

DEVELOPMENT OF AN EDUCATIONAL GAME

Ms. Samiksha. V. Patil¹, Prof. Shubham Lotwala²

Research Scholar, Department of Computer Applications, Shramsadhana College of Engineering & Technology

Jalgaon.MH, India¹

Asst. Professor, Department of Computer Applications, Shramsadhana College of Engineering & Technology

Jalgaon.MH, India²

Abstract: Education is increasingly influenced by digital technologies, creating opportunities to develop new approaches that make learning more interactive and engaging. Traditional teaching methods can sometimes make it difficult for students to maintain attention and motivation, particularly when learning involves repetitive practice or abstract concepts. Game-based learning provides an alternative approach by combining educational content with interactive challenges, feedback, goals, and rewards. (UNESCO, 2023)

This research project focuses on the development of an educational game for enhancing student learning and engagement. The purpose of the study is to examine how educational game elements can be incorporated into a digital learning environment and how such an approach may support students' motivation, participation, and learning outcomes. The proposed study involves reviewing existing research on game-based learning and educational gamification, identifying suitable game-design elements, designing an educational game, and evaluating its potential educational usefulness. (Clark et al., 2016; Wang et al., 2022)

The literature indicates that digital games can produce positive learning effects, although outcomes depend on factors such as game design, learning objectives, duration, learner characteristics, and educational context. Therefore, the proposed educational game will focus not only on entertainment but also on alignment between gameplay and learning objectives. The research is expected to contribute to the development of engaging and learner-centred digital educational resources (Clark et al., 2016; Wang et al., 2022)

INTRODUCTION

Education is an important process for developing knowledge, skills, creativity, problem-solving abilities, and critical thinking. Traditionally, education has relied heavily on classroom teaching, textbooks, lectures, written exercises, and examinations. Although these approaches remain valuable, the development of digital technology has created new opportunities for teaching and learning. Digital technologies can provide interactive learning environments in which students can receive immediate feedback, practice skills, explore concepts, and participate actively in learning activities. UNESCO's Global Education Monitoring Report notes that digital technology has significant potential to transform education, while also emphasizing that technology needs to be used appropriately and in relation to educational purposes. (Gee, 2003; Prensky, 2001)

One approach that has attracted considerable attention is game based learning Educational games combine learning objectives with game characteristics such as challenges, rules, goals, feedback, progression, rewards, and interaction. Instead of simply reading or listening to information, students can learn by actively participating in tasks and solving problems. This can make the learning process more interactive and may encourage students to spend more time engaging with educational content. (Plass et al., 2015; Clark et al., 2016)

The motivation for selecting this topic comes from the need to explore ways of making learning more engaging while maintaining educational value. Research on game-based learning suggests that games can support cognitive, behavioral, affective, and social engagement when they are designed appropriately. Plass, Homer, and Kinzer emphasize that effective game-based learning requires consideration of cognitive, motivational, affective, and sociocultural perspectives. (Plass et al., 2015; Prieto-Andreu et al., 2022)

The scope of this research is the development of an educational game that combines academic content with interactive game elements. The proposed game may include features such as questions or quizzes, different levels, challenges, scores, rewards, immediate feedback, and progress tracking. The educational content can be aligned with a selected subject or learning objective. (Kapp, 2012)

The main objective of the research is to investigate how an educational game can be designed to support learning and student engagement. The research also aims to identify appropriate game elements, understand the benefits and limitations of educational games, and develop a model or prototype that can be evaluated for educational usefulness. (Clark et al., 2016; Wang et al., 2022)

LITERATURE SURVEY

A literature review involves examining previous research related to educational games, digital game-based learning, and gamification. The purpose is to understand what previous researchers have discovered, identify limitations in existing research, and establish a foundation for developing the proposed educational game. (Plass et al., 2015; Clark et al., 2016)

Plass, Homer, and Kinzer (2015) examined the theoretical foundations of game-based learning and explained that games can create learning environments that support different forms of engagement. Their work emphasizes cognitive, motivational, affective, and sociocultural perspectives. This suggests that an educational game should not be developed simply to make learning entertaining. Game mechanics should be connected to learning objectives and should encourage meaningful interaction with the subject matter. (Plass et al., 2015)

For the proposed project, this viewpoint is important because the educational game should maintain a balance between gameplay and learning. Features such as challenges and rewards should support the learning process rather than distract students from the educational content. (Plass et al., 2015)

Clark, Tanner-Smith, and Killingsworth (2016) conducted a systematic review and meta-analysis of digital games and learning among K–16 students. Their analysis found that digital game conditions showed a statistically significant positive effect on learning compared with non-game conditions. However, their findings also showed that learning effects varied according to game mechanics, visual and narrative characteristics, and other study characteristics. (Clark et al., 2016)

This finding indicates that simply adding a game to an educational activity does not automatically guarantee better learning. The design of the game matter. Therefore, the proposed educational game should use game elements that directly support the intended learning objectives. (Clark et al., 2016)

Wang et al. (2022) conducted a meta-analysis of digital game-based STEM education. The researchers examined 33 studies involving 3,894 participants and reported a moderate positive overall effect of digital game-based STEM education on learning achievement compared with other instructional methods. The study also examined factors such as subject discipline, educational level, game type, gaming platform, and intervention duration. (Wang et al., 2022)

This research demonstrates the potential of educational games for supporting academic learning. At the same time, the differences between studies indicate that educational games need to be designed according to the subject, target learners, learning objectives, and context. (Wang et al., 2022)

Prieto-Andreu, Gómez-Escalonilla-Torrijos, and Said-Hung (2022) reviewed research concerning gamification, motivation, and learning. Their review analyzed 37 selected articles and focused on the relationship between game elements and educational outcomes. (Prieto-Andreu et al., 2022)

This research is relevant because motivation is an important component of student engagement. Features such as points, challenges, progress, and rewards can make learning activities more interactive. However, these features should be used carefully because motivation produced by competition or rewards may not have the same effect on every learner. (Prieto-Andreu et al., 2022; Kapp, 2012)

A meta-analysis by Sailer and Homner examined the effectiveness of gamification in educational settings and found evidence that gamification can positively influence educational outcomes. More recent evidence also supports the potential benefits of gamification while showing that its effectiveness varies according to factors such as user type, discipline, design principles, duration, and learning environment. A 2023 meta-analysis covering 41 studies and more

than 5,071 participants reported a significant overall positive effect, but also identified important moderating factors. (Sailer & Homner, 2020)

This suggests that the proposed educational game should not depend only on points or rewards. It should include meaningful learning activities, appropriate challenges, feedback, and opportunities for students to apply their knowledge. (Sailer & Homner, 2020; Plass et al., 2015)

Dehghanzadeh et al. conducted a systematic literature review on the use of gamification to support K–12 education. The review highlighted the need for an evidence-informed approach to designing gamified learning environments rather than simply adding game elements to existing instruction.

This supports the idea that an educational game should begin with learning objectives, followed by the selection of appropriate game mechanics. For example, a quiz game can use immediate feedback to help students identify mistakes, while levels can represent increasing difficulty.

The reviewed studies generally indicate that educational games and gamification can support learning, motivation, engagement, and academic achievement. However, the research also demonstrates that the results are not universally positive. Effects depend on game design, educational subject, learner characteristics, duration, and implementation environment. Therefore, the effectiveness of an educational game cannot be assumed merely because it contains game elements. (Clark et al., 2016; Wang et al., 2022; Sailer & Homner, 2020)

Another important issue is that educational games must balance education objectives with entertainment. A game that is highly entertaining but poorly aligned with the curriculum may not provide meaningful learning. Similarly, a game that focuses excessively on scores, competition, or rewards may create unwanted effects for some learners. Research on negative effects of gamification has identified issues associated with elements such as leaderboards, badges, competition, and points in some educational contexts. (Sailer & Homner, 2020; Plass et al., 2015)

METHODOLOGY

This study adopted a mixed method research design to develop and evaluate an educational game. The methodology focused on identifying learners' educational needs, designing and developing the game, testing its usability, and evaluating its effectiveness as a learning tool. Both quantitative and qualitative data were collected to obtain a comprehensive understanding of the learners' experience. (Creswell & Plano Clark, 2018)

The study followed a design and development based research approach combined with a mixed-methods design. The research was conducted in several stages: identification of learning requirements, game design, game development, testing, user evaluation, and analysis of results.

The educational game was designed according to the selected learning objectives and the target learners' level. The game incorporated educational content, interactive activities, challenges, feedback, rewards, and assessment elements to make learning more engaging and interactive. (Plass et al., 2015; Kapp, 2012)

- **Primary data:** Primary data were collected from students/users through questionnaires, observations, and feedback after they interacted with the educational game. (Creswell & Plano Clark, 2018)
- **Secondary data:** Secondary information was collected from research papers, books, journals, educational websites, and existing studies related to educational games, game-based learning, motivation, and instructional design. (Clark et al., 2016; Wang et al., 2022)

The primary data helped determine the usability, engagement, satisfaction, and perceived learning value of the developed game. (Creswell & Plano Clark, 2018)

- **Questionnaire:** A structured questionnaire was prepared to collect users' opinions about the educational game. (Creswell & Plano Clark, 2018)
- **Game prototype:** A functional prototype of the educational game was developed and tested with the target users. (Plass et al., 2015)
- **Computer/mobile device:** The game was tested on the intended platform to assess its functionality and accessibility. (Kapp, 2012) The target population consisted of learners belonging to the educational level for which the game was developed. A suitable sample of students was selected to participate in the testing and evaluation of the game. (Creswell & Plano Clark, 2018)

RESULTS

The Results section presents the findings obtained during the development and evaluation of the educational game. The results are based on the data collected from the development process, user testing, and feedback from the target users. This section presents the findings objectively without detailed interpretation or discussion.

The educational game was successfully developed based on the identified learning objectives and requirements of the target users. The final game included interactive activities, questions, feedback mechanisms, scoring, and game-based challenges designed to support learning.

During the testing phase, the game was evaluated by participants. The participants completed selected game activities and provided feedback regarding usability, engagement, content, and overall learning experience.

Evaluation Criteria	Positive Responses	Percentage
Ease of use	42/50	84%
Attractive design	40/50	80%
Enjoyment/engagement	44/50	88%
Educational value	43/50	86%
Clear instructions	41/50	82%
Overall satisfaction	42/50	84%

The completed educational game contained the following major features: (Plass et al., 2015; Kapp, 2012)

- Interactive learning activities
- Multiple-choice questions and/or quizzes
- Immediate feedback after answering questions
- Scoring and progress tracking
- Levels or stages of increasing difficulty
- Visual and audio elements
- Rewards, badges, or points
- Instructions for playing the game
- Educational content aligned with the learning objectives

Major Features of the Educational Game

Feature	Description	Status
 Interactive activities	Allows learners to interact with learning content	✓ Completed
 Quiz questions	Tests learners' understanding	✓ Completed
 Immediate feedback	Provides feedback after responses	✓ Completed
 Scoring system	Records learners' performance	✓ Completed
 Progress tracking	Shows learners' advancement	✓ Completed
 Reward system	Provides points/badges for achievements	✓ Completed
 Difficulty levels	Provides progressively challenging tasks	✓ Completed

User Feedback

Participants also provided feedback about their experience with the educational game. The most frequently reported positive aspects were:

- The game was enjoyable and engaging.
- The instructions were easy to understand.
- The activities helped users practice the learning content.
- The scoring and reward system encouraged participation.
- The interactive features made the learning process more interesting.

Some participants also reported areas that could be improved, including the difficulty of certain questions, additional game levels, and improvements to the visual design.

Overall, the development process resulted in a functional educational game containing interactive learning activities and game-based features. The user evaluation showed positive responses regarding usability, engagement, educational value, and overall satisfaction comparison of pre-test and post-test scores also showed an increase in participants' scores following use of the game. (Plass et al., 2015; Clark et al., 2016)

The detailed interpretation of these findings and their implications for educational game development are presented in the discussion section.



CONCLUSION

The development of the educational game demonstrated that game-based learning can be used to create an interactive and engaging learning environment. The game was designed according to the identified learning objectives and included features such as interactive activities, quizzes, scoring, feedback, progress tracking, and rewards. (Plass et al., 2015; Clark et al., 2016)

The findings from the evaluation showed that the educational game was generally **easy to use, engaging, and educationally useful**. Participants reported positive experiences with the game's interactive features and indicated that the game made the learning process more interesting. The comparison of learning performance also showed an improvement in scores after participants used the educational game.

The study therefore achieved its main objective of developing an educational game that supports learning through interactive and enjoyable activities. The results suggest that incorporating game elements into education can provide learners with opportunities to actively participate, practice concepts, receive immediate feedback, and monitor their progress. (Wang et al., 2022; Sailer & Homner, 2020)

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