

Cyber Safe Teens: A Mobile Serious Game for Raising Awareness and Prevention of Online Sexual Abuse and Exploitation of Children

Authors:

Xyrelle Herrera

ICT Department, STI College Balagtas, Bulacan, Philippines

Raymar Macawile

ICT Department, STI College Balagtas, Bulacan, Philippines

Ben Victoria

ICT Department, STI College Balagtas, Bulacan, Philippines

John Kenneth Launio

ICT Department, STI College Balagtas, Bulacan, Philippines

Kate Caranto

ICT Department, STI College Balagtas, Bulacan, Philippines

Ericson Peñalba

ICT Department, STI College Balagtas, Bulacan, Philippines

Abstract:

Online sexual abuse and exploitation of children (OSAEC) poses a growing threat in the Philippines, especially as more young people spend time in digital spaces. Through a quasi-experimental study conducted with Grade 11 Information and Communications Technology (ICT) strand students at a private college in the Philippines, this research developed and evaluated Cyber Safe Teens, a serious game designed to raise awareness about OSAEC and its prevention. The study employed the ADDIE model for game development and utilized a one-group pretest-posttest design to measure learning outcomes, complemented by the FunQ survey instrument to assess user experience. The results reveal significant improvement in participants' understanding of online safety issues, with mean scores increasing from pretest to posttest. The game evaluation demonstrates high levels of user engagement, with participants reporting high scores in delight, challenge, and autonomy. The findings indicate that serious games can serve as effective educational tools for addressing sensitive topics like OSAEC when designed with user preferences and incorporating real-life scenarios.

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Introduction

Existing research recognizes the critical role of information technology in safeguarding young people from online sexual abuse and exploitation. With today's digital generation exposed to numerous technologies, the need to use modern methods to teach them about personal safety and abuse prevention has received considerable attention (Othman et al., 2022). Of particular interest is the development of information technology solutions, such as serious games, that can help in raising awareness on child abuse and maltreatment issues (Asadzadeh et al., 2024).

The use of serious games is well known among educators, who recognize its potential to address sensitive topics like child sexual abuse prevention (Stieler-Hunt et al., 2014). There is now much evidence that focuses on optimizing mobile technology and adapting learning environments to mobile platforms, especially given the increased online activities among children (Rahman et al., 2014). Among the benefits of using such games include raising awareness, fostering informed decision-making, and promoting the reporting of abuse incidents (Mikka-Muntuomo et al., 2018). Furthermore, adopting a game-based approach to this sensitive issue offer opportunities for guaranteeing free and equal access to learning (Scholes et al., 2014).

To date, research on the implementation of serious games has focused more on addressing offline sexual abuse issues. Malamsha et al. (2021) developed a culturally sensitive mobile game called HappyToto, which aimed to educate young children and caregivers in Tanzania about sexual abuse prevention. Stieler-Hunt et al. (2014) designed an abuse prevention computer game known as Orbit, which featured an interactive adventure game with mini-games and targeted school students aged 8 to 10 years old. Pritha et al. (2022) reported that some of the existing mobile game apps focus on teaching prevention strategies among children. They found apps, like Stop the Groomer, iSafe English Children, and Child Abuse Prevention, that aim to educate children under 12 about how to avoid danger. When it comes to interventions aimed at preventing online child sexual abuse, Patterson et al. (2022) noted that these interventions take the form of websites, role-playing games, and interactive computer programs. However, Rodríguez et al. (2021) stated that there is a significant opportunity for the growth of serious gaming applications, given their minimal usage on smartphones.

Recent efforts in Southeast Asia have demonstrated success in using digital games to teach children about online dangers. The development of the May and Bay digital game in Thailand and Cambodia represents an important step forward in protecting children from online sexual exploitation (Reeves et al., 2024). However, while these neighboring countries have taken such innovative steps, the Philippines currently lacks similar interventions designed to prevent online child exploitation. To the best of their knowledge, the researchers have not found any comparable games specifically for Filipino children. Therefore, this research aims to develop and evaluate a serious game focusing on awareness and

prevention of OSAEC among teenagers. It addressed four key areas: participants' design preferences, game's features and descriptions, learning effect after taking the pretest and posttest, and evaluation using fun experience metrics. In doing so, this study aims to contribute to the limited yet growing area of research on the development and evaluation of serious game for cyber safety education.

Literature Review

Online Sexual Abuse and Exploitation of Children

OSAEC includes various forms of child sexual abuse carried out through digital platforms, including the creation and distribution of abuse materials, online grooming, and live-streamed exploitation (Dulawan & Bance, 2024). This widespread phenomenon involves manipulative tactics targeting children and their caregivers, while also including peer-related sexual content sharing, extortion, harassment, and involuntary exposure to sexual content in digital environments.

Research by Council for the Welfare of Children and UNICEF Philippines (2016) reveals that 43.7% of Filipino children aged 13-18 have experienced online violence, with a quarter of these cases involving sexual abuse. Philippine government data indicates that reported incidents increased nearly threefold during the initial COVID-19 quarantine period compared to the same timeframe in 2019 (Save the Children, 2021). The country's Department of Justice (DOJ), drawing from National Center for Missing & Exploited Children statistics, documented an additional 202,605 cases during the March-May 2020 lockdown period (Save the Children, 2021).

To further their efforts in combatting OSAEC, the Philippine authorities have prioritized strict prosecution of foreign perpetrators and local facilitators, leading to increased number of convicted offenders over the past few years (Justice and Care, 2023). In 2023, the Philippine Department of Justice's Office of Cybercrime documented more than 2.7 million cases of potential online child exploitation through CyberTipline reports from the U.S. National Center for Missing and Exploited Children (SaferkidsPH-UNICEF & Plan International, 2024). The majority of these reports involved the sharing, re-sharing, and selling of exploitation materials.

Serious Games

The integration of digital games into education has created two key approaches: serious gaming, which prioritizes educational purposes over entertainment, and digital game-based learning, which focuses on student-centered learning through gameplay (Zhou & Bakhir, 2024). These games incorporate various media elements and provide a cost-effective alternative to traditional teaching methods, leading to better knowledge retention and higher level of student satisfaction (Lee et al., 2024).

As digital gaming becomes a recreational activity among young people, researchers are exploring how serious games can incorporate both pedagogical principles and game design expertise (Asadzadeh et al., 2024). Through immersive simulations, serious games can offer students the opportunity to practice decision-making by allowing them to understand the consequences of their choices without actual consequences (Dallaqua et al., 2023). Students eager for stimulating and fun learning experience find themselves drawn to these interactive game experiences where learning feels less like studying and more like exploration (Merino-Cajaraville et al., 2023). By assuming a specific role, a student can experiment with various strategies and confront misconceptions, although this practice can be most effective when used as a complement to traditional teaching methods (Brečko et al., 2024).

While educational games show great promise for teaching important life skills, many existing applications do not fully utilize engaging game-based features (Noorbehbahani et al., 2024). Studies suggest that serious games, delivered through both schools and mobile apps, have proven effective in teaching children about personal safety and risk awareness (Pritha et al., 2022). Therefore, serious games as an accessible tool for child sexual abuse prevention should employ gameplay elements like artwork, sound, and storylines, while maintaining a "hook" to ensure that students play multiple times for better knowledge retention (Scholes et al., 2014).

Methods and Data

This research was conducted at a private college during the 2023-2024 academic year. The school was chosen for its accessibility, available resources, and curriculum alignment with cyber safety education, following a traditional lecture-based approach combined with digital platforms for academic materials. Specifically, the study involved 27 Grade 11 Information and Communications Technology (ICT) strand students aged 15-18. The students were enrolled in Media and Information Literacy, a subject that teaches them about media communication and develops their skills in critical thinking and responsible media use. Moreover, they were selected through purposive sampling based on the following criteria: their exposure to technological concepts and tools, adaptability to new technology, and regular online interactions.

This study employed the ADDIE instructional design framework to develop and assess an educational mobile game focused on online safety awareness among senior high school students. According to Braad et al. (2024), ADDIE model refers to an iterative design and development framework that distinguishes between phases of analysis, design, development, implementation, and evaluation. Within the context of creating serious games, this model uses feedback from evaluations to improve both the design and final product through repeated cycles of refinement. Further, this study employed both quantitative assessment methods and user experience evaluation techniques to measure the game's

effectiveness and engagement level. The systematic implementation of each ADDIE phase is detailed in the following paragraphs.

Analysis

Through initial assessment, the researchers identified that the participants regularly used digital technology, creating an opportunity for technology-based learning approaches. While students frequently used digital platforms, their understanding of online safety risks needed improvement. The researchers sought permission from the school's academic head to understand learning needs and define objectives for a game.

Design

The design phase involved creating the game's narrative structure, mechanics, and visual elements with non-disturbing art styles for sensitive content. The researchers conducted a preliminary survey for participants to choose colors, art styles, and game sequences. The visual elements, which drew inspiration from games with engaging approaches to sensitive content, were crafted through mood boards evoking emotions like empathy, fear, and suspense.

Development

The development of the prototype used various software applications: Adobe Photoshop for designing characters and backgrounds, Filmora for animating different scenes, and Adobe After Effects for implementing tweening animation. Visual Studio Code was utilized for C# programming as an extension for Unity, which was chosen for game development due to its user-friendly interface. Additionally, Elevenlabs.io generated voice-overs for the game's pop-up reminders.

Implementation

The implementation phase began with obtaining signed consent forms from students with parental permission, using a quasi-experimental design. The researchers ensured data confidentiality while participants received access to the game with instructions. Throughout the 25-minute gameplay, the participants' game decisions affected the story flow, with consequences either filling or depleting learning points that determined the fate of the game's main character.

Evaluation

The Evaluation phase consisted of administering pretest and posttest, which allowed researchers to directly compare the results using paired samples t-test analysis. After gameplay, the researchers administered a FunQ survey to measure participants' enjoyment of the game (Tisza & Markopoulos, 2021). The questionnaire included six subscales across 18 items measured using a 4-point Likert scale.

Results

Game Design Preferences

Concerning artistic direction, the majority (65.2%) of respondents favored the more dynamic approach, specifically the "Band Runner" style over "Little Misfortune." Furthermore, in terms of character naming conventions, less than half (41.3%) chose "Isabel" as their preferred name for the main character.

In terms of color preferences, the findings revealed multiple aspects. Initially, for the general color palette, more than a third (39.1%) favored earth colors. Subsequently, when examining specific moods, over a third (39.1%) preferred dark colors for "Uncertainty," whereas a large majority (71.7%) chose dark colors for "Suspenseful" scenes. Additionally, for the "Anticipating" mood, half (50%) of respondents selected warm colors. With respect to the background, more than half (58.7%) preferred a light background.

In relation to typography preferences, the majority (60.9%) selected a bold, artistic typeface with distinctive decorative elements for the title header. For sub-headers, a large majority (73.9%) favored a modern, dynamic font style with smooth curves and balanced proportions. Furthermore, more than half (56.5%) chose a clean, highly legible sans-serif typeface for paragraph text, prioritizing readability and professional appearance.

In terms of suspense-building elements, half (50%) of respondents identified background music as the most crucial element. As regards, narrative length preferences, more than a third (34.8%) preferred games with more than 20 scenes. With reference to setting, half (50%) of respondents preferred a mysterious atmosphere for suspenseful moods. Additionally, concerning spatial settings, less than a third (32.6%) chose Urban Dark Street as their preferred setting for suspenseful scenes.

Features of the Game

Cyber Safe Teens highlights the story of Isabel, a teenage senior high school student who is struggling financially and experiences a lack of attention from both her parents and classmates. Such a situation leads her to spend most of her time on the internet. Eventually, she discovers an app and downloads it. Through the app, she meets a stranger who exploits her financial situation, which raises her potential risk of becoming a victim of OSAEC. The game features two endings, each determined by the player's choice. Figures 1 and 2 show the game's fictional world or settings and character designs, respectively.



Figure 1: Game's Fictional World or Setting

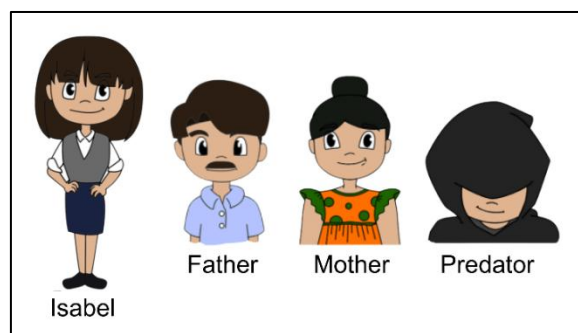









Figure 2: Character Designs

The main menu features an animated background highlighting Isabel, enhanced by accompanying background music. Additionally, the title of the game "Cyber Safe Teens" is displayed alongside four interactive buttons: "Start" button which initiates gameplay upon selection, "Credits" button for accessing information about the creators of the game, the "Question Mark" button that provides instructions, and the "Exit" button for ending the game.

As soon as the player clicks the "Start" button, a disclaimer scene appears providing important information and reminders about the game. The players can go back to the main menu by clicking the "Back" button and can move forward to the next scene by clicking the "Next" button. Upon clicking the "Next" button, the game synopsis appears providing context of the story to the player. Additionally, a "Start Game" button is available at the bottom of the synopsis, which, when clicked, transitions to the loading screen then to the first scene of the game.

Scenes	Screenshots from the Game	Descriptions
Main Menu Scene		<ul style="list-style-type: none"> Features moving background with Isabel at the front and with background music Contains four interactive buttons: Start, Credits, Question Mark, and Exit Question mark provides game instructions
Disclaimer Scene		<ul style="list-style-type: none"> Appears after clicking "Start" button Contains important game information and reminders Features "Back" button to return to main menu Has "Next" button to proceed to synopsis
Synopsis Scene		<ul style="list-style-type: none"> Provides context of the story to the player Contains "Start Game" button Transitions to loading screen Leads to first game scene
Introduction Scene (1-3)		<ul style="list-style-type: none"> Shows animated video with voiceover narration Introduces Isabel's discovery of trending app Provides glimpse of family and school life Features pause button for player control
Decision Scene (4)		<ul style="list-style-type: none"> Presents first player choice: Accept/Decline friend Shows different response videos based on choice Includes "Continue" button to advance Features Isabel's feedback on player's choice
Consequence Scene (5-6)		<ul style="list-style-type: none"> Shows different versions based on previous choice Accept path displays extended nighttime phone use Decline path shows brief phone interaction Contains unique voiceover narrations
Family Context Scene (7-9)		<ul style="list-style-type: none"> Single version showing Isabel's family situation Leads to decision about sharing personal problems Contains deeper story context Influences subsequent narrative branches

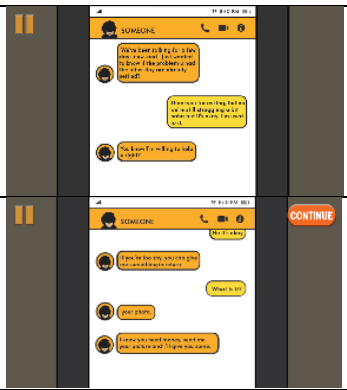
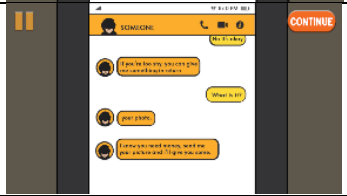


Development Scene (10-14)		<ul style="list-style-type: none"> • Depicts evolving relationship with stranger • Contains multiple decision points about accepting help • Shows stranger's persistent behavior • Features different outcomes based on choices
Crisis Scene (15-16)		<ul style="list-style-type: none"> • Reveals stranger's true intentions • Includes decisions about photo sharing • Shows consequences of previous choices • Contains warning messages about online safety
Resolution Scene (17-20)		<ul style="list-style-type: none"> • Provides OSAEC information • Contains decisions about parental involvement • Shows different ending scenarios • Features success or failure outcomes
Educational Scene		<ul style="list-style-type: none"> • Displays OSAEC statistics • Shows information about Republic Act 11930 or Anti-OSAEC and Anti-Child Sexual Abuse or Exploitation Materials (CSAEM) Act • Provides online safety reminders • Returns to main menu after completion

Table 1: Features of Cyber Safe Teens

Evaluation of the Game

The participants demonstrated high levels of autonomy (3.20) and engagement with the challenge aspects (3.46), as shown by their freedom to make their own choices in Isabel's story and their interest in discovering different story outcomes. The activity made students delighted to play the game (3.55), as they expressed happiness while making choices and wanted to play more games like it. The level of immersion was also notable (2.72), with participants often losing track of time while maintaining awareness of their learning environment. The social and emotional impact of the game was equally noteworthy. While new friendship formation was limited, the activity enhanced existing social connections (2.77), with 10 participants reporting improved communication and closer relationships. Importantly, stress levels remained minimal (2.06), with the majority of participants rarely experiencing negative emotions during gameplay.

Measure	N	M	SD	Mean Difference	df	t
Pretest	27	3.59	1.89	0.36	26	-9.545*
Posttest	27	8.07	2.11	0.41		

*p < .001

Table 2: Results of Pretest and Posttest

A paired-samples t-test was conducted to evaluate the impact of the intervention on students' scores. There was a significant difference between pretest ($M = 3.59$, $SD = 1.89$) and posttest scores ($M = 8.07$, $SD = 2.11$); $t(26) = -9.545$, $p < .001$. Students showed significantly higher scores on the posttest compared to the pretest, with a mean increase of 4.48 points. These results suggest that the intervention was effective in improving students' learning performance.

Discussion

This study set out to develop and evaluate the features of a mobile serious game for educating students about OSAEC. The study found that the game successfully incorporated the following features: real-life based scenarios, decision-making mechanics, educational reminders, and trivia elements. These findings are consistent with those of Scholes et al. (2014), who outlined that a games-based approach requires careful integration of narrative elements and interactive mechanics to support learning goals. Their research also demonstrated that incorporating age-appropriate elements such as relatable characters, immediate player feedback, and purposeful mechanics strengthens the educational effect of serious games. It helped that the research incorporated design preferences from participants prior to developing Cyber Safe Teens. This learner-centered design strategy enhanced the game's effectiveness by ensuring the content and mechanics resonated with its intended audience while maintaining its learning objectives (Reeves et al., 2024).

The second aim of this study was to assess the game's effect on learning outcomes through pretest and posttest. This study revealed that participants showed significant improvement in their understanding of online safety, with scores improving after gameplay. The result aligns with that of Jones et al. (2020), whose research on a child safety educational game demonstrated that students who played the complete game showed statistically significant improvement in their knowledge assessment scores, compared to the control group. Further, this finding reflects that of Hendrick et al. (2025), whose study demonstrated significant improvement in children's awareness of physical and online grooming risks after gameplay. Comparable results were also found in a study of a web-based training program, which showed enhanced knowledge acquisition and behavioral strategies among child participants, while maintaining healthy emotional responses (Müller et al., 2014).

The third purpose of the study was to evaluate the participants' engagement and emotional response to the game. The study found that participants experienced high levels of autonomy, challenge, and positive emotions during gameplay, with minimal negative experiences reported. These findings highlight the pressing need for engaging educational tools that can maintain student interest while delivering valuable content. In the study of Hartt et al. (2020), researchers found that students demonstrated stronger engagement and preference for game-based lectures compared to traditional teaching methods, corroborating this study's findings on the positive emotional responses and high

engagement levels during gameplay. The findings further support the idea of Jones et al. (2020) that creating a fun and engaging learning environment through serious games can effectively address the challenges of teaching sensitive content while ensuring student comfort and participation. Moreover, Rugelj and Lapina (2019) emphasized the role of player autonomy and progressive challenge systems in educational game design. They further noted that players can have meaningful control over game outcomes while receiving continuous feedback on their choices. In doing so, the game creates an engaging and effective learning experience.

Conclusion

Overall, this study successfully developed and evaluated a mobile serious game for OSAEC education, employing key features like real-life scenarios and decision-making mechanics that resonated with the target audience. The inclusion of learner preferences, interactive mechanics, and age-appropriate content proved crucial in achieving the learning objectives while maintaining student interest. The results reinforce the value of serious games as powerful tools for delivering cyber safety education.

Based on the findings, the researchers propose the following recommendations to enhance the game's effectiveness and reach:

- Enhance visual elements including button hover effects, animations, and overall design for a more immersive learning experience.
- Incorporate personalized challenges, interactive narratives, and stress management tools to increase engagement and autonomy.
- Create a web-based version that works across all devices and operating systems for improved accessibility.

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