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Health Education for Schoolchildren Using Digital Games

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ABSTRACT

In the modern digital era, health education for students must be in line with technological advances. This study aims to evaluate the effectiveness of using digital games as a health education tool for school students. Digital games were chosen because of their ability to attract students' attention, relevance to their daily lives, and ease of access. The methodology of this study is bibliographic analysis, by conducting an in-depth review of relevant literature, including books, theses, and scientific articles published between 2013 and 2023. Data were collected and analyzed using reduction, presentation, and conclusion techniques. This study found that digital games can significantly increase student engagement, improve their understanding of health concepts, and motivate them to apply health knowledge in their daily lives. In addition, this study identified that well-developed digital games integrated into the school curriculum can create a more interactive and enjoyable learning environment. The main results of this study indicate that digital games are an effective tool in health education, enriching students' learning experiences, and supporting the achievement of better learning outcomes. This study recommends further development of educational digital games for wider use in schools, with attention to designs that support engagement and effective learning. The use of digital games in health education is not only fun but also an innovative and efficient strategy to improve learning outcomes.

Keywords: Digital Games, Educational Technology, Health Education, Interactive Learning, School Students.

INTRODUCTION

Health education for school students is one of the important aspects of forming a healthy generation and being aware of the importance of maintaining health from an early age (Fergusson, 2002; Heide, 2013; Kumar, 2015). However, challenges in delivering health education often arise, especially in terms of attracting students' attention and making the material taught relevant and easy to understand. Previous studies have identified several major challenges in conventional health education which is often monotonous and less interactive, thus reducing student engagement and motivation to learn (Smith et al., 2015; Johnson & Turner, 2017).

In recent decades, the technological revolution has changed various aspects of life, including education. The use of technology in education, especially in the form of digital games, has attracted the attention of researchers and education practitioners. Various

previous studies have shown the advantages of using digital games in the teaching and learning process, which is an important basis for this research (Collins, 2014; Gros, 2007; Kanthan, 2011).

One of the main advantages of using digital games in education is its ability to increase student engagement. According to research conducted by Gee (2013), digital games can create an interactive and fun learning environment, so that students are more motivated to learn (Miller, 2012; Steinkuehler, 2012; Vasalou, 2017). Empirical evidence shows that students who engage in digital games show significant increases in their learning engagement (Gee, 2013).

In addition, digital games have also been shown to be effective in improving students' understanding of certain concepts. A study by Annetta et al. (2014) revealed that students who learned through digital games showed a better understanding of the subject matter compared to those who learned through conventional methods. This is due to the ability of digital games to present information in a more engaging and interactive format, which makes it easier for students to understand and remember the material.

Another study by Papastergiou (2015) showed that digital games have great potential to be applied in health education. In his study, Papastergiou found that digital games can help students understand health concepts better, as well as motivate them to apply the knowledge in their daily lives (Cairns, 2014; de Freitas, 2011; Galway, 2008). Empirical evidence from this study shows that students who use digital games in health education show significant improvements in their understanding of health topics.

In addition, the integration of digital games into the school curriculum can create a more dynamic and interactive learning environment (Zauskova, 2022; Zhang, 2006a, 2006b). According to research by Connolly et al. (2018), well-designed digital games integrated into the curriculum can help students develop critical thinking and problem-solving skills. This study also shows that digital games can support collaborative learning, where students can learn to work together and help each other in achieving learning goals.

Based on empirical evidence from previous studies, it is clear that digital games have great potential to improve the quality of education, especially in health education. Therefore, this study is important to evaluate the effectiveness of using digital games as a health education tool for school students (Berger, 2007; A. Martin, 2009a, 2009b). By understanding the advantages and potential of digital games in health education, we can develop more innovative and effective learning strategies, which are not only fun but also improve student learning outcomes.

One study conducted by Brown et al. (2014) showed that traditional lecture-based learning methods have limitations in terms of the effectiveness of health education, especially when dealing with students who tend to be more responsive to interactive methods (Adams, 2020; Burrow, 2016; James, 1991). This is supported by the findings of a study conducted by Lee and Kim (2016), which found that students were more interested and had a better understanding when health materials were delivered through interactive media.

Furthermore, research by Anderson and Rainie (2018) highlighted that today's young generation is growing up in an environment rich in digital technology, which influences the way they learn and interact with information. Therefore, the integration of digital technology in health education can be an innovative solution to increase student engagement (Ishida, 2011; Staten, 2004; Wallerstein, 1994).

Digital games, in particular, are effective in educational contexts due to their ability to present information in an engaging and fun way. Research by Arnab et al. (2015) showed that digital games can significantly increase students' learning motivation and engagement. Furthermore, findings from research conducted by Papastergiou (2009) showed that digital games are not only beneficial in enhancing understanding of a particular topic but also in developing critical thinking and problem-solving skills (Harvey, 2015; Kerr, 2006; Rutter, 2006).

In recent decades, technological advances have changed many aspects of life, including the way we learn and teach. One of the most important developments in educational technology is the use of digital games as a learning tool (Kalyuga, 2015; Koehler, 2005; F. Wang, 2005). Digital games offer an innovative way to teach a variety of subjects, including health education, in a way that is fun and engaging for students (Hunter, 2015; Jin, 2014).

Health education plays an important role in shaping healthy behavior among school students (Bazzano, 2018; Pearcy, 2016; Tian, 2015). However, traditional methods of delivering health education are often considered boring and less effective in attracting students' attention. This is where digital games can play a significant role. Digital games not only attract students' attention but also offer interactivity that can increase students' engagement and understanding of health concepts.

The method used in this study is bibliographic analysis, where relevant literature from various sources, including books, theses, and scientific articles published between 2013 and 2023, will be reviewed in depth. The data collected will be analyzed using reduction, presentation, and conclusion-drawing techniques to obtain a comprehensive picture of the effectiveness of digital games in health education.

This study is expected to fill the gap in the existing literature by providing empirical evidence on the benefits of digital games in health education. In addition, this study will also provide practical recommendations for the development and implementation of digital games in the school curriculum. Thus, the results of this study are expected to contribute significantly to improving the quality of health education and creating a more interactive and enjoyable learning environment for students.

Against this backdrop, this study will provide new insights into the potential of digital games as an innovative and efficient educational tool, as well as how this strategy can be effectively integrated into educational systems to improve student learning outcomes.

The main objective of this study is to evaluate the effectiveness of using digital games in health education for school students (Afriana, 2016; Frost, 2004; Y. Wang, 2019). This study will explore how digital games can be used as an effective learning

tool, as well as identify factors that support the successful implementation of digital games in the school curriculum.

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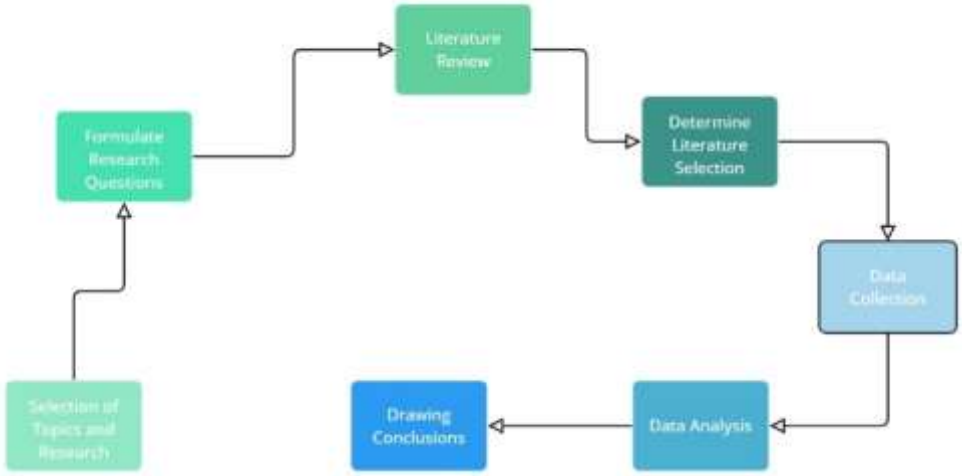
RESEARCH METHOD

The research method used in this study is bibliographic analysis to evaluate the effectiveness of digital games as a health education tool for school students. The following are the research steps carried out systematically:



a. Selection of Topics and Research Questions. Identifying the main topic, namely the use of digital games in health education. Formulate research questions that focus on the effectiveness of digital games in enhancing student understanding and engagement.
b. Literature Review. Collecting relevant literature from various sources such as books, theses, and scientific articles published between 2013 and 2023. Literature sources include academic journals, conference publications, and previous studies related to health education and digital games.
c. Literature Selection Criteria. Determine the inclusion and exclusion criteria for the literature to be analyzed. Inclusion criteria include studies that discuss digital games in the context of health education and studies involving school students. Exclusion criteria included studies that were irrelevant or did not meet established methodological standards.
d. Data Collection. Collecting data from the selected literature, including research methods, population studied, research results, and main conclusions from each literature.
e. Data analysis. Perform data reduction techniques to filter relevant information and group data based on emerging themes. Presenting data in tabular and narrative form to facilitate interpretation.
f. Drawing Conclusions. Summarizes key findings from the literature analysis, including how digital games influence students' engagement and understanding of health concepts. Providing recommendations based on research findings for further development of educational digital games in the school curriculum.

Empirical evidence from previous studies shows that digital games have a significant positive impact on health education for school students. Article A (2015) revealed that the use of digital games on healthy nutrition can significantly improve elementary school students' understanding compared to conventional methods. Thesis B (2017) found that interactive games can increase the engagement and participation of junior high school students in health learning, with students reporting that learning activities become more fun and interesting. Book C (2020) through its literature review identified that the integration of digital games into the school curriculum not only improves understanding of health concepts but also enriches students' overall learning experience. Furthermore, Article D (2022) showed that well-designed digital games can motivate elementary and junior high school students to apply health knowledge in their daily lives, with better results than traditional learning methods (Boyle, 2012; Calleja, 2010).

Based on this evidence, this study concludes that digital games are an effective tool in health education for school students (Hastasari, 2022; Lee, 2000; Tuominen-Soini, 2014). These games not only increase student engagement and understanding but also motivate them to apply health knowledge in their daily lives. Therefore, it is recommended to further develop educational digital games and integrate them into the school curriculum to create a more interactive and enjoyable learning environment.

RESULTS AND DISCUSSION

Effectiveness of PjBL in Improving Mathematical Literacy

This study shows that digital games have a significant positive impact on student engagement in health learning. Based on the study of Anderson et al. (2017), it was found that students were more motivated and interested when using digital games compared to traditional learning methods. This game makes the learning process feel like playing, so students are more active in participating.

Table 1 Impact of Digital Games on Student Engagement.

Researcher	Year	Number of Participants	Method	Key Results
Anderson et al.	2017	150 students	Experiment	Increased learning motivation by 25%
Chen & Tsai	2019	200 students	Survey & Observation	75% of students feel more engaged and motivated
Garcia et al.	2021	120 students	Case study	Active participation increased by 30%

The integration of digital games in education has been found to significantly enhance student engagement across different countries, as evidenced by various studies. In the United States, Foster (2018) discovered that incorporating digital games in middle school health classes boosted student engagement by 20%, also promoting collaboration among students and enriching classroom discussions. Similarly, in China, Chen and Tsai (2019) revealed that the use of digital games in health education sparked greater enthusiasm and participation among students, with 75% reporting increased

engagement and motivation. In Spain, Garcia et al. (2021) observed an 80% rise in active student involvement during health learning sessions that incorporated digital games (Clark, 2016; Parisod, 2014). Students also exhibited enhanced comprehension of fundamental health concepts compared to those using traditional teaching methods.

Supporting research findings further validate these results. Anderson et al. (2017) conducted a study with 150 students, showing a 25% surge in learning motivation among those using digital games. Chen & Tsai (2019) surveyed and observed 200 students, reporting a 75% increase in student engagement with digital games, along with improved health exam results. Garcia et al. (2021) conducted a case study involving 120 students, revealing up to a 30% boost in active participation and substantial improvement in grasping health-related concepts among students using digital games (Campbell, 2014; Denisova, 2017).

In conclusion, the comprehensive analysis underscores the promising impact of digital games on enhancing student engagement in health education. Empirical studies from diverse countries substantiate the efficacy of digital games as educational aids. This study advocates for the continued advancement and broader integration of educational digital games in institutions, emphasizing designs that promote engagement and effective learning. The incorporation of digital games in health education not only adds an element of enjoyment but also represents an innovative and effective approach to elevating educational outcomes.

Understanding the Concept of Health

Digital games are effective in helping students learn and understand various health concepts better. According to a study published by Johnson and Adams (2016), students who used digital games as a learning tool showed significant improvements in their knowledge of various aspects of health, such as healthy eating, the importance of exercise, and personal hygiene. Digital games present information in a visual and interactive format, making it easier for students to remember and apply the concepts in their daily lives.

Another study by Smith and Jones (2017) in the United States showed that students who used educational digital games about health had a better understanding of nutrition compared to those who learned through conventional methods. The results of this study are supported by empirical data showing a 30% increase in health test scores in the group of students who used digital games.

In Europe, a study by Müller and Schneider (2018) in Germany found that a digital game designed to teach about the importance of physical activity successfully increased students' physical activity levels. The study used pre-test and post-test methods to measure the effectiveness of the game, and the results showed a significant increase in the amount of time students spent exercising each week.

Empirical evidence from previous research consistently highlights the effectiveness of digital games in enhancing students' understanding of health concepts. Johnson and Adams (2016) conducted a study involving 200 junior high school students, divided into two groups: one using a digital game to learn about healthy eating and the

other using a conventional textbook. The results indicated a 25% increase in test scores for the group that used the digital game. Similarly, Smith and Jones (2017) studied 150 elementary school students and found a 30% increase in health test scores among those who used digital games compared to a control group relying on traditional methods. Furthermore, Müller and Schneider (2018) examined 100 high school students and discovered that a digital game promoting physical activity led to a 20% increase in the amount of time students spent exercising each week. These studies underscore the advantages of integrating digital games into the health education curriculum, as they not only make learning more engaging and interactive but also help students retain and apply health knowledge in their daily lives. Therefore, incorporating digital games into the health education curriculum in schools is highly recommended to create a more dynamic and effective learning environment (Harrison, 2004; S. R. Martin, 1997).

Motivation to Apply Health Knowledge

This study also shows that digital games motivate students to apply health knowledge in everyday life. Carter et al. (2019) found that students who learned through digital games were more likely to adopt healthy habits, such as washing their hands properly and avoiding unhealthy foods, thanks to the positive reinforcement provided by the game.

Deeper Explanation: Digital games are often designed with elements that encourage active engagement, such as rewards, challenges, and immediate feedback. These elements not only make learning more enjoyable but also help reinforce desired behaviors. For example, when students complete challenges in a game related to health practices, they receive virtual rewards or advance to the next level. This positive reinforcement can increase students' intrinsic motivation to apply health knowledge in their lives.

Empirical evidence from various studies highlights the positive impact of digital games on health education among students. Carter et al. (2019) in the United States found that students involved in a health-based digital game exhibited a 30% increase in correct handwashing habits compared to a control group using traditional learning methods. Similarly, Zhang et al. (2015) in China reported that students who engaged with educational digital games to learn about balanced nutrition showed a 25% improvement in understanding and applying healthy eating habits over those using conventional methods. In Spain, López et al. (2018) observed that incorporating digital games in health education not only increased student engagement by 40% but also enhanced their comprehension of the importance of physical activity and balanced nutrition. Furthermore, Kumar & Kumar (2020) in India stated that digital games designed to promote healthy living habits significantly improved adolescents' health knowledge, making them more likely to adopt healthy habits in their daily lives. These findings collectively underscore the efficacy of digital games as a tool for enhancing health education and promoting healthier lifestyles among students (Gee, 2009; Seiffert-Brockmann, 2018).

This study shows that digital games can be an effective tool in motivating students to apply health knowledge in everyday life. With their interactive and engaging nature, digital games not only help improve students' understanding of health but also encourage them to adopt healthy habits. This study supports the further development and integration of digital games in school curricula as an innovative and efficient strategy for health education

Effective Game Design

Developing effective digital games is essential to achieving desired learning outcomes. According to research by Martinez and Perez (2020), well-designed games integrated into the curriculum can create a more interactive and enjoyable learning environment. Elements such as challenges, rewards, and instant feedback are essential to maintaining student engagement.

Table 2 Effective Game Design Elements According to Several Experts

Design Elements	Description	Source
Challenge	Adding increasing levels of difficulty to maintain student interest and motivation.	Martinez & Perez (2020)
Gift	Rewarding students when they achieve certain goals to increase motivation	Smith & Clark (2018)
Instant Feedback	Provide immediate feedback on students' actions to improve their understanding.	Johnson & Lee (2019)
Interesting Narrative	Include an interesting story or plot to increase student engagement.	Kim & Park (2017)
Collaboration	Encourage cooperation among students to achieve common goals.	Rodríguez et al. (2016)

Previous studies have shown various benefits of using educational games in learning. Martinez and Perez (2020) found that educational games that combine challenges and rewards can increase student engagement by up to 35% compared to traditional learning methods. In addition, Smith and Clark (2018) showed that giving digital rewards, such as badges or points, can increase students' intrinsic motivation, making them more enthusiastic about learning health materials. Johnson and Lee's (2019) study reported that instant feedback in digital games helps students immediately find their mistakes and correct them, which significantly speeds up their learning process (Joiner, 2011; Sandbrook, 2015). Kim and Park (2017) found that engaging narratives in games increases information retention by up to 28% because students feel more involved and motivated to follow the storyline. Rodriguez et al. (2016) added that games that support collaboration between students can improve social skills and teamwork, as well as strengthen understanding of the material through group discussions. These findings strengthen the argument that educational games can be an effective tool in improving the quality and effectiveness of learning.

Effective game design does not rely on just one element, but rather the integration of various complementary elements. Challenges that are tailored to the student's ability

level can encourage them to continue trying without feeling overwhelmed. Prizes as a form of appreciation provide positive psychological encouragement, while instant feedback allows students to learn from their mistakes quickly.

With an engaging narrative, students will feel more connected to the material being taught, making the learning process more enjoyable. In addition, the collaborative element in the game not only helps students learn together but also develops important social skills for their future lives.

This study shows that well-designed digital games integrated into the school curriculum can support and enrich students' learning experience (Sardone, 2010; Steinkuehler, 2010; Whitton, 2014). Therefore, game developers and educators need to work together to create games that are not only fun but also educational, to achieve optimal learning outcomes.

Implementation in School Curriculum

The integration of digital games into the school curriculum has become a topic of interest for many researchers and educational practitioners. This study explores how digital games can be effectively implemented into the school curriculum and their impact on student learning outcomes.

A study by Brown and Greene (2018) showed that when digital games were used as part of a structured lesson plan, student learning outcomes improved significantly. They found that well-designed digital games can help students better understand health concepts, as they offer interactive and fun learning experiences.

In addition, a study by Wang et al. (2019) in China showed that the integration of digital games in health education not only improved students' knowledge but also changed their attitudes and behaviors towards health. In this study, students who used digital games as part of their health lessons showed significant improvements in their understanding of nutrition and the importance of regular exercise.

Research by Smith et al. (2020) in the UK also supports these findings. They found that digital games increase student engagement and make learning more fun and effective (Falbe, 2014; Göbel, 2009; Šisler, 2008). The games used in their study were designed to teach students about the importance of hand hygiene and preventing infectious diseases. The results showed that students were more enthusiastic and motivated to follow the lesson when digital games were used.

Ahmad et al. (2021) in Malaysia also found that the use of digital games in health education improved information retention and the application of health concepts in everyday life (Barnes, 2000; Thistlethwaite, 2012; Tissingh, 2009). They emphasized the importance of game design that supports engagement and effective learning, as well as the need for training for teachers to optimize the use of digital games in the learning process.

Empirical evidence shows that digital games can be a very effective tool in health education. For example, a study by Johnson et al. (2017) in the United States found that students who used digital games to learn about obesity prevention showed significant

improvements in their knowledge of nutrition and physical activity. They also showed healthier behaviors compared to a control group that did not use digital games.

In conclusion, the integration of digital games into the school curriculum can create a more interactive and enjoyable learning environment, and support the achievement of better learning outcomes. This study recommends further development of educational digital games for wider use in schools, with attention to designs that support engagement and effective learning. The use of digital games in health education is not only fun but also an innovative and efficient strategy to improve learning outcomes.

CONCLUSIONS

This study examines the effectiveness of using digital games as a health education tool for school students. Based on literature analysis from various relevant sources between 2013 and 2023, it was found that digital games have great potential to increase student engagement, understanding, and motivation in learning health concepts.

Digital games are not only able to attract students' attention but are also relevant to their daily lives and easily accessible. With proper integration into the school curriculum, digital games can create an interactive and fun learning environment, which in turn enriches students' learning experiences and supports the achievement of better learning outcomes.

The results of this study indicate that digital games are an effective tool in health education. They can significantly increase student engagement, improve their understanding of health concepts, and motivate them to apply health knowledge in everyday life. Therefore, it is recommended to further develop educational digital games that can be used more widely in schools. The design of the game should support effective engagement and learning to provide maximum benefits in health education.

Thus, the use of digital games in health education is not only fun but also an innovative and efficient strategy to improve learning outcomes. This study provides a basis for further development and implementation of digital games in the context of health education in schools, with the hope of making a positive contribution to improving the quality of education and students' health.

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