. <u>Content development:</u> Difficulty creating compatible materials for various platforms.
4. <u>Security and privacy</u>: Risks with digital learning materials and user data.
5. <u>Assessment challenges:</u> Difficulty evaluating learning outside traditional settings.
6. <u>Digital divide</u>: Inequality between those with and without access to mobile technology.

III   Mobile and gamified approach

Gamification leverages the engaging and motivating aspects of games to drive real-world outcomes in various domains, such as business, education, and health. If properly designed, it can be a powerful tool for influencing and achieving objectives (Werbach & Hunter, 2012).

Hsu & Chen (2018) highlight the value of integrating game mechanics, or 'gamification', to enhance user experience by incorporating game elements into non-game contexts. This strategy promotes user engagement and fosters a more interactive, positive experience across different environments. In this context, Hsu and Chen (2018) emphasise the term User Experience as the overall interaction users have with a product or system, considering factors such as ease of use, functionality, and emotional response (as cited in Partala & Saari, 2015), underscoring the importance of user-centred design to enhance engagement and satisfaction.

Mobile devices and gamification are closely related, as they take advantage of the unique features of mobile devices, such as the use of fewer computational resources and simpler design compared to games on other platforms (Davidsson, 2006, as cited in Wei & Hai Hiung, 2012). On the other hand, the game-based learning approach can be more meaningful at earlier stages, as it provides greater stimulation due to the interactivity that these devices offer. According to Huizenga (2009, as cited in Wei & Hai Hiung, 2012), this type of learning promotes motivation, engagement and the development of new skills, especially when students interact in educational environments specifically designed for mobile games.

IV   Case studies in mobile learning

As previously discussed, mobile learning has a wide potential for application in various educational settings, providing innovative strategies that optimize teaching and learning processes. Two specific areas in which this approach has made a significant impact are analyzed in the following section, consolidating itself as an effective tool for the development of skills and knowledge.

Duolingo

The following is one of the is the most popular, accessible, and enjoyable language-learning platform offering over 35 languages for free. It provides motivating, bite-sized lessons rooted in learning science, designed to make education both effective and engaging. Users set goals and track progress daily, with lessons designed to fit into short breaks (Duolingo, 2024).

Duolingo, a language learning platform, was established in 2011 by Luis von Ahn and Severin Hacker. The company released its mobile application in 2012, which has since risen to prominence as the foremost method for language acquisition. It has achieved remarkable success, ranking among the most frequently downloaded educational applications worldwide (Duolingo, 2024).

Duolingo's teaching approach is based on learning science, using methods like spaced repetition, active recall, and implicit learning. Lessons are designed to be bite-sized and engaging, emphasizing practice, gradual progression, and real-world application. The platform incorporates personalized feedback and gamification elements to keep learners motivated. Duolingo also uses AI to tailor lessons to individual users' strengths and weaknesses. The goal is to make learning accessible, enjoyable, and scientifically effective (Duolingo, 2024).

This learning app has emerged as one of the leading platforms for language learning, offering a wide range of foreign languages (Kim et al., 2018). Duolingo has gained recognition from both Apple and Google as one of the top applications in its category (Kim et al., 2018). Figure 1 shows Duolingo main page with some of the characters used.
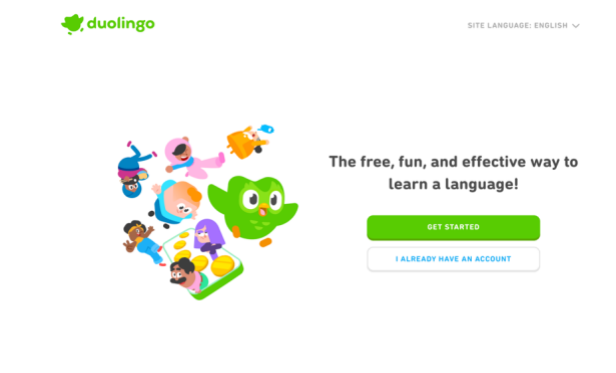

Figure 1: Screenshot of Duolingo homepage. Source: (Duolingo,2024)

Mobile Learning in STEM: Science, Technology, Engineering, and Mathematics

While PCs and laptops have been the main platforms for learning programming, Tillmann et al. (2012) note that mobile devices are increasingly preferred, especially in introductory courses, due to their widespread use and benefits like immediate feedback.

Othman et al. (2022) explore various educational technologies in programming, highlighting mobile learning as a method to address challenges for beginners. They cite Halim and Phon (2020), who found that mobile learning significantly boosts students' motivation and interest in programming. Othman et al. (2022) also point out the need for more discussion on combining mobile learning with other educational approaches to enhance programming skills and cognitive abilities.

Mobile devices offer flexibility and portability, allowing novice programmers to access learning materials anywhere, anytime, overcoming space and time limitations (Iqbal et al., 2013). Many students already own mobile devices, facilitating the adoption of mobile learning without extra hardware (Iqbal et al., 2013). Mobile learning supports understanding course content by providing access to recorded lectures and materials, enabling self-paced study and review of missed classes (Iqbal et al., 2013).

Limitations of using mobile for programming education

Programming education faces challenges when using mobile devices, such as limited screen size and input capabilities compared to traditional PCs (Tillmann et al. 2012) Mobile environments might initially complicate software development processes (Tillmann et al. 2012). Using touchscreens instead of keyboards can hinder coding efficiency (Tillmann et al. 2012).

Additional limitations include difficulty viewing complex code on small screens, risk of data loss, and lower robustness compared to desktops (Iqbal et al., 2013; Kukulska-Hulme, 2007). Specialized programming software is harder to add to mobile devices (Iqbal et al., 2013) . While mobile devices are beneficial for supplementary learning, they cannot fully replace traditional computer-based programming environments due to these limitations.
In the following section a successful case of STEM application will be analysed.

Brilliant

Brilliant is a gamified hands-on online learning platform offering over 70 courses in technical subjects, focusing on interactive problem-solving rather than passive learning. With a community of over 10 million users, it emphasizes STEM subjects—Science, Technology, Engineering, and Mathematics (Figure 2) (Brilliant, 2024).
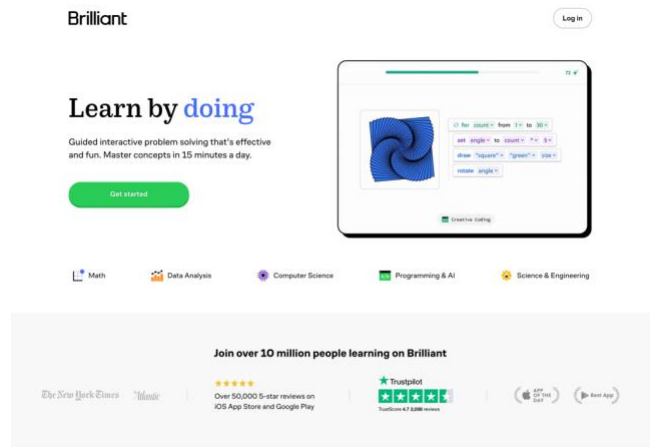

Figure 2: Brilliant website. Source (Brilliant,2024)

Characteristics

Interactive learning experience: The platform uses exercises, quizzes, and daily challenges to keep students engaged with the materials.

Gamification: Brilliant has fully implemented the concept of gamification in its teaching methodology. The user experience feels more like a game than a traditional learning experience, which is seen as a positive aspect.

Elements of gamification mentioned include:

- Interactive exercises and quizzes

- Daily challenges that keep users engaged

- A drag-and-drop interface that feels rewarding

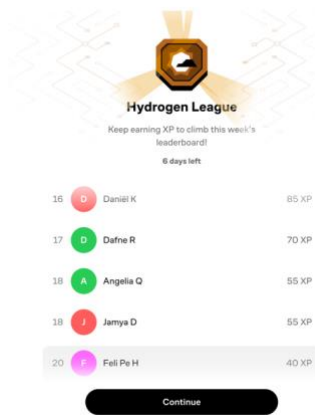- A visual style that makes the learning experience feel more like a game (Figure 3)

Figure 3: Visual Style of gamification element like leaderboards (Brilliant,2024)

<u>Visual learning:</u> The platform features a strong visual style with animations, making it appealing to visual learners.

<u>Customizable learning paths:</u> Brilliant allows users to customise their learning experience based on their needs and interests.

V.   Conclusion

Mobile learning has emerged as an educational methodology, combining the accessibility of mobile devices with innovative pedagogical strategies such as gamification. This approach not only enhances student motivation and engagement, but also effectively adapts to the diverse needs of today's education. As discussed, mobile application development has great potential, especially for beginners, by providing interactive and gamified environments that make learning more intuitive and engaging.

When thoughtfully designed, mobile learning applications can serve as effective tools for bridging gaps in traditional education, offering learners the flexibility to acquire knowledge at their own pace while maintaining high levels of engagement. Integrating gamification elements into these apps further amplifies their impact, making them a highly promising proposition for the future of education in a variety of areas. Therefore, investing in the design and proper implementation of mobile learning tools represents a transformative opportunity to improve education and make it more inclusive and effective.

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