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The Influence of Pro Evolution Soccer Digital game-based learning on Understanding Soccer Rules among Tenth Grade Students

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ABSTRACT

The purpose of the study. This research endeavors to examine the influence of Pro Evolution Soccer on the understanding of Soccer regulations among tenth-grade students at SMA Dharma Pancasila Medan.

Materials and methods. The employed research methodology is experimental, utilizing a pretest-posttest framework devoid of a control group. The participant cohort includes 36 students, consisting of 17 males and 19 females. Data collection involved assessments of Soccer rule comprehension pre- and post-intervention, facilitated by the Pro Evolution Soccer game.

Results. Data analysis indicated a substantial effect on comprehension of Soccer rules following the educational intervention utilizing the Pro Evolution Soccer game. This is supported by paired t-test findings, demonstrating that the posttest mean score (74.792) notably exceeds the pretest mean score (60.347), yielding an average difference of 14.44 and a significance level ($p < 0.05$).

Conclusions. The study concludes that Pro Evolution Soccer effectively enhances students' comprehension of Soccer rules. Incorporating video clips into the learning approach further enriches students' understanding. The research advocates for the broader implementation of such innovative educational methods in physical education and sports to enhance learning quality and student motivation.

Keywords: game-based learning; pro evolution soccer; understanding Soccer rules; high school students; physical education.

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INTRODUCTION

Schools integrate instruction, education, and training to instill positive characteristics in students. These aspects must be implemented continuously, coordinated, and aligned with current student developments. Physical Education, Sports, and Health (PESH) are integral components of the educational curriculum from elementary to tertiary levels(Siregar et al., 2022). The primary goal of physical education is to develop students' cognitive, affective, and psychomotor skills, as well as foster positive attitudes such as sportsmanship, integrity, discipline, responsibility, cooperation, confidence, and democratic values(Lavenia & Edwarsyah, 2020; Tarigan et al., 2023). Within the PESH curriculum, major ball games include basketball, volleyball, and soccer. Student competency standards require them to engage in exercises across various sports branches according to specified procedures and quality standards. Fundamental skills emphasize that students must master and understand direct playing skills in one major ball game, namely soccer(Duncan et al., 2022). Soccer is a team sport that necessitates cooperation among team members. Success in soccer is identified through the application of simple gameplay characteristics, where mastering basic skills is key to success(Dolci et al., 2018; Alficandra et al., 2022).

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Soccer enjoys immense popularity worldwide, including in Indonesia. To fully experience soccer, understanding the rules of the game is crucial. This understanding enhances not only enjoyment in watching but also potentially shapes players' character and discipline(Wang & Callahan, 2003). However, a lack of understanding of soccer rules often hinders achieving educational goals among participants. Conventional teaching methods are frequently dull and fail to provide deep understanding due to limited teaching media used by educators(Siregar et al., 2023). Mastering the fundamental technical skills and understanding the rules of the game are essential for players to excel on the field(Li et al., 2022; Fikri et al., 2024). One emerging approach to teaching soccer skills and knowledge is through the use of video games, particularly Pro Evolution Soccer(Gyaurov et al., 2022). The influence of game-based learning using Pro Evolution Soccer on improving students' understanding of socce r rules is an area that warrants further investigation(Wiering et al., 2001; Ward et al., 2017). This study aims to explore the potential benefits of incorporating Pro Evolution Soccer into the learning process for tenth-grade students, with a focus on enhancing their comprehension of the game's rules. Researchers have long recognized the value of leveraging video game design principles to develop educational games that can foster student engagement and learning(Kucher, 2021).

Previous research has broadly demonstrated that game-based learning, with its emphasis on interactive experiences, goal-oriented tasks, and contextual relevance, can be a highly effective approach for enhancing student understanding and academic achievement across a range of subjects, including sports-related disciplines(Shipherd & Burt, 2018; Thompson & Gillern, 2020). A meaningful body of research has shown that the engaging and immersive nature of educational games can foster deeper engagement, motivate learners, and lead to improved comprehension and retention of key concepts, making game-based learning a valuable tool for enhancing student learning outcomes in sports-related topics(Iacovides et al., 2011; Sousa et al., 2023). Additionally, research has highlighted the importance of mastering fundamental soccer techniques, such as ball control, dribbling, kicking, and heading, as a prerequisite for players to perform well on the field. Given the potential benefits of game-based learning and the significance of understanding soccer rules, this study aims to investigate the influence of Pro Evolution Soccer on improving tenth-grade students' knowledge of football rules. In the process of PESH education, particularly in soccer, audiovisual media can be utilized. The effectiveness of using audiovisual media has been supported by Edgar Dale's cone of experience theory(The Cone of Experience, 2017). Dale's classification in the cone of experience theory serves as a guide for utilizing audiovisual media. Audiovisual media is deemed effective because movements in models or videos remain consistent and can achieve 100% accuracy in repeated demonstrations(Effective Learning Retention Rate Research Fact, 1985).

The use of games in educational contexts has significant potential benefits. Thus, integrating games into education requires an understanding of their positive potential in supporting learning and skill development. Games initially served as entertainment platforms for leisure time but have evolved into activities widely popular among youth. While some play games to relax, others participate seriously or in competitions. This phenomenon has given rise to "Electronic Sports" or "e-Sports"(Zayeni et al., 2020). In the e-sports industry, there are several sports-themed games such as soccer, including PES (E-football) and FIFA, as well as basketball, such as NBA2K. PES (Pro Evolution Soccer) is a virtual soccer game developed and released by Konami Computer Entertainment Tokyo, with assistance from the Blue Sky production team(Smithies et al., 2020; Jenny et al., 2018). New versions of this game are regularly released annually(Pro Evolution Soccer 2013, 2023). PES is renowned as one of the most popular games globally (Full Form of PES, 2024). It offers an engaging and nearly realistic virtual soccer experience, allowing players to control the game as if they were participating in a real match.

At SMA Dharma Pancasila Medan, there are X-grade students who are active young generations with a strong interest in sports, particularly soccer. Additionally, SMA Dharma Pancasila has a soccer field frequently used for inter-school soccer match preparations. However, observations indicate that their understanding of soccer regulations is still suboptimal. Based on the above explanation regarding observations conducted at SMA Dharma Pancasila Medan, specifically among X-grade students, the author identified an issue where students' understanding of soccer regulations is not optimal. Therefore, the author was motivated to conduct research titled "The Impact of Pro Evolution Soccer Learning on Understanding Soccer Regulations Among X-grade Students at SMA Dharma Pancasila Medan," aiming to demonstrate the influence of PES learning on soccer regulation comprehension.

This research aims to determine the impact of using PES game-based learning on understanding soccer regulations among X-grade students at SMA Dharma Pancasila Medan. The lack of understanding of soccer rules among students hampers achieving educational objectives. Integrating PES game in the learning process is expected to significantly enhance students' understanding, making learning more engaging, interactive, and effective. This study employs a quasi-experimental method with a pretest-posttest design. The sample consists of 36 X-grade students who will receive PES game-based learning. Data will be collected through comprehension tests before and after the learning sessions. This research is expected to demonstrate that the use of PES game in education can enhance students' understanding of soccer regulations, contributing to innovative teaching methods in physical education.

MATERIALS AND METHODS

Study Participants

The study involved 36 tenth-grade students at SMA Dharma Pancasila Medan, Indonesia, with a nearly balanced gender distribution of 17 males (47.2%) and 19 females (52.8%). As in the following table 1:

Table 1. Participant Demographics and Background Information

Category	Details
Total Participants	36 students
Gender Distribution	• Males: 17 (47.2%)• Females: 19 (52.8%)
Grade Level	10th grade (X-grade)

Age Range		15-16 years old
School		SMA Dharma Pancasila Medan, Indonesia
Score Range	**Number of Students**	**Percentage**
40-50	8	22%
51-60	13	36%
61-70	9	25%
71-80	3	8%
81-90	2	6%
91-100	1	3%
Score Statistics		
Measure		**Value**
Highest Score		95
Lowest Score		40
Mean Score		60.35
Median		57.5
Mode		55
Standard Deviation		12.37

The study focused on tenth-grade students at SMA Dharma Pancasila Medan, with specific inclusion and exclusion criteria guiding participant selection. Participants were required to be enrolled in Grade X, with both male and female students eligible for inclusion. The sample encompassed students within the typical age range for tenth grade, drawn from three class sections totaling 102 students. To be included, students needed to actively participate in both the pre-test and post-test assessments and be present throughout the Pro Evolution Soccer game-based learning intervention. Exclusion criteria comprised students not enrolled in the specified grade, those who missed either the pre-test or post-test, and students absent during the primary learning intervention.

The investigation into digital game-based learning has garnered thorough ethical clearance from the Institutional Review Board of SMA Dharma Pancasila Medan, Indonesia, signifying a robust adherence to ethical research principles, as denoted by Reference Number: UNIMED-REC/IRB/2024/01187. Informed consent was meticulously acquired from all 36 student participants, with explicit consent secured from parents or guardians for underage individuals. The ethical framework underscored the paramount importance of participant welfare, ensuring absolute anonymity through the utilization of distinct coded identifiers and the implementation of rigorous data confidentiality measures. Participants were unequivocally apprised of their inherent right to withdraw from the research at any moment without facing repercussions, thereby highlighting the voluntary nature of the research engagement.

Study Organization

This study employs a quasi-experimental method with a pretest-posttest design. The sample consists of 36 X-grade students who will receive learning using the PES game. Data will be collected through comprehension tests administered before (pretest) and after (posttest) the learning sessions. The instruction provided involves using the PES game for learning, which is structured accordingly, supplemented with video lessons on the discussed topics, compiled from footage that is integrated into a cohesive video unit to stimulate students' curiosity about the researched topic by the researcher. The form of intervention and implementation in this study can be seen in the following table:

Table 2. Intervention Implementation Tables

Program Overview				
Component	**Details**			
Total Duration	8 weeks			
Session Frequency	2 sessions per week			
Session Length	60 minutes			
Total Sessions	16 sessions			
Primary Location	School Computer Laboratory			
Secondary Location	Soccer Field			
Participant Group Size	36 students (17 males, 19 females)			
Weekly Session Breakdown				
Week 1-2: Introduction and Basic Rules				
Session	**Topic**	**Activities**	**Materials**	**Duration**
1	PES Interface Introduction	• Game controls tutorial• Basic navigation• Practice exercises	• PES game• Tutorial handouts• Practice worksheets	60 min
2	Basic Soccer Rules	• Rule demonstration in PES• Interactive practice• Q&A session	• PES game• Rule handbook• Quiz materials	60 min
3	Video Analysis	• Match footage review• PES scenario recreation• Group discussion	• Video clips• PES game• Discussion guides	60 min
4	Practice Application	• Rule application exercises• Mini-games• Assessment	• PES game• Assessment sheets • Feedback forms	60 min
Week 3-4: Advanced Rules and Gameplay				
Session	**Topic**	**Activities**	**Materials**	**Duration**
5	Offside Rules	• Offside scenarios in PES• Interactive examples• Practice exercises	• PES game• Scenario cards• Visual aids	60 min

6	Fouls and Advantages	• Foul recognition• Advantage rule practice• Group activities	• PES game• Rule charts• Practice sheets	60 min
7	Set Pieces	• Free kicks• Corner kicks• Penalty situations	• PES game• Drill guides• Assessment tools	60 min
8	Tournament Practice	• Mini-tournament• Rule application• Feedback session	• PES game• Tournament brackets• Evaluation forms	60 min
Week 5-6: Complex Scenarios				
Session	**Topic**	**Activities**	**Materials**	**Duration**
9	Referee Decisions	• Decision-making scenarios• Group analysis• Practice exercises	• PES game• Scenario cards• Evaluation sheets	60 min
10	Advanced Tactics	• Tactical situations• Rule implications• Practice games	• PES game• Strategy guides• Assessment tools	60 min
11	Match Analysis	• Full match review• Rule identification• Group discussion	• PES game• Analysis sheets• Discussion guides	60 min
12	Mini-Tournament	• Competitive games• Rule application• Performance review	• PES game Tournament sheets• Feedback forms	60 min
Week 7-8: Integration and Application				
Session	**Topic**	**Activities**	**Materials**	**Duration**
13	Real vs Virtual	• Match comparison• Scenario practice• Analysis exercises	• PES game• Match footage• Comparison sheets	60 min
14	Rule Review	• Comprehensive review• Practice scenarios• Q&A session	• PES game• Review materials• Question bank	60 min
15	Tournament Prep	• Final practice• Rule reinforcement• Strategy session	• PES game• Practice guides• Strategy sheets	60 min
16	Final Assessment	• Tournament play• Rule evaluation• Final feedback	• PES game• Assessment tools• Feedback forms	60 min
Implementation Team Responsibilities				
Role	**Responsibility**		**Qualifications**	**Time Commitment**
Lead Instructor (PE Teacher)	• Overall program supervision• Rule instruction• Assessment administration• Progress monitoring		• Licensed PE teacher• Soccer expertise• Teaching experience	16 sessions + prep time
Technical Assistant	• PES game setup• Technical support• Equipment maintenance• Software updates		• IT background• Gaming experience• Technical support skills	16 sessions + setup time
Principal Investigator	• Research oversight• Quality control• Data analysis• Report preparation		• PhD in related field• Research experience• Project management skills	Oversight + analysis time
Research Assistants (2)	• Data collection• Session support• Documentation• Student assistance		• Research background• Data collection experience• Documentation skills	16 sessions + admin time
Resource Requirements				
Category	**Items**		**Quantity**	**Notes**
Hardware	• Gaming computers• Projector• Screens• Controllers		• 18 computers• 1 projector• 2 screens• 36 controllers	One computer per 2 students
Software	• PES game licenses• Recording software• Analysis tools		• 18 licenses• 1 recording suite• Analysis package	Updated versions required
Materials	• Handouts• Assessment sheets• Feedback forms		• 36 sets each• Weekly supplies• Documentation	Regular replenishment
Facilities	• Computer lab• Soccer field• Classroom		• 1 lab• 1 field• 1 room	Scheduled access needed

Statistical Analysis

The data analysis technique utilized in this study is the Paired Sample T-test. Prior to conducting the paired T-test, the study will perform prerequisite tests such as normality tests to verify the normal distribution of data, and homogeneity tests to ensure comparable variances between the groups or conditions being compared. Normality will be assessed using Kolmogorov-Smirnov and Shapiro-Wilk tests in SPSS 27. If the p-value exceeds 0.05, the data is considered normally distributed; however, if the p-value is less than 0.05, the data is considered non-normal. Homogeneity will be tested using an F-test between the Pre-test and Post-test data in SPSS 27. The homogeneity test will employ Levene's test, where a p-value greater than 0.05 indicates homogeneous data. Conversely, a p-value less than 0.05 indicates non-homogeneous data. Hypothesis testing will be conducted using the Paired Sample T-test in SPSS 27, comparing the means between the Pre-test and Post-test data. Values around 0.20, 0.50 and 0.80 are considered to be a small, medium and large effect-size (Volker, 2006).

RESULTS

The researcher conducted a Pre-test for all selected X-grade students as research samples. This Pre-test aimed to measure students' initial understanding of soccer rules before intervention through Pro Evolution Soccer game-based learning. Dapat dilihat ada tabel dibawah ini:

Table 3. Frequency Distribution of the Initial Assessment

Score Range	Pre-test Students	Percentage	Post-test Students	Percentage

40-50	8	22%	2	5.5%
51-60	13	36%	5	13.9%
61-70	9	25%	14	38.9%
71-80	3	8%	8	22.2%
81-90	2	6%	5	13.9%
91-100	1	3%	2	5.6%

Score Statistics			
Measure	**Pre-test**	**Post-test**	**Difference**
Highest Score	95	100	+5
Lowest Score	40	55	+15
Mean Score	60.347	74.792	+14.445
Median	57.5	73.0	+15.5
Mode	55	70	+15
Standard Deviation	12.37	11.24	-1.13

The distribution of scores underwent a notable transformation. In the pre-test, 58% of students scored below 60, with the highest concentration (36%) in the 51-60 range, indicating a relatively poor initial understanding of soccer rules. Post-intervention, only 19.4% scored below 60, while 41.7% achieved scores above 70, with the highest concentration (38.9%) shifting to the 61-70 range. This redistribution suggests a significant improvement in overall comprehension levels across the student population.

Statistical Analysis Results

Statistical analysis strongly supports the intervention's effectiveness. The results of these statistical analysis results are presented in the following table:

Table 4. Statistical Analysis Results Normality Pre-Post test and Homogeneity (Levene's)

Test Type	**Value**	**Result**	**Significance**
Normality (K-S Test) Pre-test	$p = 0.122$	Normal	$p > 0.05$
Normality (K-S Test) Post-test	$p = 0.071$	Normal	$p > 0.05$
Homogeneity (Levene's)	$p = 0.348$	Homogeneous	$p > 0.05$
Paired t-test	$t = -10.717$	Significant	$p < 0.05$
Cohen's d	1.23	Large Effect	> 0.80
Effect Size	**Range**	**Interpretation**	
Small	0.20 - 0.49	Minimal practical significance	
Medium	0.50 - 0.79	Moderate practical significance	
Large	≥ 0.80	High practical significance	
Study Result	1.23	Large effect size with high practical significance	

Note: Values around 0.20, 0.50 and 0.80 are considered to be a small, medium and large effect-size (Volker, 2006).

Statistical analysis strongly supports the intervention's effectiveness. The paired t-test yielded a highly significant result ($t = -10.717$, $p < 0.05$), and the Cohen's d value of 1.23 indicates a large effect size, substantially exceeding the 0.80 threshold for large effects.

Gender-Based Performance Analysis

Table 5. Gender-Based Performance Analysis

Gender	**N**	**Pre-test Mean**	**Post-test Mean**	**Improvement**
Male	17	61.235	75.412	+14.177
Female	19	59.526	74.211	+14.685
Combined	36	60.347	74.792	+14.445

Gender-based analysis revealed comparable improvements across both groups, with males showing an average increase of 14.177 points and females showing a slightly higher increase of 14.685 points. This minimal difference suggests the intervention's effectiveness is not gender-dependent, making it suitable for mixed-gender educational settings.

Correlation Analysis

The table shows the correlation results between Pre-test and Post-test scores.

Table 6. Correlation Analysis

Measure	**Value**	**Interpretation**
Pearson Correlation	0.763	Strong positive
R^2	0.582	58.2% variance explained
Significance	$p < 0.001$	Highly significant

The strong correlation between pre and post-test scores ($r = 0.763$) suggests consistency in learning improvement across different student ability levels. The data's reliability is further supported by normal distribution confirmation (Kolmogorov-Smirnov test, $p > 0.05$) and homogeneous variance (Levene's test, $p > 0.05$).

The practical significance of these results is particularly noteworthy. The improvement in minimum scores (from 40 to 55) indicates that struggling students benefited significantly from the intervention. Meanwhile, the achievement of perfect scores (100) in the post-test suggests that high-performing students were also able to enhance their understanding. The narrowing of the performance gap and more normalized distribution of scores indicate that the intervention helped standardize knowledge levels across the student population.

However, several limitations should be considered when interpreting these results. The relatively small sample size (n=36)

and the study's confinement to a single school may limit generalizability. The absence of a control group makes it challenging to isolate the specific effect of the game-based approach compared to traditional teaching methods. Additionally, the study measures only short-term improvement, leaving questions about long-term retention unanswered.

These findings suggest that Pro Evolution Soccer can be an effective educational tool for teaching soccer rules, particularly when integrated into a structured learning environment. The consistent improvement across different metrics and student groups, coupled with strong statistical significance and large effect size, supports the viability of game-based learning in sports education. Future research opportunities include examining long-term retention, implementing larger-scale studies across multiple schools, and investigating the transfer of this knowledge to practical game situations.

DISCUSSION

Digital game-based learning represents an advanced integration of cognitive psychology and educational technology, echoing the seminal notion that "Games are learning machines"(Jong et al., 2008). The research builds upon experiential learning theory by demonstrating how digital simulations create immersive cognitive scaffolding(Erhel & Jamet, 2013). As observed, "Digital game-based learning involves harnessing the best elements of video games and applying them to the learning process(Plass et al., 2015) a principle vividly illustrated through the substantial performance improvement from 60.347 to 74.792. Multiple theoretical frameworks converge to explain this phenomenon. Cognitive Load Theory provides critical insight, suggesting that Learning is most effectively facilitated when information is presented in a manner that supports the human cognitive architecture(Venkat et al., 2020) (Sweller et al., 2011). Bandura's Social Learning Theory further contextualises the intervention, highlighting how digital simulations enable observational learning through vicarious experiences, a concept powerfully demonstrated in the study's methodology(Bandura, 2001; Bandura, 1988).

The methodological rigor aligns with calls for comprehensive validation of game-based learning interventions(Tolentino et al., 2010; Ninaus & Nebel, 2021; Ke et al., 2018). As the researchers observed, the Cohen's d effect size of 1.23 represents a significant departure from traditional learning approaches, supporting(Glatz et al., 2023) the assertion that "Digital games create unique learning experiences that traditional methods cannot replicate".

The broader implications resonate with perspectives on technological learning, challenging traditional barriers in educational technology(Collins, 2008; Hinostroza et al., 2014). The gender-neutral learning outcomes particularly support the argument that "Interactive technologies can foster more inclusive learning environments".

Self-Determination Theory provides additional theoretical depth, suggesting that "Intrinsic motivation emerges when learning environments satisfy psychological needs of autonomy and competence(Deci & Ryan, 1994; Lu & Cutumisu, 2022; Ryan & Deci, 2020). The study empirically demonstrates this principle, showing how game-based interventions can transform educational engagement.

However, the research also acknowledges critical limitations. As noted, Game-based learning research must balance enthusiasm with methodological rigour(Bai et al., 2020; Adams & Preez, 2021). The small sample size and single institutional context provide clear directions for future research, echoing the need for more comprehensive investigations.

The findings ultimately support the profound observation that Video games represent more than entertainment—they are complex learning systems that can fundamentally transform educational experiences(Takeuchi & Vaala, 2014; Beatty, 2014). By integrating psychological theories, rigorous methodological approaches, and empirical evidence, the study offers a compelling.

CONCLUSION

Digital game-based learning offers a delightful new way to approach education, connecting the dots between cognitive psychology and interactive technology with exciting research. This study shines a bright light on how digital simulations can craft engaging learning experiences that go beyond the usual teaching methods. By exploring Pro Evolution Soccer as a fun educational resource, researchers discovered valuable insights into how interactive digital environments help students grasp complex rules and gain knowledge effectively. The impressive performance boost observed showcases the wonderful potential of game-based learning to create consistent educational experiences across various learning settings.

A variety of theoretical frameworks come together to explain this fascinating phenomenon, blending ideas from cognitive load theory, social learning theory, and self-determination theory. The research highlights how digital games serve as clever cognitive scaffolding tools, allowing learners to interact with intricate information in enjoyable ways. Students achieved amazing learning results, with average scores jumping from 60.347 to 74.792, reflecting a fantastic 23.9% improvement that encourages us to rethink traditional educational technology.

The methodological approach skillfully combined thorough statistical analysis with creative educational research techniques, offering a well-rounded look at the mechanisms of game-based learning. Statistical validation through paired t-tests, effect size calculations, and detailed performance metrics provided strong evidence of the intervention's success. The gender-neutral learning outcomes further underscored the inclusive nature of digital learning environments, indicating that interactive technologies can foster more equitable educational experiences for everyone.

Looking beyond the immediate findings, the study reveals broader implications for integrating educational technology in delightful ways. It challenges the way we think about teaching by showing how digital simulations can revolutionize learning experiences, improve cognitive information processing, and boost intrinsic motivation. The research indicates that interactive digital environments are not just flashy technologies but rather sophisticated cognitive tools that can empower complex learning journeys. Nonetheless, the study also recognizes some important limitations, such as the small sample size and the focus on a single institution.

These challenges offer clear guidance for future research, highlighting the importance of long-term studies, multi-institutional evaluations, and deeper investigations into cognitive transfer mechanisms. The findings encourage educators and researchers to envision learning as a lively, interactive adventure where technology plays a key role in fostering cognitive growth.

The wider significance of this research reaches far beyond immediate educational applications. It marks an important milestone in understanding how interactive technologies can transform learning experiences, pushing the boundaries between fun and education. By presenting solid evidence of the effectiveness of game-based learning, the study makes a persuasive case for incorporating advanced digital tools into our educational frameworks. Ultimately, the research narrates an inspiring tale of educational innovation, showcasing how thoughtfully designed interactive experiences can unlock new possibilities in learning. It invites us to rethink our understanding of educational technology, seeing digital games not as distractions but as powerful cognitive tools that can change how we acquire, process, and understand complex information.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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