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The impact of game-based learning for PATHFIT 2: Balancing fair play and technology

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ABSTRACT

This study, entitled Game-Based Learning: Balancing Fair Play and Technology, aimed to assess the impact of an innovative game-based learning (GBL) application integrating fair play and technology in enhancing learners' motivation, teamwork, and self-confidence in Physical Education at Binalatongan Community College. It specifically determined the significant difference in learners' academic performance before and after the implementation of the GBL application and examined the relationship between learners' performance and their perceptions of the application. A descriptive-correlational research design was used with 110 respondents selected through Slovin's formula. Data were gathered using a 20-item multiple-choice test and a survey questionnaire and analyzed using mean, standard deviation, t-test, and Pearson r. Results revealed a significant improvement in learners' academic performance after the implementation of the GBL application. The posttest mean score (M = 18.80, SD = 1.89) was significantly higher than the pretest score, with a t-value of -12.761 and a p-value of <0.001, indicating a significant difference and leading to the rejection of the null hypothesis. The effect size of -1.721 showed a large effect, confirming the strong impact of the intervention. However, no significant relationship was found between learners' academic performance and their perception of the GBL application (r = 0.002, p = 0.983), resulting in the acceptance of the null hypothesis. Although learners had very positive perceptions (M = 4.98, SD = 0.03), these did not significantly influence their academic performance.The study concludes that the innovative GBL application effectively improved learners' academic performance, but perception was not significantly related to performance outcomes.

Keywords: Game-based learning (GBL), physical education, academic performance, learner motivation.

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INTRODUCTION

Quality Physical Education (QPE) extends beyond the traditional concept of physical education by emphasizing not only the frequency and variety of physical activities but also inclusivity, values formation, peer-led learning, and holistic skill development. Unlike conventional physical education, QPE promotes comprehensive physical, cognitive, social, and emotional growth that contributes to learners' overall well-being and employability. According

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to UNESCO, QPE is a fundamental component of the Fit for Life program and directly supports Sustainable Development Goal 4 on Quality Education by ensuring inclusive and equitable access to quality physical education while fostering both cognitive and non-cognitive competencies (Promoting Quality Physical Education Policy, 2022). This perspective recognizes physical education as an essential educational discipline that develops healthy, resilient, and socially responsible citizens capable of contributing meaningfully to society.

Despite the recognized importance of Quality Physical Education, sustaining learners' motivation and participation remains a persistent challenge across educational systems worldwide. International evidence indicates that many learners demonstrate low interest in physical education because instruction frequently relies on repetitive and traditional teaching approaches that fail to stimulate engagement (Sun & Gao, 2021). These concerns have become more pronounced with the growing prevalence of sedentary lifestyles and increased screen time, both of which have substantially reduced learners' participation in physical activities and weakened their enthusiasm for physical education. In response, educators have increasingly adopted innovative instructional approaches such as game-based learning (GBL), which integrates game elements including rewards, challenges, interactive activities, and immediate feedback into educational experiences. Research has consistently demonstrated that gamification enhances learner motivation, concentration, problem-solving abilities, engagement, and overall academic performance, suggesting that technology supported instructional innovations can transform learners' educational experiences in meaningful ways (Oliveira et al., 2023). Collectively, these studies converge on the premise that learner-centered and technology-enhanced pedagogies provide effective alternatives to conventional instructional practices by creating more interactive and motivating learning environments.

The Philippine educational context reflects many of these international concerns while simultaneously recognizing the need for instructional innovation. Both the Department of Education (DepEd) and the Commission on Higher Education (CHED) advocate learner-centered pedagogical approaches that promote active participation, inclusivity, and meaningful learning experiences in Physical Education. This commitment to transforming physical education recognizes that all learners deserve educational environments that support their physical, psychological, cognitive, and social development while ensuring safety and inclusivity. Milne (2023) identifies three essential strategies for transforming Physical Education into a more learner-centered discipline. The first involves creating a strong classroom community by developing shared agreements with learners, understanding their identities and experiences, and fostering cooperation, leadership, and empathy. The second emphasizes adopting learner-centered pedagogy through active listening, providing learners with choices regarding participation and assessment, and encouraging reflection on skill development, game experiences, and peer interactions. The third focuses on continuous reflective practice, whereby educators consistently refine their instructional approaches while engaging in ongoing professional development. These interconnected strategies reinforce the importance of instructional environments that actively engage learners while responding to their diverse needs and abilities.

Although these pedagogical innovations have gained considerable attention, important contextual gaps remain, particularly within Philippine higher education institutions situated in rural communities. Physical Education continues to be perceived as less significant than academically oriented subjects despite its compulsory status, resulting in irregular attendance, reduced learner engagement, lower achievement, and limited development of essential physical, social, and psychological competencies. Existing literature has extensively documented the positive effects of game-based learning on learner engagement and motivation across various educational settings; however, relatively little empirical evidence exists regarding its effectiveness in tertiary level Physical Education, especially within community

colleges that experience unique contextual challenges. Rural higher education institutions frequently encounter limitations in digital infrastructure, instructional resources, and access to innovative teaching strategies. Large class sizes combined with diverse learner abilities further complicate instructional delivery by limiting opportunities for individualized guidance and meaningful learner participation. These contextual realities suggest that although game-based learning possesses considerable theoretical promise, its effectiveness within resource-constrained rural educational settings requires further empirical investigation.

These concerns are particularly evident at Binalatongan Community College in San Carlos City, Pangasinan, where learners frequently demonstrate low motivation, limited self-confidence, inadequate teamwork, and minimal engagement during Physical Education activities. The combination of traditional instructional methods, limited educational resources, and restricted access to digital technologies contributes to learners' underperformance in both academic and physical domains. Without interactive and engaging instructional approaches, learners often participate minimally, develop essential physical competencies more slowly, and exhibit lower levels of confidence during learning activities. Consequently, the holistic objectives of Physical Education remain only partially realized, underscoring the necessity of implementing instructional strategies capable of simultaneously enhancing learner motivation, collaboration, confidence, and skill acquisition.

Within this context, game-based learning emerges as a promising instructional approach capable of addressing many of the persistent challenges confronting Physical Education instruction. By integrating technology with principles of fair play, collaboration, and meaningful participation, game-based learning aligns closely with the fundamental objectives of Quality Physical Education, which emphasize holistic learner development through engaging and inclusive educational experiences. The convergence of international research supporting gamification, national educational policies advocating learner-centered pedagogy, and the specific instructional challenges observed within rural higher education establishes a compelling rationale for investigating the educational value of innovative game-based learning applications. At the same time, the limited body of research examining these interventions within Philippine community colleges highlights an important gap in the existing literature, thereby justifying further scholarly inquiry.

Guided by these theoretical, empirical, and contextual considerations, the present study assessed the impact of an innovative game-based learning application that integrates fair play and technology on learners' motivation, teamwork, self-confidence, empowerment, and skill development in Physical Education at Binalatongan Community College during the second semester of the 2025-2026 academic year. The research was motivated by the researcher's firsthand observations as a Physical Education instructor regarding learners' persistent difficulties with motivation, confidence, teamwork, and active participation during instructional activities. By systematically examining the educational outcomes associated with this innovative instructional approach, the study seeks to generate evidence-based insights that can contribute to improving Physical Education instruction within rural higher education institutions. Ultimately, the findings are expected to inform instructional practice by demonstrating how technology-enhanced, learner-centered pedagogies can promote more engaging, meaningful, inclusive, and empowering learning experiences while advancing the broader goals of Quality Physical Education.

Statement of the problem

The main objective of this study is to assess the impact of the innovative game-based learning application that integrates fair play and technology in enhancing learners' motivation, teamwork, and self-confidence in Physical Education at Binalatongan Community College.

Specifically, this study aims to:

1. What is the level of learners' performance before and after the implementation of innovative Game-Based Learning?
2. What is the level of learners' perception of the innovative game–based learning (GBL) application?
3. Is there a significant difference in learners' academic performance before and after the implementation of innovative Game-Based Learning?
4. Is there a significant relationship between the level of learners' performance after implementing the innovative GBL and the level of learners' perception in the innovative game–based learning (GBL) application?
5. What recommendations can be made to improve the innovative game–based learning application to enhance learners' participation in Physical Education lessons at Binalatongan Community College?

METHODOLOGY

This study employed a descriptive-correlational research design to examine the impact of the VitaGrocer App, an innovative Game-Based Learning (GBL) application, on learners' participation, cooperation, self-confidence, motivation, and performance in Physical Education. The project integrated educational content with game mechanics to create an engaging, learner-centered learning environment that was accessible through mobile devices and computers. Descriptive research utilizes quantitative methods to describe existing conditions through describing, recording, analyzing, and interpreting observable phenomena. It also involves comparison or contrast and attempts to determine relationships among existing non-manipulated variables, as explained by Kahn (2006). The correlational component of the study enabled the researcher to examine the relationship between learners' performance and their perceptions of the innovative GBL application.

The VitaGrocer App was designed as an interactive educational platform that promotes active participation, cooperation, self-confidence, and motivation through technology-based learning experiences. The application incorporated several interactive components, including Virtual Grocery activities, Physical Tasks, Spin-the-Wheel challenges, and a Rewards System. These features encouraged active participation, collaboration, decision-making, and experiential learning while making classroom activities more enjoyable and interactive. The system consisted of several integrated modules, including the User Interface, Virtual Grocery, Physical Task, Spin-the-Wheel, Rewards and Scoring, and Database buttons. The application utilized learner-friendly interfaces supported by interactive buttons, images, timers, and progress trackers to ensure accessibility and ease of navigation. Through the application, learners selected grocery items, completed physical activities, participated in randomized challenges, earned rewards, and monitored their learning progress. A secure database system stored learner information, scores, participation records, and completed activities for monitoring and evaluation purposes. To further enhance learner engagement and motivation, the application incorporated game mechanics such as points, badges, rewards, timers, and progress tracking. The system may be developed using technologies such as HTML, CSS, JavaScript, and database management systems to support its interactive features and overall functionality. Collectively, the project design emphasized the creation of an engaging Game-

Based Learning environment that promoted participation, cooperation, self-confidence, and motivation among learners.

The project development followed a systematic process to ensure the successful creation and implementation of the VitaGrocer App. During the design phase, the researchers developed the application layout, system flow, and principal features, including the Virtual Grocery, Physical Task Activities, Spin-the-Wheel Task System, and Rewards System. Particular attention was given to developing a user-friendly interface that promoted easy navigation and accessibility for learners. During the development phase, the application was created using appropriate software tools and programming technologies. Multimedia elements such as images, animations, icons, and interactive buttons were incorporated to enhance learner engagement, while a database system was developed to securely store learner information, scores, completed tasks, and participation records. Following system development, the application underwent functionality, usability, and performance testing. Necessary revisions were implemented based on feedback obtained from users and evaluators. Upon completion of these refinements, the application was implemented during classroom activities in which learners participated in virtual grocery tasks, physical activities, randomized challenges, and reward-based learning experiences. The effectiveness of the VitaGrocer App in improving learners' participation, cooperation, self-confidence, and motivation was subsequently evaluated through data gathering and performance assessment. Overall, the project development adhered to a systematic sequence that ensured the successful production of an engaging and educational Game-Based Learning application.

The operation of the VitaGrocer App was carried out through mobile devices and computers, allowing learners to log into the system and access the Virtual Grocery, Physical Tasks, Spin-the-Wheel Challenges, and Rewards System. Learners completed assigned tasks, earned rewards, and monitored their progress throughout the application. To ensure the effectiveness of the system, several testing procedures were conducted. Functionality testing verified that all application features operated properly, usability testing evaluated the ease of navigation and overall user experience, compatibility testing ensured that the application functioned effectively across different devices, and user acceptance testing collected feedback from learners and evaluators for further system improvement. These procedures ensured that the VitaGrocer App functioned efficiently while providing an engaging Game-Based Learning experience. Following implementation, the evaluation procedure assessed the effectiveness of the application in enhancing learners' participation, cooperation, self-confidence, and motivation. Data were collected through survey questionnaires and subsequently analyzed and interpreted to determine the impact of the application on learners' engagement and learning experiences. Feedback obtained from learners and evaluators also served as the basis for identifying areas requiring further enhancement to ensure the continued effectiveness of the application.

The study was conducted among learners enrolled in the College of Education at Binalatongan Community College, San Carlos City, Pangasinan, during the second semester of the school year 2025–2026. The respondents were selected through simple random sampling (SRS). The required sample size was determined using Slovin's formula, $n=N1+Ne2$, where $N=152$ and $e=0.05$ or 5% margin of error. Based on the computation, $n=1521+1520.052$ and $n\approx110$. Consequently, the study involved 110 enrolled learners taking the Physical Education course. The researcher selected this sampling procedure because the population was finite and the method ensured precision through the specified margin of error without requiring the participation of the entire population.

The primary research instruments consisted of a 20–item pre and post-test multiple-choice examination and a survey questionnaire. The 20–item test assessed learners' performance before and after implementing the innovative Game-Based Learning application, with all test items focusing on nutrition and its components. The survey questionnaire measured learners' perceptions following implementation of the GBL application. It consisted of statements reflecting learners' experiences after using the innovation. The instruments were validated by at least 3 individuals with expertise in conducting research, including master teachers, education program supervisors, or college deans. A Cronbach's alpha coefficient was expected to indicate high reliability. To ensure both internal and external validity and establish content validity, the draft instrument was first submitted to the research adviser for review and subsequently evaluated by experts in Physical Education and educational research. The questionnaire was revised based on their recommendations before final administration. A five-point Likert-scale format was employed to measure learners' perceptions regarding the impact and effectiveness of the game-based learning application in terms of motivation, skills development, self-confidence, teamwork, and social interaction. Prior to the actual data collection, pilot testing was conducted among learners who did not participate in the main study to verify that the instrument consistently produced stable results and to identify any potential issues requiring revision.

Data collection was conducted using both the 20–item test and the survey questionnaire. The researcher personally administered and retrieved all completed instruments to ensure complete data collection while immediately addressing any questions or requests for clarification from the respondents. The learner questionnaire consisted of two components. The first component comprised the 20–item test administered as both the pre-test and post-test to determine learners' level of knowledge before and after implementing the Game-Based Learning application. The second component consisted of the survey questionnaire, which assessed learners' perceptions regarding the Game-Based Learning application following its implementation. Prior to conducting the study, permission was obtained from the President of Binalatongan Community College and the Dean of the College of Education, thereby confirming the legitimacy and official endorsement of the research while promoting participants' confidence in providing honest and accurate responses. Strict confidentiality was maintained throughout the investigation. Only authorized research personnel were granted access to the collected data, which were securely stored in both digital and physical formats. Participant identifiers were anonymized to protect individual privacy. The entire data collection process extended over 4 months, beginning with participant recruitment and preliminary data gathering and continuing through data analysis and presentation of results. This timeframe allowed for the complete implementation of the Game-Based Learning application and facilitated follow-up with participants whenever clarification or validation of responses became necessary.

The collected data from the 20–item test and survey questionnaire were organized, encoded, and analyzed using the Statistical Package for the Social Sciences (SPSS). Prior to inferential analysis, the Shapiro-Wilk test was conducted to determine the normality of the data distribution. The results indicated that the data were not normally distributed; therefore, the researcher used the Wilcoxon test. Mean (averaging) was employed to answer sub-problem 1 by determining the level of learners' performance before and after implementing the innovative Game-Based Learning application. The average weighted mean, utilizing the five-point Likert scale, was used to answer sub-problem 2 by determining the level of learners' perceptions regarding motivation, teamwork, and self-confidence after implementation of the innovative Game-Based Learning application. To answer sub-problem 3, the researcher employed a paired sample t-test to determine whether a significant difference existed in learners' performance before and after implementing the innovative Game-Based Learning application. For sub-

problem 4, inferential statistics, specifically the Pearson correlation coefficient (Pearson r), was used to determine whether a significant relationship existed between learners' performance after implementing the innovative Game-Based Learning application and their perceptions of the innovation. Finally, the analyzed findings served as the basis for developing recommendations intended to improve Game-Based Learning applications in enhancing learners' performance and participation in Physical Education lessons at Binalatongan Community College.

RESULTS AND DISCUSSION

This chapter presents the results, analysis, and interpretation of the data gathered from the 110 learners enrolled in the College of Education who were taking the Physical Education course at Binalatongan Community College, San Carlos City, Pangasinan, during the second semester of the school year 2025–2026. The respondents were selected using simple random sampling (SRS) based on Slovin's formula. The study employed a descriptive-correlational research design to determine the effectiveness of the VitaGrocer Game-Based Learning (GBL) application and to examine learners' perceptions and academic performance following its implementation. Data were collected through a researcher-developed 20–item pre-test and post-test multiple-choice examination and a validated survey questionnaire measuring learners' perceptions of the application in terms of motivation, cooperation and teamwork, and self-confidence. The gathered data were analyzed using mean, weighted mean (WM), standard deviation (SD), paired sample t-test, Pearson correlation coefficient (Pearson r), the Shapiro-Wilk test for normality, and effect size, with all inferential analyses interpreted at the 0.05 level of significance. The discussion presented in this chapter is grounded entirely on the data obtained from the respondents and interpreted in direct relation to the objectives of the study while being contextualized through relevant theoretical and empirical literature.

The findings revealed substantial improvement in learners' academic performance following the implementation of the VitaGrocer Game-Based Learning application. Prior to the intervention, the respondents obtained a pretest mean score of 12.77 with a standard deviation of 4.58. Following exposure to the Game-Based Learning application, the posttest mean score increased to 18.80 with a standard deviation of 1.89, resulting in a computed mean difference of 6.03. The increase in the mean score demonstrates that learners acquired greater mastery of the instructional content after using the application. Likewise, the reduction in the standard deviation from 4.58 to 1.89 indicates that learner performance became more homogeneous after the intervention, suggesting that the application not only improved achievement but also contributed to greater consistency in learning outcomes among the respondents. These findings indicate that integrating interactive game mechanics into Physical Education instruction provides an effective instructional environment that enhances learners' understanding of nutrition concepts while simultaneously promoting active engagement. This observation is consistent with previous studies demonstrating that Game-Based Learning improves learner achievement by increasing motivation, sustaining attention, and providing immediate feedback that facilitates meaningful learning. The findings likewise support learner-centered instructional theories that emphasize active participation, experiential learning, and technology integration as effective means of promoting academic achievement.

Learners likewise demonstrated highly positive perceptions regarding the motivational value of the VitaGrocer Game-Based Learning application. All five motivational indicators received a verbal interpretation of "Strongly Agree." Statement 3 obtained the highest weighted mean of 4.98 with a standard deviation of 0.13, whereas Statements 1, 2, 4, and 5 each obtained

a weighted mean of 4.95 with a standard deviation of 0.21. The composite weighted mean of 4.96 with a standard deviation of 0.03 was verbally interpreted as "Strongly Agree." These findings indicate that learners consistently perceived the application as highly effective in increasing their motivation, interest, and engagement during learning activities. The remarkably high weighted means, coupled with very small standard deviations, demonstrate strong agreement among respondents regarding the motivational benefits of the application. This outcome reinforces existing literature asserting that gamified learning environments increase intrinsic motivation by incorporating rewards, challenges, competition, and immediate reinforcement into instructional activities. The findings further suggest that integrating technology with meaningful educational tasks creates learning experiences that encourage sustained participation and greater enthusiasm toward Physical Education.

Similarly, learners expressed overwhelmingly positive perceptions regarding the application's ability to promote cooperation and teamwork. Every indicator received a verbal interpretation of "Strongly Agree." Statements 2 and 5 obtained the highest weighted mean of 5.00, while Statements 1 and 3 obtained a weighted mean of 4.98 and Statement 4 obtained a weighted mean of 4.99. The composite weighted mean of 4.99 with a standard deviation of 0.07 was likewise interpreted as "Strongly Agree." These findings suggest that the VitaGrocer application effectively fostered collaboration, shared decision-making, teamwork, and active participation among learners during classroom activities. Such outcomes align with collaborative learning theories, which emphasize that meaningful interaction among peers strengthens communication, problem-solving abilities, and interpersonal relationships. The integration of collaborative game mechanics appears to have created opportunities for learners to work collectively toward common objectives while maintaining high levels of engagement and participation.

The respondents also demonstrated highly favorable perceptions regarding the effectiveness of the VitaGrocer application in developing self-confidence. All indicators received the verbal interpretation of "Strongly Agree." Statement 4 obtained the highest weighted mean of 5.00, while Statements 1, 2, and 5 each obtained a weighted mean of 4.98 with a standard deviation of 0.13, and Statement 3 obtained a weighted mean of 4.99 with a standard deviation of 0.10. The composite weighted mean of 4.99 with a standard deviation of 0.06 was verbally interpreted as "Strongly Agree." These results indicate that the Game-Based Learning application successfully encouraged learners to become more confident, active, and willing to participate throughout the instructional process. The interactive nature of the application, together with its reward system and learner-centered activities, likely provided learners with repeated opportunities to experience success, thereby strengthening their self-efficacy and confidence. These findings support social cognitive perspectives asserting that mastery experiences and positive reinforcement contribute significantly to the development of learner confidence and persistence during academic tasks.

When learners' overall perceptions of the VitaGrocer Game-Based Learning application were consolidated across motivation, cooperation and teamwork, and self-confidence, the findings revealed uniformly positive evaluations. The overall level of perception obtained a weighted mean of 4.98 with a standard deviation of 0.03 and was verbally interpreted as "Strongly Agree." Motivation to participate obtained a weighted mean of 4.96 with a standard deviation of 0.03, while cooperation and teamwork and developing self-confidence each obtained a weighted mean of 4.99 with standard deviations of 0.07 and 0.06, respectively. These consistently high ratings indicate that learners regarded the VitaGrocer application as an effective instructional innovation that enhanced their engagement, collaboration, and confidence throughout the learning process. The extremely low standard deviations further demonstrate remarkable consistency among respondents' evaluations, suggesting that the positive perceptions were widely shared regardless of individual learner differences. These

findings reinforce contemporary educational literature advocating the integration of Game-Based Learning as an effective pedagogical strategy capable of promoting meaningful learner engagement while simultaneously developing important cognitive, affective, and social competencies.

Inferential analysis further established the effectiveness of the VitaGrocer Game-Based Learning application in improving learners' academic performance. The paired sample t-test comparing pretest and posttest scores revealed a computed t-value of -12.761 with a p-value of <0.001. Since the obtained p-value is lower than the 0.05 level of significance, the null hypothesis was rejected, indicating a statistically significant difference between learners' academic performance before and after implementing the Game-Based Learning application. Moreover, the computed effect size of -1.721 exceeded the criterion for a very large practical effect, demonstrating that the observed improvement was not only statistically significant but also educationally meaningful. The increase in the mean score from 12.77 (SD = 4.58) to 18.80 (SD = 1.89) provides strong evidence that the VitaGrocer application substantially enhanced learners' understanding and achievement. The very large effect size indicates that the intervention produced a considerable educational impact beyond what might be expected through normal instructional progression. These findings support previous empirical investigations reporting that Game-Based Learning significantly enhances learner achievement by promoting active participation, increasing engagement, and facilitating meaningful knowledge construction through experiential and interactive learning environments.

The relationship between learners' academic performance following implementation of the VitaGrocer Game-Based Learning application and their perceptions of the innovation was likewise examined using the Pearson correlation coefficient. The posttest obtained a mean score of 18.80 with a standard deviation of 1.89, whereas the overall level of perception obtained a mean score of 4.98 with a standard deviation of 0.03. The computed Pearson correlation coefficient yielded an r-value of 0.002, which was verbally interpreted as "No Relationship." Furthermore, the obtained p-value of 0.983 exceeded the 0.05 level of significance, indicating that the relationship was not statistically significant. Consequently, the null hypothesis was accepted or not rejected. Although learners consistently expressed highly favorable perceptions of the VitaGrocer application, these perceptions were not significantly associated with their posttest academic performance. This finding suggests that while learners generally appreciated the application and recognized its value, differences in academic achievement were likely influenced by additional factors beyond their subjective evaluations of the instructional innovation. Variables such as prior knowledge, cognitive ability, learning strategies, study habits, and individual differences may have contributed more directly to variations in posttest performance than learners' perceptions alone. This result is consistent with educational research indicating that positive attitudes toward instructional technologies do not necessarily translate into proportional differences in measurable academic achievement, particularly when learner satisfaction is uniformly high across respondents, thereby limiting variability necessary to establish significant correlations.

Overall, the findings provide substantial evidence supporting the educational effectiveness of the VitaGrocer Game-Based Learning application. The intervention significantly improved learners' academic performance, as demonstrated by the increase in mean scores from 12.77 (SD = 4.58) to 18.80 (SD = 1.89), the statistically significant paired sample t-test result of -12.761 with p <0.001, and the very large effect size of -1.721. Furthermore, learners expressed overwhelmingly positive perceptions of the application across motivation (WM = 4.96, SD = 0.03), cooperation and teamwork (WM = 4.99, SD = 0.07), self-confidence (WM = 4.99, SD = 0.06), and overall perception (WM = 4.98, SD = 0.03), all of

which were verbally interpreted as "Strongly Agree." Although the Pearson correlation analysis revealed no statistically significant relationship between learners' academic performance and their perceptions of the application ($r = 0.002$, $p = 0.983$), this finding underscores the complexity of learning outcomes, which are influenced by multiple interacting factors beyond learner attitudes alone. Collectively, these results address all research objectives by demonstrating that the VitaGrocer Game-Based Learning application serves as an effective instructional innovation that enhances academic achievement while simultaneously fostering learner motivation, collaboration, and self-confidence. These findings contribute to the growing body of literature supporting technology-enhanced Game-Based Learning in Physical Education and provide an empirical foundation for subsequent conclusions, recommendations, and future research concerning innovative instructional strategies in higher education.

CONCLUSION

The study established that the implementation of the Game Based Learning (GBL) application was effective in improving learners' academic performance and enriching their overall learning experience in Physical Education. The findings demonstrated a substantial increase in learners' academic achievement following the implementation of the intervention, as evidenced by the improvement in the mean pretest score of 12.77 (SD = 4.58) to a mean posttest score of 18.80 (SD = 1.89), resulting in a mean difference of 6.03. This improvement was further supported by the results of the paired samples t test, which revealed a statistically significant difference between learners' academic performance before and after the implementation of the GBL application, with a t value of -12.761 and a p value of less than 0.001. These findings confirm that the intervention produced a significant positive effect on learners' academic achievement and fulfilled the primary objective of determining the effectiveness of the application in enhancing learning outcomes in Physical Education.

The study likewise revealed that learners developed a very positive perception of the Game Based Learning application, particularly in terms of motivation, cooperation and teamwork, and self-confidence. The overall composite mean of 4.98 (SD = 0.03), interpreted as "Strongly Agree," indicates that the application successfully created an engaging, supportive, and learner centered environment that encouraged active participation and meaningful interaction. These positive perceptions suggest that the application effectively addressed important cognitive, social, and emotional dimensions of learning by fostering enthusiasm, collaboration, confidence, and sustained engagement throughout the instructional process. However, despite these highly favorable perceptions, the findings further revealed no significant relationship between learners' academic performance and their level of perception toward the GBL application, as reflected by an r value of 0.002 and a p value of 0.983. This result indicates that although learners viewed the application very positively, such perceptions did not necessarily correspond to higher academic performance, thereby supporting the acceptance of the null hypothesis.

The effectiveness of the Game Based Learning application can also be attributed to its interactive and authentic learning features, which collectively promoted meaningful engagement and practical application of knowledge. The Virtual Grocery feature enabled learners to participate in simulated grocery shopping situations that required them to select food items according to nutritional needs, meal preparation objectives, or budgeting scenarios. Through these realistic tasks, learners developed decision making skills, cooperation, and critical thinking while applying practical knowledge either individually or collaboratively. The Physical Task Activity feature encouraged learners to perform simple exercises, movement based activities, and wellness challenges, with completion verified through uploaded photographs or videos, thereby strengthening accountability, active participation, and self-

confidence. Similarly, the Spin the Wheel Task System introduced an element of excitement by randomly generating learning missions related to nutrition, grocery selection, teamwork, and physical wellness, increasing learner anticipation while promoting participation and collaboration. Complementing these features, the Rewards System reinforced learner engagement by providing points, badges, stars, and virtual rewards upon successful completion of assigned tasks and challenges. This positive reinforcement enhanced learners' motivation, confidence, and willingness to participate actively in the learning process. Taken together, these integrated components demonstrate that the Game Based Learning application functions as an effective instructional tool that improves academic performance while simultaneously enhancing learners' motivation, cooperation, teamwork, self-confidence, and overall learning experience.

In light of these findings, the study recommends that learners actively engage in Game Based Learning activities to further improve academic performance, strengthen teamwork and communication skills through collaborative learning, enhance lesson understanding and retention by utilizing GBL applications as instructional tools, develop greater self-confidence through full participation in interactive and competitive activities, and maintain a positive attitude toward innovative instructional approaches. Since Game Based Learning transforms learners from passive recipients into active participants by integrating instructional content within engaging game mechanics, its continued use can effectively address learners' cognitive, social, and emotional needs. Teachers are likewise encouraged to integrate the VitaGrocer application into classroom instruction to promote improved academic performance while fostering motivation, teamwork, cooperation, and self-confidence. They should continue designing engaging and interactive learning experiences, provide clear guidance throughout GBL activities, and regularly evaluate the effectiveness of the application to ensure alignment with instructional objectives. By incorporating the VitaGrocer application into classroom practice, teachers can transform abstract academic concepts into practical and meaningful learning experiences through gamified activities involving grocery mechanics, resource management, budgeting, and nutritional science while assuming the role of facilitators of active learning. Future researchers are encouraged to extend this investigation by employing mixed methods approaches to examine how multiplayer features and team based grocery quests satisfy learners' psychological need for relatedness. Additional studies may also explore peer to peer interactions during cooperative gameplay, investigate how shared resource management strengthens social connection and classroom belonging, and determine how these collaborative dynamics contribute to reducing individual performance anxiety during competitive learning activities. Through these directions, future research can provide a more comprehensive understanding of the broader educational benefits and sustained effectiveness of Game Based Learning applications in diverse instructional contexts.

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