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ASSESSING THE EFFECTIVENESS OF GAMIFIED CRIME SCENE SIMULATOR FOR PCCR STUDENTS

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ABSTRACT

This study investigates the efficacy of a gamified learning crime scene simulator as an instructional tool for students at the Philippine College of Criminology (PCCR). The research aims to assess the impact of the simulator on student performance, engagement, and comprehension of crime scene investigation techniques. The evaluation analyzes the relationships between various factors and the outcomes of the gamified learning experience.

The methodology involves implementing the gamified learning crime scene simulator within the academic curriculum at PCCR and gathering performance data from participating students. Quantitative data, including academic performance metrics, user engagement levels, and simulator usage patterns, are collected and analyzed to identify correlations and predictors of success. The study's significance lies in its potential to inform educators, administrators, and technology developers about the effectiveness of gamified learning tools in enhancing the educational experience for students in forensic science or related disciplines. The findings may contribute to the refinement of teaching methodologies, curriculum development, and the design of gamified learning platforms. Additionally, implications for law enforcement training programs and potential benefits for future graduates entering the workforce are explored.

KEYWORDS: *Gamified, Crime Scene Simulator, Criminal Justice, Instructional Tool, Student Performance*

INTRODUCTION

Background of the Study

The Philippine College of Criminology (PCCR) is an esteemed institution dedicated to providing high-quality education in the field of criminal justice. As part of its commitment to fostering innovative teaching methodologies, PCCR has adopted various educational technologies to enhance the learning experience of its students. One such initiative is the implementation of a gamified learning crime scene simulator, designed to simulate real-world crime scene scenarios and facilitate experiential learning among PCCR students.

The integration of technology into education has witnessed significant advancements in recent years, particularly with the emergence of gamified learning platforms. Gamified learning environments utilize interactive features and gamification strategies to enhance student motivation. These techniques create immersive digital spaces that ignite student interest and promote active engagement. By incorporating gamified elements, these environments aim to cultivate dynamic learning experiences that foster motivation and sustained participation among students (Lavoué et al., 2021).

According to Gerard et al. (2022), the application of gamified learning crime scene simulators in educational settings offers a transformative opportunity for teaching crime scene investigation techniques in criminology. By simulating real-world scenarios, students can apply their skills in immersive contexts, enhancing engagement and learning outcomes. Collaborative development processes, such as creating gamified virtual simulations with students and academics, empower learners and improve their readiness for professional challenges. This innovative approach promises to revolutionize criminology education, equipping students with practical skills and competencies essential for their future careers.

While gamified learning crime scene simulators hold promise for enhancing student learning outcomes, there's a critical need to evaluate their effectiveness and understand factors influencing student performance within these virtual environments.

In light of these considerations, it aims to evaluate the performance of the gamified learning crime scene simulator implemented for PCCR students. This study will analyze factors like student engagement and learning outcomes. It seeks to understand the effectiveness of the simulator in teaching crime scene investigation techniques and assess the impact of collaborative development processes on student empowerment. Ultimately, the research aims to enhance criminology education at PCCR by equipping students with practical skills essential for their future careers.

This study contributes valuable insights to the ongoing discussion surrounding the integration of technology in criminal justice

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education. Assessing the effectiveness of the gamified crime scene simulator at PCCR provides practical guidance for improving such tools in preparing students for real-world investigative tasks. Through analyzing student engagement, learning outcomes, and collaborative development methods, the research aims to optimize criminology education and equip students with crucial skills for their professional journeys.

Objectives of the study

The study aimed to investigate several critical aspects of the gamified crime scene simulator (CSS) and its impact on PCCR students. The primary focus included evaluating the level of effectiveness of the CSS in terms of exposure to crime scene techniques, technological proficiency, and alignment with different learning styles. Additionally, the study assessed students' academic performance based on their final grades and examined any correlation between the simulator's effectiveness and academic outcomes. It also explored the challenges encountered by students and instructors in using the CSS, including the perceived seriousness of these challenges. Finally, the study assessed whether there was a significant difference in the perception of these challenges between the two groups and proposed an action plan based on the findings to improve the effectiveness and usage of the
simulator.

STUDY SITE

The study was conducted at the Philippine College of Criminology (PCCR), situated at 641 Sales St., Quiapo, Manila, 1001 Metro Manila. PCCR served as the primary educational institution for criminology students in the heart of Metro Manila, making it an ideal locale for examining the impact of the gamified learning crime scene simulator on the performance of PCCR students. The campus facilities and resources, coupled with the diverse student population, offered a representative setting for the research, ensuring that findings could be applied to similar educational contexts within the field of criminology. The study's focus on PCCR provided a localized perspective on the effectiveness of the gamified learning tool within the unique academic environment of this esteemed institution.

METHODOLOGY

Research Design

The study used a quantitative descriptive method. It involved collecting and analyzing numerical data. It was ideal for identifying trends and averages, making predictions, testing relationships, and generalizing results for large populations. Quantitative data was collected through pre-test and post-test measures, focusing on crime scene investigation skills and knowledge for within-group and between-group comparisons. Statistical analysis to assess the relationship between simulator use and dependent variables. This comprehensive methodology aimed to provide a nuanced understanding of the simulator's impact while controlling for potential confounding variables.

Locale and Population

This study exclusively targeted a specific group within the academic community at the Philippine College of Criminology (PCCR) by employing a purposive sampling technique. The following were the criteria for selecting respondents: 1. Second-year, third-year, and fourth-year students. 2. Those who belonged to the first fifteen (15) sections per shift. 3. Those who passed (CDI1) Fundamentals of Criminal Investigation and Intelligence (CDI2) Special Crime Investigation (CDI4) Traffic Management and Accident Investigation (CDI6) Fire Protection and Arson Investigation, respectively. The target respondents were two hundred fifty (250) 2nd year students, three hundred fifty (350) PCCR students for the 3rd year, and one hundred fifty (150) 4th year students, all of whom had used the gamified crime scene simulator application in their class activities.

Data-Gathering Tools

The study utilized a self-structured survey questionnaire, which was divided into two parts. Part 1 focused on assessing student engagement within the gamified learning crime scene simulator and its impact on their performance in crime scene investigation techniques at PCCR. Part 2 involved in-depth examinations of individual or group experiences with the simulator, providing qualitative insights into its practical application and its effect on students' understanding of simulated crime scene investigations. To ensure the validity of the questionnaire, the researcher sought validation from three tool validators: a content expert, a grammarian, and a statistician, to ensure face validity. Any entries that did not pass validation were revised, and questions that were deemed unsuitable were removed. After receiving approval, the validated questionnaire was distributed to selected respondents, and the certificate of tool validation was included in the appendices of the research.

Ethical Considerations

Ethical considerations were prioritized throughout the research to ensure the protection, well-being, and rights of all participants. Informed consent was obtained from participants, ensuring they understood the study's purpose, nature, and potential risks and benefits. Participation was entirely voluntary, and individuals had the freedom to decline or withdraw at any time without facing negative consequences. Anonymity and confidentiality were strictly observed, with participants' responses and personal information protected and stored securely.

The researcher respected participants' privacy by collecting only essential information and avoiding intrusive or irrelevant questions. Data protection measures were implemented to safeguard against unauthorized access, loss, or misuse, in compliance with relevant data protection laws and regulations. Efforts were made to avoid harm by minimizing potential distress, steering clear of sensitive topics, and offering support resources when necessary. Transparency was maintained by clearly communicating the study's purpose, procedures, and intended use of the data, as well as providing contact information for queries or concerns.

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Fairness and equity were upheld by designing the survey to avoid discrimination or bias against any individual or group. Additionally, data were used solely for the stated research purposes, with findings reported accurately and objectively to prevent misrepresentation or bias. These ethical considerations ensured a responsible and respectful approach to conducting the research.

Treatment of Data

The data collected from surveys and structured questionnaires were analyzed using a combination of descriptive and inferential statistical tools. Descriptive statistics, including the mean and standard deviation, provided a summary of the central tendency and variability of the responses. The mean ($\bar{X}$) represented the average scores, reflecting the general perceptions of the respondents, while the standard deviation (σ) measured the dispersion of responses around the mean, offering insights into the variability of opinions. A four-point Likert scale was utilized to evaluate survey results, focusing on two primary areas: the effectiveness of the Gamified Learning Crime Scene Simulator and the severity of challenges that influenced its performance evaluation for PCCR students.

Pearson's correlation coefficient was employed to assess the strength and direction of the linear relationship between simulator usage (X) and performance outcomes (Y). A positive correlation indicated that increased usage was associated with improved performance, whereas a negative correlation suggested the opposite. This helped quantify the relationship between key variables, offering valuable insights into the impact of the simulator on learning outcomes.

To determine significant differences in the assessments of two respondent groups, a t-test was conducted. The test of significance involved comparing the computed t-value with the critical tabular t-value; if the computed value exceeded the critical value, the null hypothesis was rejected, indicating a significant difference in perceptions. Additionally, the weighted mean was calculated to analyze responses on the four-point scale, allowing for a comprehensive evaluation of feedback. Percentage analysis was also used to measure the frequency distribution of respondents and describe their demographic profiles.

RESULTS

Table 1 Level of effectiveness of the gamified crime scene simulator (CSS) application for PCCR students in terms of Exposure

A. Exposure	Med	Int
1. The PCCR Crime Scene Simulator Application has sufficiently exposed you to crime scene investigation techniques.	3.52	VE
2. The PCCR Crime Scene Simulator Application enables you to apply theoretical knowledge in a practical setting.	3.50	VE
3. PCCR Crime Scene Simulator provides you with hands-on experience in crime scene investigation.	3.49	VE
4. The PCCR Crime Scene Simulator exposes you to various forensic elements, such as ballistics, fingerprint analysis, and DNA profiling.	3.49	VE
5. The PCCR Crime Scene Simulator Application promotes interdisciplinary collaboration among students, reflecting real-world forensic investigation scenarios.	3.50	VE
6. The PCCR Crime Scene Simulator Application presents highly realistic scenarios, immersing students in authentic crime scene investigation experiences.	3.48	VE
7. The PCCR Crime Scene Simulator Application effectively exposes students to various forensic analysis techniques, including forensic photography and forensic chemistry, allowing them to apply their knowledge in a practical and immersive environment.	3.49	VE
8. The PCCR Crime Scene Simulator Application effectively helps students develop practical problem-solving skills in crime scene investigation by	3.52	VE
challenging them to apply their knowledge and expertise in hands-on, engaging scenarios.		
9. The PCCR Crime Scene Simulator Application requires students to collect evidence using the tools and techniques they have learned throughout the course in meticulously crafted crime scenes, serving as a practical application of their classroom knowledge.	3.48	VE
10. The PCCR Crime Scene Simulator Application gave me a full look at crime scene investigation and forensic science.	3.50	VE
Overall	**3.57**	**VE**

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The overall finding of 3.57 indicates that the gamified Crime Scene Simulator (CSS) application for PCCR students is perceived as "Very Effective" (VE) in providing exposure to crime scene investigation techniques. This suggests that students feel the application successfully immerses them in realistic crime scene scenarios and allows them to apply theoretical knowledge in a practical, hands-on environment. Additionally, it supports interdisciplinary collaboration and exposes students to essential forensic elements and analysis techniques, helping them develop relevant problem-solving skills and utilize investigative tools.

Table 2
Level of Effectiveness of the Gamified Crime Scene Simulator Application for Students in Terms of Technology Proficiency

B. Technological Proficiency	Med	Int
1. The user interface of the PCCR Crime Scene Simulator is very easy to navigate.	3.40	VE
2. The simulator effectively presents 3D crime scenes, enhancing the overall learning experience.	3.42	VE
3. The simulator offers a variety of scenarios, including arson, murder, and traffic, which helps to keep students engaged.	3.47	VE
4.The simulator allows students to collect evidence from crime scenes in a highly effective manner.	3.45	VE
5. The simulator exposes students to various forensic analysis techniques, such as forensic photography and forensic chemistry, in a comprehensive manner.	3.48	VE
6. The crime scenes presented in the simulator are highly realistic, providing students with an immersive experience.	3.44	VE
7. The simulator fosters collaborative learning among students, promoting teamwork and communication.	3.49	VE
8. The simulator's technical support is very effective, ensuring that students can quickly resolve any technical issues.	3.45	VE
9. The simulator incorporates user feedback to improve its functionality, ensuring that students have a say in its development.	3.46	VE
10.The simulator is highly compatible with different devices and operating systems, making it accessible to a wide range of users.	3.44	VE
Overall	**3.51**	**VE**

The overall mean score of 3.51, with an interpretation of "Very Effective" (VE), indicates that the Gamified Crime Scene Simulator Application is highly effective in enhancing students' technological proficiency. The finding suggests that all aspects of the application's design, functionality, and support systems are well-regarded by users. This consistency across scores highlights the app's effectiveness in delivering a smooth, immersive, and educational experience that meets students' expectations

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Table 3
Level of Effectiveness of the Gamified Crime Scene Simulator Application for Students in Terms of Learning Styles

C. Learning Styles	Med	Int
1.The PCCR Crime Scene Simulator utilizes helpful visual learners and shows elements such as images and graphics.	3.58	VE
2. Users enjoy visual experiences in the crime scene simulator.	3.55	VE
3. The PCCR Crime Scene Simulator matches how students like to learn and presents content in a way that fits each person's style, helping them stay engaged, understand better, and remember more.	3.55	VE
4. The PCCR Crime Scene Simulator effectively caters to different learning styles, such as visual, auditory, and kinesthetic, ensuring that students with diverse preferences can engage with the content in a manner that suits them best.	3.56	VE
5.The simulator accommodates diverse learning preferences, including hands-on, collaborative, and interactive learning styles, providing students with awell-rounded educational experience that meets their individual needs.	3.55	VE
6.The PCCR Crime Scene Simulator incorporates elements that appeal to various learning styles, enhancing the overall learning experience for students and promoting effective understanding of crime scene investigation concepts.	3.55	VE

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7. The simulator provides ample opportunities for students to engage with content based on their preferred learning styles, ensuring a personalized learning experience that caters to individual preferences and needs.	3.54	VE
8. The PCCR Crime Scene Simulator adapts to different learning styles to promote effective understanding and retention of crime scene investigation concepts, ensuring that all students can benefit from the educational experience.	3.55	VE
9. The simulator addresses the learning preferences of students with different learning styles, ensuring that all users can benefit from the educational experience and develop the necessary skills for crime scene investigation.	3.56	VE
10. The simulator integrates features that cater to different learning styles, promoting engagement, understanding, and knowledge retention among students with diverse learning preferences, ensuring that all users can benefit from the educational experience.	3.55	VE
Overall	**3.60**	**VE**

The overall mean score of 3.60, interpreted as "Very Effective" (VE), signifies that the Gamified Crime Scene Simulator Application excels in catering to various learning styles, effectively supporting students with diverse educational preferences. The consistent mean scores (between 3.54 and 3.58) across different criteria indicate that students find the application equally engaging and supportive of their learning needs, whether visual, auditory, kinesthetic, or collaborative.

All evaluated factors, such as exposure, technological proficiency, and learning styles, have been rated as "Very Effective" or "Effective" by respondents. In the case of the gamified CSS application, only a small proportion of students rated it as "Less Effective" or "Not Effective."

Table 4
Level of Academic Performance of the Students using CSS in terms of The Students' Final Grade

Academic Performance	Mean ± Std Dev	Interpretation
Final Grade	81.30 ± 14.95	Below Average – Above Average

Based on the results, it shows that the average grade of students is 81.30, with grades ranging from 66.35 to 96.25. This indicates that the range of the grades of students is from below average to above average. The results show us that while the majority of students achieve grades above the passing mark, there are still variations in academic performance that reflect differing levels of effectiveness in utilizing the CSS.

Table 5
Relationship between the Level of Effectiveness of the Gamified Crime Scene Simulator and the Academic Performance of Students

Predictor	Response	Spearman-rho ρ Coefficient Value	Interpretation	p-Value
Gamified Scene Simulator Application	Academic Performance	0.010	Weak Relationship	0.781

**significant @ ≤ 0.05*

When examining the academic performance and its relationship with the gamified crime scene simulator, a Spearman-rho coefficient value of 0.010 is interpreted to have a weak relationship, and a p-value of 0.781 tells us that this relationship is not significant.

Table 6 Degree of Seriousness of The Challenges Encountered in Utilizing the Gamified Crime Scene Simulator as Perceived By the Respondents

Challenges Encountered in utilizing the gamified crime scene simulator	Student		Instructor	
	Med	Int	Med	Int
1. Bugs can disrupt the simulator, causing it to crash or not work properly.	3.58	VS	3.80	VS
2. The simulator may require expensive and advanced computers to run.	3.56	VS	3.80	VS
3. The simulator may not function well on all devices or systems.	3.56	VS	3.73	VS

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4. The simulator might not create a realistic crime scene experience.	3.58	VS	3.62	VS
5. The simulator might oversimplify complex forensic work.	3.56	VS	3.80	VS
6. The simulator won't provide useful training if it's too easy. It might frustrate users if it's too hard.	3.59	VS	3.67	VS
7. The simulators keeping a user interested and motivated over time in using the application can be tough.	3.55	VS	3.80	VS
8. The simulator provides content that is accurate and relevant to real procedures.	3.55	VS	3.80	VS
9. The simulator has a difficulty in giving a feedback and assessments,	3.59	VS	3.42	VS
10. The simulator is costly in developing and maintaining the application	3.58	VS	3.80	VS
Overall	**3.64**	**VS**	**3.64**	**VS**

**Legend: VS – Very Serious, S – Serious, LS – Less Serious, NS – Not Serious*

Table 6 highlights the challenges encountered in utilizing the gamified crime scene simulator, as perceived by both students and instructors. Both groups agreed that the challenges were significant and warranted attention.

From the students' perspective, the most serious challenges included difficulties in receiving feedback and assessments (3.59), the lack of effectiveness in training when the simulator is too easy (3.59), and technical issues such as bugs causing crashes or malfunctions (3.58). These challenges were deemed critical as they directly affect the simulator's functionality, educational value, and the overall learning experience.

Table 7 Comparative Analysis in the Degree of Seriousness of the Challenges of the Gamified Crime Scene Simulator and the Perception of the Respondents

Challenges Encountered	Type of Respondent				Mann-Whitney Z-Value	Test Statistics p-value
	Student		Instructor			
	Med	Int	Med	Int		
Challenges Encountered	3.64	VS	3.64	VS	0.687	0.492

**significant @ ≤ 0.05; Legend: VS – Very Serious, S – Serious, LS – Less Serious, NS – Not Serious*

Table 7 presents a comparative analysis of the perceived seriousness of challenges in using the gamified crime scene simulator by students and instructors. Both groups viewed these challenges as very serious. A Mann-Whitney test was conducted to assess differences in perceptions, yielding a value of 0.687 and a p-value of 0.492. These results indicate no significant difference between the two groups' perceptions of the challenges.

This similarity may stem from shared experiences and insights into the simulator's functionality and its impact on both learning and teaching processes, highlighting common concerns across both respondent groups.

CONCLUSION

The PCCR Crime Scene Simulator Application has proven to be an effective educational tool in training students for crime scene investigation. High ratings indicate its success in exposing students to practical techniques, enhancing problem-solving skills, and applying theoretical knowledge in a realistic setting. The simulator aligns well with Kolb's Experiential Learning Theory, supporting hands-on learning, and integrates problem-based learning (PBL) to foster critical thinking. Additionally, it follows constructivist principles, particularly Vygotsky's Zone of Proximal Development, providing a supportive learning environment for refining skills.

While the simulator is highly valued for its technology, user-friendly design, and its ability to promote collaborative learning, expose students to diverse forensic techniques, and keep them engaged with varied scenarios, its impact on academic performance appears limited. A weak and statistically insignificant relationship between the simulator's effectiveness and academic performance suggests that other factors, such as study habits and motivation, play a more significant role in student outcomes.

Despite its effectiveness, both students and instructors identified several serious challenges, including inadequate feedback, insufficient challenge levels, technical issues, and high maintenance costs. These challenges affect the simulator's educational value and should be addressed for improvement. A comparative analysis showed no significant difference in how students and instructors perceive these challenges.

To enhance the simulator's effectiveness while minimizing its emotional and psychological impact on students, strategies such as debriefing sessions, adjusting difficulty levels, and offering psychological support are recommended. By balancing the educational benefits with students' well-being, the simulator can continue to provide a valuable, engaging, and comprehensive learning experience.

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RECOMMENDATION

Following the comprehensive findings, testing, and thorough evaluation procedures conducted during this study, the researcher have formulated the following recommendations:

1. Conducting a longitudinal study is crucial to assess the long-term impact of the gamified crime scene simulator (CSS) on students' academic performance and career outcomes. This type of study would track students over an extended period to understand if initial gains in exposure, technological proficiency, and learning styles translate into sustained improvements in academic performance and practical skills relevant to criminology. Longitudinal studies can also reveal any potential diminishing returns or unforeseen challenges associated with prolonged use of CSS, providing insights into its lasting educational benefits.
2. Explore the integration of emerging technologies, such as virtual reality (VR) and augmented reality (AR), into the CSS framework. Assess how these technologies can enhance the realism, interactivity, and immersive learning experiences offered by the simulator. By incorporating VR/AR capabilities, future researchers can potentially improve engagement levels among students and provide more dynamic and realistic crime scene scenarios for practical training. This will align with advancing technological trends in education and offer opportunities to innovate within criminology education.
3. Conduct comparative analyses across multiple institutions or different student cohorts within PCCR to understand variations in CSS effectiveness. Compare results between institutions with different resources, curriculum structures, and student demographics to identify institutional factors influencing CSS implementation and outcomes. Comparative analysis can highlight best practices, reveal contextual factors impacting effectiveness, and provide insights into how CSS can be tailored to meet the diverse needs of students across different educational settings. This will support evidence-based decision-making in curriculum design and educational policy.
4. To maximize the effectiveness of the crime scene simulator (CSS) in criminology education, it is crucial to maintain and promote its use as a primary learning tool, ensuring regular updates and enhancements. Increasing the frequency of CSS use in coursework, supported by workshops and training, will help students and instructors fully utilize its features. Continuous monitoring of academic performance will allow for data-driven refinements to better align the simulator with educational goals. Additionally, investing in technical reliability, bug fixes, and scenario accuracy will enhance realism and user satisfaction. Student and instructor feedback should guide future developments, ensuring the CSS remains reliable, realistic, and valuable across all platforms.

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