

Evaluating and Developing Educational Gaming Applications to Raise Awareness of Child Sexual Abuse

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Abstract—Nowadays, sex education is an essential requirement for children aged 6-12 years. Alongside other initiatives, introducing sex education-related games may hold immense potential in effectively detecting and preventing instances of child abuse. As a society, embracing and promoting these educational tools could lead to a safer and more informed environment for children. Therefore, the objectives of this paper are to evaluate the usability of existing sex education games for children and to propose a novel prototypical game for children's sex education aimed at enhancing usability. To accomplish the objectives of this research, firstly, two existing games (*Child Abuse Prevention* and *The Good Touch Game*) were evaluated through Heuristic Evaluation to reveal the usability problems. Secondly, a prototype game *Good Touch Bad Touch* was designed and developed considering avatars (boy/girl) and animation-based stories set in three different (home, school, and playground) environments. Thirdly, its usability was assessed through the Heuristic Evaluation and System Usability Scale (SUS). Finally, the Heuristic Evaluation findings of the three games were compared. As an outcome, the study found that existing sex education-related games have significant number of usability problems ($n = 15$ and 16) with high severity, while a few usability problems ($n=6$) were found in the developed game *Good Touch Bad Touch*. Additionally, the developed prototypical game showed a good SUS score (82.142) which ensures high usability and user experience of the proposed game.

Index Terms—Sex education, games, Prototype design, Heuristic evaluation, Bangladesh context, System Usability Scale (SUS).

I. INTRODUCTION

Child sexual abuse (CSA) starts from a sheer act of inappropriate touching. The rate of sexual abuse in Bangladesh, notably among children and adolescents remains concerning. In 2021, according to the Bangladeshi non-profit organisation Manusher Jonno Foundation (MJF), several hundred children were abused [1]. The numbers are believed to be greater

as many abuses remain undetected. This is because in most cases, the children are not even aware that they are being abused. Most CSA victims project mental, behavioural and interpersonal issues later in their life [2] [3]. Thus, teaching children about good and bad touch is crucial in saving them from abuse and childhood trauma. Nowadays, measures are being taken to introduce sex education to children in schools while the concept of *good touch, bad touch* is still new in Bangladesh. In majority incidents, the perpetrators of CSA are closely known by the child or the child's family members. Statistics indicate that approximately 90% of children who are victims of sexual abuse are familiar with their abuser [4]. Statistics have found that 1 in 5 girls and 1 in 20 boys is a victim of child sexual abuse [5]. Hence, all children need to be taught about good touch and bad touch even before they are at the age of going to school. This is challenging as parents do not feel comfortable talking about this issue, especially in developing countries like Bangladesh [6].

Many initiatives and research have been done on leveraging information technology to prevent, detect and address child sexual abuse. For example, Endendijk et al. [7] developed a dress-up game that is used in therapy with victims of child sexual abuse while Scholes et al. [8] examined the development of a game-based approach to CSA prevention in Australia. Storytelling games is an innovative approach to teach children about good and bad touch, making education entertaining. Incorporating fun and interactive elements improves effectiveness in addressing sensitive topics while avoiding discomfort. Work has been done on special needs children but CSA is an unexplored area in Bangladesh [9] [10]. Thus, further research and development are required focusing on children aged 6 to

12 and in the context of developing countries like Bangladesh.

Therefore, the objectives of this research are to evaluate the ease of use of the existing sex education games for children, to propose an effective and usable prototype game to teach children about good touch and bad touch and to evaluate the usability performance of the proposed system. To achieve these research objectives, a literature review was carried out and the most related games were reviewed to extract features for developing a novel game to teach good touch and bad touch in the context of Bangladesh. Based on the availability, two games were selected. Then the selected games were evaluated through the Heuristic Evaluation approach [11] and usability problems were identified. Next, a prototype game was designed on *Scratch* [12] considering the revealed features and addressing the problems identified in the reviewed games. *Scratch* is a visual programming language that allows users to design their own interactive stories, games, and animations. Finally, the prototype was evaluated through Heuristic Evaluation (HE) and the System Usability Scale (SUS) [13] [14] to measure its usability performance.

The remainder of the paper is structured as follows: An overview of relevant work is given in Section II, focusing on existing sex education application for children and techniques used for feature extraction. Section III outlines the methodology employed to conduct a heuristic evaluation. The design of the prototype is detailed in Section IV. Section V presents the evaluation results of the prototype, while Section VI compares the prototype with selected existing games. Finally, Section VII discusses the key findings, limitations, and potential directions for future research.

II. LITERATURE REVIEW

This section briefly discusses the prior studies on game-based approaches focusing to the sex education, child sexual abuse, as well as protect or recovery from different types of abuse.

Although some of the studies focus on therapeutic approaches to help recover from abuse, prevention and therapy games have similar purpose of creating a safe, interactive environment for children where they can either learn to recognize this harmful behavior or process their emotions after experiencing abuse. For example, Pharsy et al. [15] designed a prototype storytelling app for children to express their daily experiences and associated emotions, helping parents monitor signs of abuse. Additionally, they surveyed parents in India and Canada and the results revealed widespread concern about CSA, with storytelling being the popular option to let the children know about this topic. Endendijk et al. [16] conducted an assessment of the therapeutic “Vil Du!?” designed for child sexual abuse victims. The evaluation revealed many positive aspects of the game such as putting the child in control and reducing barriers to disclosure. Moreover, they examined the acceptability of the game among therapists through questionnaires and semi-structured where the majority of the therapists evaluated the game positively, indicating high acceptability. In another study, Springer et al. [17] presented a

structured therapeutic game-based cognitive-behavioural therapy model aimed at supporting non-offending caregivers of sexually abused children. Using engaging therapeutic games, their research demonstrated positive outcomes, including emotional expression and reduced self-blame among caregivers. Similarly, Mikka et al. [18] created a game called “CyberBullet - Share Your Story” where the player has to select a character and navigate through various social media locations. Users addressed a variety of cyber concerns that they encounter and as the game progresses, the moral bar grows or shrinks. The game has aspects of adventure, storytelling, and quizzes, appealing to both boys and girls.

Again, Moon et al. [19] developed a Sexual Abuse Prevention Mobile Application for primary school children in Korea, and compared it to text-based education. The study found the app to significantly enhance children’s recognition and prevention of sexual abuse, with sustained and improving outcomes over four weeks. On the other hand, Crouch et al. [20] created a “Word Game” to study how parents’ implicit cognitive processes affect their risk of child physical abuse. High-risk parents showed more aggressive behaviour in the game. A summary of the features extracted from the most related works is portrayed in Table I. These features will be incorporated in the prototype game that is to be designed.

To sum up, several work has been found related to designing gaming applications to detect child abuse or support victims, with some focused on the parents and caregivers of the abused victim. However, no work was found that specifically designed a storytelling game to create CSA awareness among children or conducted usability evaluation. Moreover, none of the reviewed works focused on the users of Bangladesh. Therefore, this research focuses on designing and evaluating the ease of use of a storytelling game that will educate about good touch and bad touch in the context of Bangladesh.

TABLE I: Extracted Feature Table

Application and Reference	Extracted Features
A therapeutic game [7]	1. Engage in character interactions such as making the character walk or perform certain hand movements 2. Pause/ Stop button 3. Vibrant and colourful visuals/icons 4. Easy-to-perceive visuals
Children’s Storytelling App [15]	5. Avatar Selection
CyberBullet-Share Your Story [18]	6. Different levels with different stories 7. The user is given scenarios and they have to choose between options 8. Restart the game and home option for level selection 9. Unlock new levels as the user progresses with the game 10. Lively animation, visuals, and sounds

III. EVALUATION STUDY

A. Selection of Applications

Applications related to teaching children about good and bad touch were searched online by mid-October 2023 using search strings like ‘Good Touch Bad Touch Game’, ‘Sex Education Game’, and ‘Child Abuse Prevention Game’. After a comprehensive search, the two most related games were selected based on availability. *Child Abuse Prevention (CAP)* [21] is a mobile game developed by Mage Studio which has over 10,000 downloads and an average rating of 3.9. *The Good Touch Game (GTG)* [22] is a game published on TinyTap and has over 5,000 plays. TinyTap is a repository of educational games made by teachers, therapists, and education experts from around the world. The common features of these games include (a) Different levels with different stories; (b) The user is given scenarios, and they have to choose between options; (c) Vibrant and colourful visuals.

To evaluate the existing games, heuristic evaluation has been chosen to assess the overall usability of those systems. This technique has been selected because identification and focus on specific issues can be done without having to speak to the users [23].

B. Heuristic Evaluation

The heuristic evaluation was carried out by the authors of this article who have practical experience in usability and UX evaluation of software applications. The evaluators first familiarized themselves with the app’s context and target users. Each evaluator independently reviewed the apps, identifying issues based on Nielsen’s heuristics [11]. Additionally, problems were categorized using Nielsen’s severity levels (0-4), where 0 = no issue, 1 = aesthetic (fix if possible), 2 = minor (low priority), 3 = major (essential fix), 4 = critical (must fix before launch). Individual evaluation reports for each game were then compared to prepare a single aggregated report. During aggregation, all conflicts were solved through discussion.

Figure 5 displays a heuristic inspection of *The Good Touch Game*, where two friends are hugging—this is a good touch. If user incorrectly selects it as a bad touch, the game provides no feedback and proceeds with the wrong choice. This violates heuristics H5 (error prevention) and H9 (error recognition and recovery). The game should provide feedback on incorrect choices to prevent repeated mistakes.

It has also been seen that *Child Abuse Prevention* uses explicit language that is not age-appropriate. Moreover, the scenarios and context of the games are not relatable for Bangladeshi users. These problems violate the heuristic H2 (match between the system and the real world).

The number of problems (i.e., violations of the usability guidelines) violating each heuristic for both games is summarized in Fig. 2. The result shows that these two games have a good number of usability problems. A total of 31 problems have been found by evaluating the two games mentioned above, with an average severity of 3.06. Around 33% and

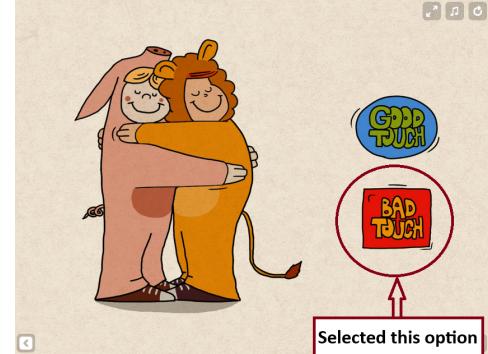


Fig. 1: Screenshot of a scene in “The Good Touch Game”

47% of the total revealed problems were catastrophic and major problems respectively. Violations have been observed in all heuristics, but the maximum number of violations was found for H4 and H7. Among the 31 problems, few example problems of both games have been presented in Table II.

Existing Games’ Heuristic Evaluation

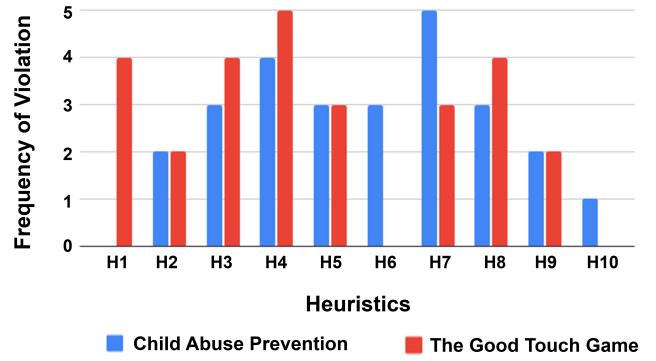


Fig. 2: Problems Identified Using Nielsen’s Heuristic

TABLE II: Examples of problems found during heuristic evaluation

Game Title	Problem No	Problem	Severity
Child Abuse Prevention	P01	No quit game option	4
	P02	Difficulty distinguishing visual options after a scenario.	4
	P03	The game progresses despite incorrect answer.	3
Good Touch Game	P01	There is no visible text if the wrong answer is selected	4
	P02	The game has very limited options.	4
	P03	No option to go back	3
	P04	Game freezes upon wrong option selection.	3

IV. DESIGN OF THE PROTOTYPICAL GAME

A prototypical game “Good Touch Bad Touch” was designed and developed on the Scratch platform [12] to address the revealed usability problems. The game

(<https://scratch.mit.edu/projects/91029106>) is designed for Bangladesh and is presented in Bengali, using a storytelling approach proven to enhance children's creativity, communication and cognitive development [24]. Key features of the game include:

- (a) Scenario and an environment tailored to Bangladesh context.
- (b) Use of native language
- (c) Selection of avatar (girl or boy)
- (d) Initial level focuses on educating children about good/bad touch.
- (e) Enhanced interactivity for improved user engagement
- (f) Immediate feedback on user choices
- (g) Use of considerate language without explicit terms

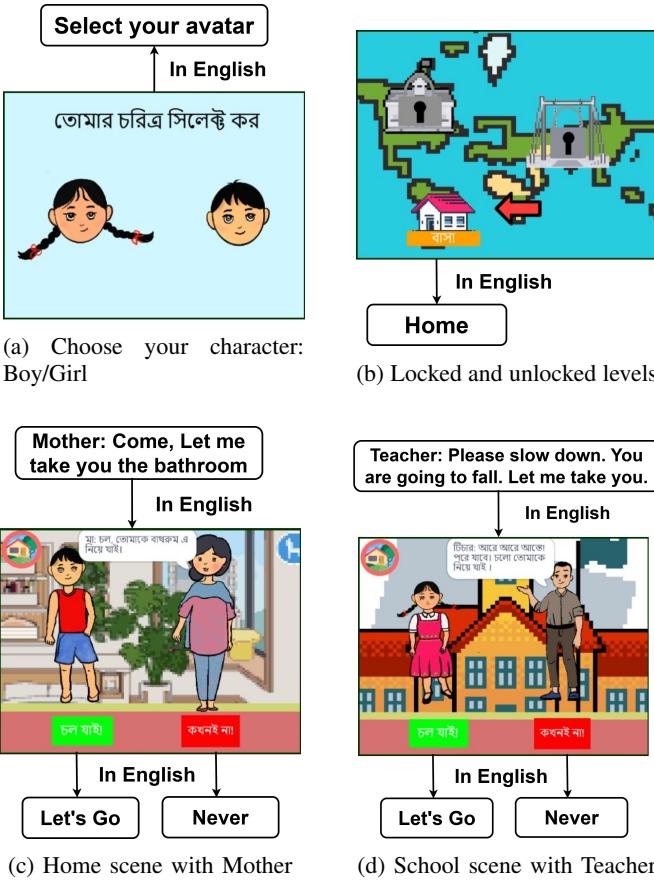


Fig. 3: Snapshots of the “Good Touch Bad Touch” game.

A few snapshots of the prototype are given in Fig. 3. The user will select an avatar (girl or boy), as shown in Fig. 3(a). The game has three levels representing three environments of home, school, and playground. The stories in the designed game were created keeping in mind that most child abuse cases are committed by individuals close to the children, such as relatives, school teachers and staff, and friends. Therefore, it is essential to teach the user about the safety circle. After selecting avatar, users navigate through three levels represented by icons on the home page (Fig. 3(b)). Level 1, set in the home environment, involves conversations with the

mother, uncle, and aunt. In Fig. 3(c), the boy avatar is seen having a conversation with his mother. After making choices, users receive immediate feedback, including an explanation of whether their decision was correct or not. Once all the appropriate options have been selected, level 1 successfully ends. The other two levels progress in the same manner. The flow diagram for all of the game mechanics is shown in Fig. 4.

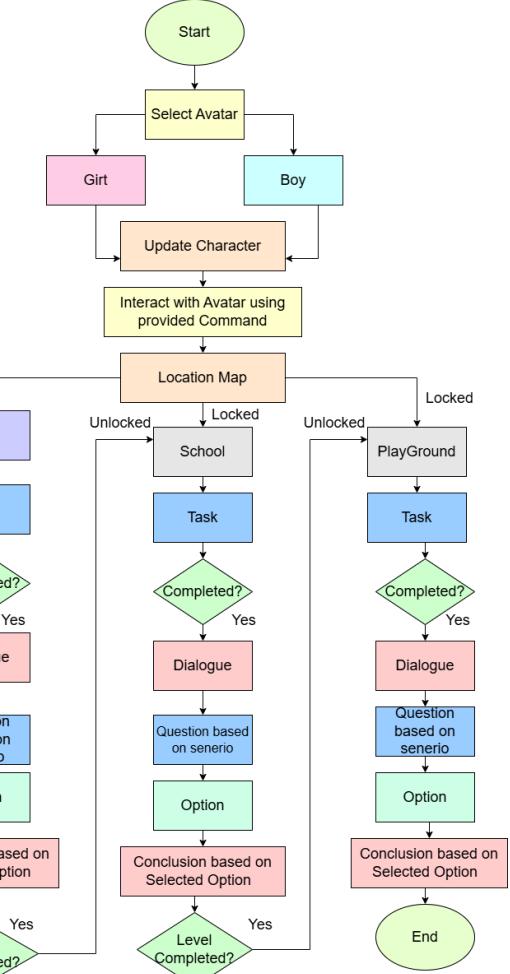


Fig. 4: Flowchart of the prototype game

V. EVALUATION OF THE PROTOTYPE

To evaluate the designed prototype properly, two methods are used: the System Usability Scale (SUS) [25] Evaluation and the Heuristic Evaluation [11].

A. System Usability Scale (SUS)

SUS [25] is a reliable tool for measuring usability. It contains ten questions with five response options for respondents (strongly disagree, disagree, neutral, agree, strongly agree). After taking participants' responses, those responses were converted into a number for each of the 10 questions {ranging from 1 point for strongly disagree to 5 points for strongly agree}. The SUS score of a participant is determined as follows. $X = \text{Sum of the points for all odd-numbered questions}$

$- 5 Y = 5 - \text{Sum of the points for all even-numbered questions}$
 $\text{SUS Score} = (X + Y) \times 2.5$

SUS score demonstrates the usability performance in the aspect of effectiveness, efficiency, and overall ease of use. If the SUS score is above 80.3, it is deemed *Excellent*(Grade A), 68 - 80.3 is considered *Good*(Grade B), 68 is *Graded C Okay*, while score between 51-68 is considered *Poor*(Grade D), and score less than 51 is considered *Awful*(Grade F). For the odd questions, the score should be high and for the even questions, the score should be low.

Children aged 6-12 might not fully understand the standard SUS questionnaires designed for older users. Inspired by [26], our facilitator simplified the SUS questions so that the children could easily comprehend and respond to them.

A total of 18 participants (11 girls and 7 boys) of varying ages, with an average age of 9.4 years, explored the designed game. Participants were recruited through acquaintances of the authors, including friends and family members. Ethical considerations were carefully addressed during the recruitment process, and parental consent was obtained for all participants.

Parents were present throughout the experiment, were informed of the study's nature, ensuring they understood their involvement. They were assured of confidentiality and voluntary participation. After playing the game, participants shared their experiences and responded to the SUS questions, with the average responses shown in Table III.

TABLE III: SUS questions with corresponding average scores

SUS Question	Average Score
Q1. I think that I would like to use this system frequently.	4.0
Q2. I found the system unnecessarily complex.	1.3
Q3. I thought the system was easy to use.	4.4
Q4. I think that I would need the support of a technical person to be able to use this system.	1.1
Q5. I found the various functions in this system were well integrated.	3.7
Q6. I thought there was too much inconsistency in this system.	2.3
Q7. I would imagine that most people would learn to use this system very quickly.	4.1
Q8. I found the system very cumbersome to use.	1.4
Q9. I felt very confident using the system.	3.8
Q10. I needed to learn a lot of things before I could get going with this system.	1.1

The overall SUS score for the designed system is 82.142 which is in the “Grade A” (*Excellent*) range of this evaluation technique. The score for only female participants is 82.75 and for the male is 81.0. Therefore, no significant difference is observed between the scores.

B. Heuristic Evaluation

The designed system was evaluated by four experts (three females and one male) having 2 to 4 years of professional experience in UI design and evaluation. All of them have completed several courses in human-computer interaction, usability and accessibility evaluation, and interface design. The experts' reports were compared to prepare a single aggregated report (see Table IV) while all conflicts were solved through discussion. The number of problems(i.e., violations of the

TABLE IV: Heuristic Evaluation Findings of Prototype Game

Problem No	Problem	Evidence	Severity
P01	The functionalities of the system are not consistent, and which task is to perform after which isn't clear.	H4	4
P02	Proper and structured documentation is not given to the users.	H9, H10	4
P03	The tasks' sequence is predefined. A user does not have any freedom to select the sequence of tasks, although tasks are not dependable on each other.	H3, H7	3
P04	The icons used in the design of the application are not understandable.	H2	3
P05	The bad touch situations are not realistic.	H2	3
P06	Only the status is shown when we reach the goal. In the middle, no status is shown.	H1	3

usability guidelines) violating each heuristic is summarized in Figure 5. A total of 6 problems were found that violated eight heuristics with an average severity of 3. H5, H6 and H8 were not found to be violated.

VI. COMPARATIVE ANALYSIS

A total of 15 and 16 usability problems were identified in *Child Abuse Prevention* and *The Good Touch Game*, respectively, while only 6 problems were found in the designed game, *Good Touch Bad Touch*. Figure 5 indicates that the existing games had significantly more heuristic violations, whereas the designed game had the fewest, with zero violations in heuristics H5, H6 and H8. Most issues in the existing games were categorized as catastrophic or major, while the designed game had fewer such problems. The designed game addressed

Comparative Analysis (Heuristic Evaluation)

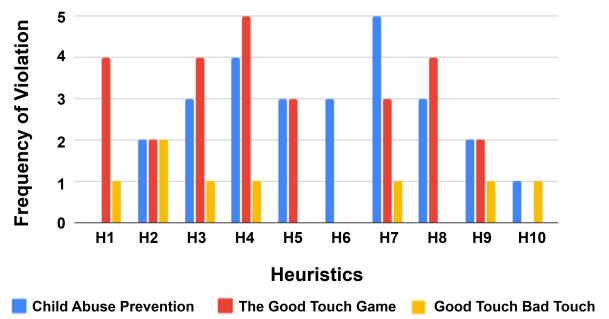


Fig. 5: Heuristics violated in each evaluated system

several issues present in the existing systems. For instance, *The Good Touch Game* had a dull design, while *Child Abuse Prevention* used animations that were hard to interpret. In contrast, the developed game features a colorful, engaging interface and clear animations, making it easier for children to understand scenarios. Additionally, the designed game provides consistent feedback for both correct and incorrect choices, unlike *The Good Touch Game*, which lacked proper feedback. Furthermore, *Child Abuse Prevention* used

explicit language unsuitable for children, whereas the designed game employs age-appropriate language.

VII. CONCLUSION

In this study, two games for sex education *Child Abuse Prevention* and *The Good Touch Game* were analyzed to extract their features and to identify the usability problems. A prototype game *Good Touch Bad Touch* was designed considering the revealed features and addressing the problems identified. All three games were evaluated and found that the proposed game had the least number of usability problems. Moreover, the frequency of the violation of each heuristic was also the lowest in the proposed game compared to the other games. Additionally, the SUS score of 82.14 indicates that the designed game has excellent usability performance. Therefore, it can be concluded that the designed game performs better than the existing sex education games in terms of usability. The contributions made through this research are as follows:

- (i) The existing games like [17], [18] focused on providing post-abuse therapy and raising awareness about cyberbullying; while the game developed in this study explicitly focused on raising CSA awareness through storytelling.
- (ii) Very few studies have conducted usability evaluations of their designed games for CSA awareness; while this research evaluate the existing gaming applications and evaluate the usability of the proposed game to determine its ease of use.
- (iii) Existing studies [15] and [19] have focused on regions like India, Canada, and Korea; while this study developed the game focusing to a specific country (Bangladesh) context.

The study has a few limitations like the evaluation was conducted following the heuristic evaluation approach only. Only a limited number of features were considered in the proposed *Good Touch Bad Touch* game. To make the system more appealing and practical, more levels with various real-scenarios can be included. In addition, user studies can be conducted to assess the acceptability of the game among the focused users.

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