World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(REVIEW ARTICLE)

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Unveiling shadows: A gamified approach to raise awareness and combat phishing tactics

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World Journal of Advanced Research and Reviews, 2024, 24(02), 2077–2084

Publication history: Received on 04 October 2024; revised on 20 November 2024; accepted on 22 November 2024

Article DOI: https://doi.org/10.30574/wjarr.2024.24.2.3453

Abstract

This paper addresses the growing threat of phishing attacks in the Philippines by developing an engaging educational game designed to enhance information retention and actively engage players in cybersecurity learning. Despite efforts by law enforcement, phishing attacks remain a significant cybersecurity threat in the Philippines, with current preventive measures and awareness campaigns proving insufficient to address evolving cyber threats.

The study aims to evaluate the effectiveness of gamification in cybersecurity education through the development and testing of "Unveiling Shadows," a game developed using Unity Game Engine and C# programming language. Using quantitative survey research methodology, the study collected data from 100 participants aged 12 and above through an online survey utilizing a four-point Likert scale to measure learning outcomes and user engagement.

Results demonstrated that "Unveiling Shadows" achieved high effectiveness in educating players about phishing tactics, with particularly strong outcomes in password security awareness and understanding the risks of sharing sensitive information online. The findings suggest that cybersecurity educators should consider incorporating gamified learning experiences that simulate real-world scenarios to enhance engagement and knowledge retention. Future research should explore the long-term impact of gamified cybersecurity education on user behavior and investigate the effectiveness of this approach across different demographic groups in the Philippine context.

Keywords: Phishing; Cybersecurity education; Gamification; Philippines; Mobile game

1. Introduction

Phishing has emerged as a significant cybersecurity threat in the digital age, targeting individuals, organizations, and governments worldwide. This deceptive practice exploits both technological vulnerabilities and human psychology to obtain sensitive information illicitly [1]. In the Philippines, the escalating frequency of phishing incidents highlights the urgent need for enhanced cybersecurity measures and public awareness [2].

A recent high-profile case involving unauthorized GCash transactions, investigated by the National Privacy Commission (NPC), exemplifies the sophistication of these attacks. The incident, attributed to phishing rather than platform vulnerabilities, highlights the critical importance of user vigilance [3]. Insights from the PNP Anti-Cybercrime Team reveal the diverse tactics employed by cybercriminals in the Philippines. PCpl Evan Rasthy Atad (2024) highlighted the prevalence of fraudulent investment schemes and deceptive work-from-home opportunities that lure victims with seemingly simple tasks. Pat Regine Joy Dela Cruz (2024) emphasized the widespread use of malicious links disseminated through popular messaging platforms and social media, often disguised as updates from trusted entities such as banks.

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To combat this growing menace, traditional awareness programs are being supplemented with innovative approaches. Gamification has shown promise as an effective tool for educating individuals about phishing prevention and best practices [4]. In response to this challenge, "Unveiling Shadows" has been conceptualized as an immersive gaming experience. This educational tool simulates real-world phishing scenarios within the context of everyday Filipino life, making the content accessible and relevant to its target audience. Players are tasked with identifying potential threats and making informed decisions to safeguard their personal information.

The game employs a pixelated, retro-inspired aesthetic to create an engaging visual experience. This design choice not only appeals to nostalgia but also serves to make complex cybersecurity concepts more approachable. By transforming educational material into an interactive format, "Unveiling Shadows" aims to enhance information retention and actively engage players in the learning process. The effectiveness of "Unveiling Shadows" in enhancing players' understanding of phishing tactics and their ability to apply protective measures will be evaluated through game assessments. This approach allows for quantifiable measurement of the game's impact on participants' cybersecurity awareness and skills.

By addressing the specific phishing threats prevalent in the Philippines and integrating guidance from professionals, "Unveiling Shadows" strives to contribute to the development of a more cyber-aware society. The ultimate goal is to encourage individuals with the knowledge and skills necessary to recognize and combat phishing attempts, thereby fostering a more secure digital environment for all Filipinos. This gamified approach to cybersecurity education allows individuals to develop practical skills and knowledge in an engaging and interactive manner, helping them stay safe in an increasingly digital world and avoid falling victim to constantly evolving tactics [5].

Studies have documented significant cybersecurity challenges in the Philippines. Devanesan [6] revealed a dramatic surge in phishing attacks in the Philippines during the COVID-19 pandemic. Dela Cruz [3] highlighted a significant phishing incident affecting GCash users in the Philippines. RESPICIO and CO. [7] established that cybercrime and online fraud in the Philippines encompass various illegal activities, including phishing, online scams, and unauthorized access.

In the context of the growing potential of gamification in cybersecurity education, Hart et al. [8] explored the use of serious games for improved cybersecurity and proposed “Riskio”, an innovative interactive game, as a solution.

Several studies support the potential effectiveness of gamified approaches in addressing cybersecurity awareness. Dapitan et al. [9] conducted a study on developing a 2D game application to improve computer network and security learning. Hodhod et al.'s [10] "CyberHero" showed the value of adaptive difficulty in cybersecurity games, a feature that could enhance engagement and effectiveness across diverse player backgrounds. Bhardwaj [11] introduced a game called "Cyber Air-Strike" to teach fundamental cybersecurity concepts.

The literature and studies highlight a critical need for innovative approaches to cybersecurity education, particularly in addressing the escalating threat of phishing attacks in the Philippines. Research consistently identifies a significant knowledge gap in cybersecurity awareness among non-technical professionals and younger demographics, emphasizing the potential impact of gamified educational tools like "Unveiling Shadows." The increasing frequency of phishing incidents in the country, as documented by various sources including the National Privacy Commission and the PNP Anti-Cybercrime Team, highlights the urgency of developing effective awareness programs. Traditional educational methodologies have shown limitations in providing engaging and practical experiences in cyber threat identification, creating an opportunity for gamified approaches to fill this crucial gap.

1.1. Statement of the Problem

Despite the efforts of the Philippine National Police Anti-Cybercrime Unit, cybercrime cases, especially phishing attacks, are becoming increasingly prevalent, posing a serious threat to individuals, businesses, and organizations across the country. The persistent rise suggests that current preventive measures and public awareness campaigns may be insufficient to address the evolving nature of these cyber threats. The need for innovative and effective educational tools that can engage and inform the Filipino public about phishing tactics and best practices for cybersecurity is critical. Hence, this proposed study seeks to solve this problem.

- How can the game "Unveiling Shadows" effectively educate the general population about the prevalent phishing attacks?
- How can the game utilize interactive simulations and real-world scenarios to simulate phishing realistically, thereby preparing users to recognize and respond to potential phishing attacks effectively?

- To what extent does the game "Unveiling Shadows" effectively enhance players' understanding of complex phishing tactics and empower them to apply best practices in real-world scenarios?

1.2. Objectives of the Study

The main objective of this proposed study is to develop an engaging and immersive narrative-driven game that educates players about the pervasive threat of phishing attacks, ranging from simple email scams to sophisticated ones. The game aims to empower players with the knowledge and skills necessary to identify and avoid phishing attempts across various digital platforms by simulating realistic scenarios. The game will enhance players' critical thinking and decision-making skills in the face of evolving phishing tactics. The specific objectives are as follows.

- To design a compelling storyline that realistically portrays prevalent phishing threats, enhancing players' ability to recognize and respond appropriately to real-world phishing attempts.
- To develop a pixelated game that employs retro-style graphics, delivering a nostalgic gaming experience while educating players about phishing and cybersecurity.
- To measure and analyze the game's effectiveness in improving players' comprehension of involved phishing tactics and their ability to apply best practices by implementing game assessments.

2. Material and Methods

Figure 1 Game Design

"Unveiling Shadows," a 12-level cybersecurity game set in Intramuros, Manila, teaches players about phishing tactics and online safety through engaging challenges within the walled city. Featuring retro-style graphics and informative animations between levels, "Unveiling Shadows" blends education with entertainment. This approach aims to make cybersecurity learning more relatable and memorable for Filipino players, ultimately raising awareness about the importance of digital safety in today's interconnected world.

2.1. System Development

The proponents have agreed to employ the Kanban Methodology for software development life cycle in developing the proposed "Unveiling Shadows: A Gamified Approach To Raise Awareness And Combat Phishing Tactics". The Kanban Methodology is workflow optimization management that uses visual board systems to help teams visualize, manage, and improve their work processes by limiting work in progress and enhancing efficiency. This structured approach helps the team to maintain focus, adapt to changes quickly, and deliver the "Unveiling Shadows" game effectively.

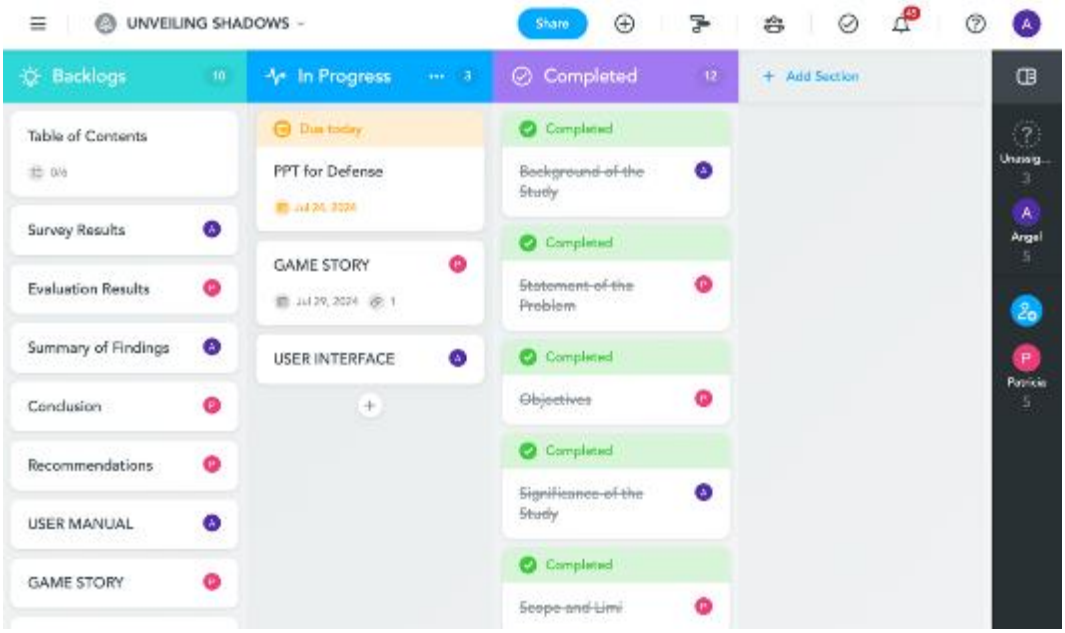

Figure 2 Unveiling Shadows Kanban Board

The proponents will implement the Kanban methodology to facilitate workflow, ensuring efficient task management and continuous improvement. A digital Kanban board will be utilized for real-time progress monitoring and to visualize the flow of work. The board is divided into three columns: "Backlogs," "In Progress," and "Completed."

2.1.1. Backlogs

All upcoming tasks and user stories are stored and prioritized serving as the entry point for new work items and represents the team's to-do list. Tasks in the backlog are typically not yet ready for development but are queued for future work cycles. In this phase, the listed work items will be assigned to a team member with set expected due dates and guidelines for completion.

2.1.2. In Progress

Tasks that are actively being worked on by the developers are displayed which represents the current workload of the development team. The workload is limited to ensure that developers are not overwhelmed with too many tasks at once, allowing for a more focused and efficient development process. Additionally, weekly meetings are also under this column for the developers to discuss progress, address any roadblocks, and ensure alignment on project goals.

2.1.3. Completed

The tasks that have been checked and tested to meet the project requirements and are ready for deployment serving as a clear indicator of progress and accomplishments, allowing the team to easily track completed works.

2.2. System Evaluation

To ensure that "Unveiling Shadows" effectively meets its educational objectives and provides an engaging user experience, a comprehensive evaluation of the game's functionality and quality will be conducted. This evaluation will assess the game's ability to raise awareness about phishing tactics and improve players' cybersecurity skills. The evaluation will focus on two key characteristics:

2.2.1. Functional Suitability

This characteristic examines how well the system’s features fulfill both the explicit and implicit requirements of its target users when operated within defined parameters. It evaluates whether the system can effectively perform its intended functions in a manner that aligns with user expectations and needs.

a) Overall Experience: This involves examining the precision and applicability of the cybersecurity content presented, how well the game evaluates player performance in various challenges, and whether the material effectively raises awareness about phishing threats specific to the Philippine context.

2.2.2. Interaction Capability

This characteristic assesses the system's capacity to facilitate smooth communication between users and the interface. It measures how effectively users can engage with the product to exchange information and accomplish their desired objectives. This includes evaluating the ease of use, clarity of the interface, and overall user experience in completing tasks within the system.

a) Usability and Design: The proponents will evaluate several aspects of the game's design, including the effectiveness of its tutorial system, how clearly it communicates goals and player progress, the intuitiveness of its navigation, how easily players can access important information within the game, and the overall appeal of its narrative and character progression.

2.3. Evaluation Framework

The evaluation process will focus on measuring the game's effectiveness in three key areas: phishing awareness improvement, player engagement with cybersecurity concepts, and practical application of defensive strategies. Through a structured Google Forms survey, data will be collected to analyze how well "Unveiling Shadows" achieves its educational objectives while maintaining an engaging gaming experience.

2.4. Research Instruments

The proponents will employ instruments to gather data on the effectiveness of "Unveiling Shadows" in raising awareness about phishing tactics and improving players' cybersecurity skills. Key input from interviews with the PNP Anti-Cybercrime Team and Department of Justice will help shape the survey questions to ensure relevance to current cybersecurity challenges.

Table 1 Likert Scale (Four-point) for Survey Interpretation

Scale	Rating
Strongly Agree	4
Agree	3
Disagree	2
Strongly Disagree	1

3. Results and Discussion

The proponents employed a quantitative survey research methodology to assess the developed game, utilizing a four-point Likert scale in an online survey distributed via Google Forms to 100 participants aged 12 and above. This approach enabled the gathering of standardized and quantifiable data on various aspects of the game experience, with the survey questionnaire addressing key areas aligned with ISO 25010: 2023: Learning Outcomes, Functional Suitability, and Usability and Design Interaction Capability.

Table 2 Summary of ISO Evaluation

Criteria	Sum	Count	Mean	Interpretation
Functional Suitability	2111	100 x 6 = 600	3.51	Very Good
Interaction Capability	3120	100 x 9 = 900	3.46	Very Good

$$\text{SUM} = x_1 + x_2 + x_3 + \ldots + x_n$$

$$\text{MEAN} = \frac{sum}{count}$$

Table II shows the result of the four-point scale evaluation survey for the game Unveiling Shadows. For Functional Suitability, the results show a sum of 2111 from 600 total responses (100 participants answering 6 questions each), yielding a mean score of 3.51. The score falls within the range of "Very Good" according to the numerical scale. Similarly, Interaction Capability demonstrates strong performance with a sum of 3120 from 900 responses (100 participants answering 9 questions), resulting in a mean of 3.46, also interpreted as "Very Good". The evaluation covering Functional Suitability and Interaction Capability suggests that the developed game performs well across all evaluated aspects with particularly strong outcome on the said criteria.

Table 3 Numerical Scale of the Summary of Mean

Numerical Scale	Descriptive Rating
3.35 – 4	Excellent
2.60 – 3.25	Very Good
1.85 – 2.50	Fair
1 – 1.75	Poor

Table III shows the established numerical scale to categorize the summary of a mean value into descriptive ratings providing a standardized framework for interpreting and communicating the performance or quality associated with a mean value. The value of 3.35 to 4 is categorized as "Excellent," while values of 2.60 to 3.25 as "Very Good." The scores ranging from 1.85 to 2.50 are deemed as "Fair," and values of 1 to 1.75 are considered as "Poor."

3.1. Functional Suitability

The evaluation of functional suitability showed consistently positive results across all assessment criteria. The majority of users validated the game's cybersecurity information accuracy (97% positive response), assessment capabilities (97% positive response), and feedback system effectiveness (99% positive response). Most notably, 98% of participants affirmed the game's suitability for raising phishing awareness in the Philippines, with 74% expressing strong agreement. The adaptive difficulty system received 97% positive feedback, demonstrating successful progression matching to player skills. Additionally, 97% of users confirmed the practical applicability of the game's cybersecurity information to real-life situations, with 68% strongly agreeing on its relevance to everyday practices.

3.2. Interaction Capability

The usability assessment revealed strong performance across multiple aspects of the game's design and functionality. The tutorial system proved highly effective, with 95% of participants confirming its usefulness in teaching navigation and interaction. The game's interface showed strong accessibility, with 91% of users finding the objectives and progression clear, while 91% reported easy navigation through different sections. The in-game phishing information notebook received particularly high marks, with 97% of users finding it easily accessible. Player engagement was notably strong, with 97% of participants finding the storyline and character development compelling. The game demonstrated exceptional inclusivity, with 95% confirming its accessibility for different cybersecurity knowledge levels, 94% affirming its suitability for various age groups, and an impressive 99% reporting its effectiveness for players with limited technical backgrounds. Additionally, 98% of users found the game provided adequate support for newcomers to cybersecurity concepts, indicating successful implementation of educational scaffolding.

4. Conclusion

The evaluation of the mobile application game "Unveiling Shadows" indicates its effectiveness in raising awareness and providing practical and relevant insights among the players for phishing tactics in the Philippine context.

The proponents effectively employed a pixelated game with retro-style graphics that kept 97% of the participants engaged through the gameplay and successfully educated them on the topic of phishing tactics, cybersecurity, and safeguarding themselves against potential online threats.

The key findings showed a strongly positive result, successfully indicating that the “Unveiling Shadows” has a significant impact on cybersecurity, particularly phishing awareness and education.

Although the content of the game received promising results, there is always room for improvement. These improvements include enhancing the user accessibility and game navigation to boost its overall effectiveness, allowing players to more easily access and benefit from the strong educational content.

Compliance with ethical standards

Acknowledgements

The proponents would like to express their sincere gratitude to several individuals and organizations who have been instrumental in the completion of this capstone project. The proponents wish to thank their research coordinator, advisor, and panelists for their invaluable guidance, expertise, and support throughout this study. Their insightful feedback and continuous encouragement have been crucial to this project's development. The proponents extend their sincerest appreciation to the PNP Anti-Cybercrime Team Manila Police District and Department of Justice Office of Cybercrime Team on warmly welcoming the proponents and wholeheartedly providing access to valuable data and insights regarding phishing incidents in the Philippines, which formed an essential foundation for this research. PCpl Evan Rasthy Atad, Pat Regine Joy Dela Cruz, and Pat Alex Daco for their generous assistance and dedication in providing valuable insights despite their demanding schedules. The proponents also wish to thank the participants who volunteered their time to take part in the survey and game testing phase. Their feedback and engagement were vital in evaluating the effectiveness of "Unveiling Shadows.”

This capstone project was conducted at Pamantasan ng Lungsod ng Maynila, Manila, Philippines.

Disclosure of Conflict of interest

The researchers declare no competing interests in this study.

Statement of informed consent

All participants provided informed consent in compliance with the Data Privacy Act of 2012 (RA 10173).

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