Development Process and Usability Assessment of the SmartShield Web-Based Educational Module for Sexual Abuse Prevention

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Abstract

Background: Child sexual abuse is a global issue, stressing the need for early prevention education. SmartShield, a web-based tool, offers accessible, interactive materials to teach school children about the dangers, signs, and prevention of abuse. When it comes to challenging topics where conventional approaches are inadequate, it emphasizes the internet's potential as an engaging education tool.

Objective: This study aimed to document the process of designing and developing a web-based educational module on child sexual abuse prevention for primary school children and to assess the usability of the prototype.

Methods: The nominal group technique (NGT) was applied for content development of the web-based educational module, involving parents, health teachers, psychologists, counsellors, and child education specialists. The prototype was developed and hosted on the OpenLearning platform. A total of 30 participants, comprising teachers and parents of primary school children, were invited to access and use the platform. They assessed its usability using the validated Malay version of the System Usability Scale Questionnaire for the Assessment of Web-Based Platform questionnaire. A usability score of 68 was set as the cut-off for a usable web-based platform.

Results: The SmartShield Level 1 and SmartShield Level 2 web-based educational module were developed in local Malay language. The NGT discussion had suggested three main menus which are Front Page, Introduce Yourself, and Topics. The prototype was published in Openlearning platform. The mean (SD) usability scores was 93.1 (7.73) for SmartShield Level 1 and 92.1 (9.70) for SmartShield Level 2 which indicates that SmartShield is a usable web-based educational module and it can be used as a tool for school programs on sexual abuse prevention.

Conclusions: The SmartShield a web-based educational module, can function as a user-friendly tool for school education programs on sexual abuse prevention.

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Introduction

The World Health Organization (WHO) classifies child sexual abuse (CSA) as a ‘silent health emergency,’ (1). The phrase describes a serious public health emergency that has received limited awareness and response from the public, authorities, and healthcare practitioners (2). Global CSA prevalence ranges from 8-31% for girls and 3-17% for boys, with 9 out of 100 girls and 3 out of 100 boys experiencing forced intercourse (3). A meta-analysis of 55 studies from 24 countries found global CSA rates at 11.8% for girls and 7.9% for boys. Rates are higher in African countries, reaching 34.4% for girls and 19.3% for boys. European countries report lower rates, about 7% of UK young adults reported abuse before age 16 (4,5). The actual global prevalence of CSA is likely much higher (6).

The Royal Malaysian Police recorded 4,278 cases of child abuse in 2007 and 2008 and 2,193 cases from January to July 2009. From 2010 to May 2017, the Women, Family, and Community Development Ministry reported 13,272 rape cases (59.7%), 1,796 incest cases (8.07%), 1,152 unnatural sex cases (5.18%), and 6,014 sexual assault cases (27.04%) involving children (7–9). With the consistent increase in these statistics, Malaysia is projected to exceed 10,000 cases in the next decade (10). One approach to assist children in identifying sexual abuse is through sexual education (11). The United Nations Educational, Scientific and Cultural Organization (UNESCO) recommends that sex education guidelines be age-appropriate, evidence-based, culturally sensitive, and comprehensive (14). Due to frequent misinformation in children’s sexual education, there is an urgent need for a proper school-based education module (13).

In the digital era, technology and education work together to address complex issues in society, especially preventing sexual abuse (14). Integrating effective sexual abuse prevention in school curricula is urgent, given alarming global statistics, highlighting the need for accessible, age-appropriate, and cost-effective strategies (15). Usability in educational technology involves ease of use, engagement, content relevance, and accessibility, all essential for enhancing learning outcomes

and effectively conveying critical messages (16,17). This usability assessment aims to contribute to best practices in educational technology for CSA prevention (18). This study focuses on developing and assessing the usability of the *SmartShield* for sexual abuse prevention, tailored for primary school children.

Methods

This study involves content consolidation, prototype development, and prototype usability assessment by the intended user. The details of the processes are provided below.

***Content consolidation*:** The content of the module for primary school children covered body parts, safe touches, puberty, sexual grooming, and pornography, based on Malaysia's Ministry of Education curriculum, UNESCO guidelines, and literatures review (19). The modules cover key knowledge, attitudes, and skills essential for sexual abuse prevention. Combining these domains empowers children by providing foundational knowledge, fostering self-awareness, and equipping them with practical skills to respond effectively to potential abuse. UNESCO's eight key concepts aim to equip children with knowledge, attitudes, and skills for health, well-being, and dignity. These concepts include: (i) relationships, (ii) values, rights, culture, and sexuality, (iii) understanding gender, (iv) safety from violence, (v) health skills, (vi) body and development, (vii) sexuality and behavior, and (viii) sexual and reproductive health (19).

A nominal group technique (NGT) ensured the *SmartShield* prototype included relevant content and user-friendly features. This structured approach gathered expert input through small group discussions, following four stages: silent generation, round-robin, clarification, and voting (20). For the consolidation of *SmartShield*, the NGT focused on three areas: identifying essential user knowledge, ensuring self-explanatory content for clarity, and designing a user-friendly website to improve accessibility (17). The NGT included diverse professionals and stakeholders, such as a child

educationist, psychologist, counselor, health education teacher, and four user representatives. Participants were briefed two weeks before the session. The researcher (MNMP) moderated the online session, starting with an introduction to the problem statement and session objectives. Participants first wrote down ideas for a user-friendly website and sexual abuse prevention info during the silent generation phase. In the sharing phase, ideas were shared in a round-robin format and recorded on an online whiteboard. Participants then discussed and elaborated on their suggestions, followed by voting to prioritize ideas. The session ended with the moderator summarizing the agreed points on the whiteboard.

***Prototype Development*:** Insights from the NGT influenced the prototype's content and design, which was uploaded to the OpenLearning platform. It underwent preliminary testing by NGT participants, focusing on understandability and functionality. Feedback was incorporated into the final version with email account access. Two prototypes were developed, named *SmartShield* Level 1 for lower primary school children and *SmartShield* Level 2 for upper primary school children.

***Prototype Usability Assessment**:* A cross-sectional study was conducted to assess the usability of the *SmartShield* platform users, specifically teachers and parents of primary school children, using purposive sampling. Sample size estimation followed a single mean formula, with a standard normal distribution value of 1.96 and a standard deviation of 11.52 for the *ColorApp* prototype usability score (17). After accounting for a detectable difference of 5 units and a 20% non-response rate, the required sample size was 30. Researchers invited teachers and parents of primary school children to participate in the study and explained its purpose. Those who agreed completed a consent form and received two *SmartShield* links for evaluation. The first link was for *SmartShield* Level 1 (ages seven to nine), and the second was for *SmartShield* Level 2 (ages ten to twelve). Participants accessed the platform at their convenience over two weeks, with each session lasting about 20 minutes.

***Measuring tool*:** The usability of the web-based prototype was assessed using the validated Malay version of the System Usability Scale (SUS) Questionnaire, known in Malay as 'Skala Kebolehgunaan Platform Sesawang.' This 10-item questionnaire, translated from the original English version, has been adapted for local Malay language use (21). The Malay version has been validated to assess the usability of web platforms. Responses are scored on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The overall score is calculated by summing all item scores and multiplying by 2.5, resulting in a range from 0 to 100. A standard usability score of 68 is recommended to indicate good usability of a web platform (17). Data entry and statistical analysis were conducted using IBM SPSS version 27. Descriptive statistics were used.

Results

Nominal Group Technique Outputs: All participants agreed that the SmartShield web-based prototype should include key topics such as a front page, an 'Introduce Yourself' section, and other relevant subjects. The primary language selected was Malay, with plans to add more languages later. 'Sexual abuse' was translated as 'Penderaan seksual.' To enhance clarity and accessibility, the content was simplified into videographics with narrative explanations in straightforward language. The prototype features were designed to be user-friendly, incorporating easy navigation, clear language, bullet points, infographics, videos, and interactive elements.

Prototype development: The web-based prototype, *SmartShield*, was developed for the Openlearning platform. Users first encounter the front page, which presents essential information on sexual abuse prevention and includes an option to watch a brief related video. Internet access is required to access all features, and additional sections cover various topics related to sexual abuse prevention. The interfaces of *SmartShield* Level 1 (Figure 1) and *SmartShield* Level 2 (Figure 2) are shown.

***Usability assessment*:** A total of 30 participants were involved in the usability assessment of *SmartShield* Level 1 and *SmartShield* Level 2. Table 1 presents the sociodemographic characteristics of the participants in this study.

Table 1. Sociodemographic characteristics of participants (n = 30)

Characteristics	n (%)
Age (years)	42.4 (7.24)[a]
Sex	
Male	11 (36.7)
Female	19 (63.3)
Highest education level	
Secondary	6 (20)
Tertiary	24 (80)
Occupation	
Unemployed	2 (6.7)
Self-employed	4 (13.3)
Retired	3 (10.0)
Clerical work	7 (23.3)
Professional	14 (46.7)

[a]mean (SD)

Usability assessment of SmartShield 1 module for lower primary school children: Thirty respondents participated in the usability assessment. The System Usability Scale scores for the *SmartShield* 1 module range between 72.5 and 100.0. It is skewed to the left with a median (IQR) of 95.0 (89.38, 98.13) and a mean (SD) of 93.1 (7.73).

Usability assessment of SmartShield 2 module for upper primary school children: Thirty respondents participated in the usability assessment. The System Usability Scale scores for the *SmartShield* 2 module range between 70.0 and 100.0. It is skewed to the left with a median (IQR) of

96.3 (87.5, 100.0) and a mean (SD) of 92.1 (9.69).

Discussion

The *SmartShield* web-based module incorporates the Ministry of Education's health curriculum, covering body parts, safe touches, pubertal changes, sexual grooming, reproductive systems, and pornography. It uses simple language, visuals, videos, and animations, following the VARK theory with visual, auditory, and kinesthetic activities (24). The *SmartShield* content was developed using the NGT, a semi-qualitative method that explores the preferences of the target group (25). It ensures all members contribute to discussions, minimizes dominance by any one person, and helps identify and prioritize key issues for content development (26). The *SmartShield* Level 1 covers body parts, safe and unsafe touches, self-protection, and prioritizing safety. The *SmartShield* Level 2 includes signs of maturity, personal hygiene, sexual grooming, menstrual cycles, human fertilization, and self-protection. The two levels differ in content focus, tailored to different age groups and maturity levels.

This study utilized the SUS questionnaire because it is widely used, and findings from Indonesia also conclude that this version is reliable for usability practitioners (26). The questionnaire was also used to assess a mobile app on colorectal cancer education, where users found it user-friendly for community learning (17).

Other studies have used tools like the Post-Study System Usability Questionnaire (PSSUQ) and the Computer System Usability Questionnaire (CSUQ) for usability assessments. These questionnaires are similar in evaluating system usefulness, information quality, and interface quality, and their findings correlate with SUS scores (26). However, as these questionnaires have not been translated into Malay, the SUS questionnaire was used in this study.

SmartShield's usability scores exceed the minimum threshold, demonstrating its user-friendliness for its target audience. Originating from a school-based CSA intervention program, it holds potential for

enhancing school-based CSA interventions. Usability assessments can further enhance the effectiveness of these programs, which have been shown to significantly improve students' knowledge, attitudes, and skills. A systematic review and meta-analysis of 29 school-based CSA intervention programs confirmed their effectiveness in enhancing these key areas among students (27).

Usability assessments are crucial for the success of educational programs. This study's findings, with scores exceeding the minimum threshold, instill confidence in its effectiveness, improving the learning experience and educational outcomes for researchers, educators, and parents (18,28).

Strength and Limitation

The creation of *SmartShield*, a web-based tool, is seen as a strength for educating primary school students on sexual abuse prevention and represents an innovative approach to disseminating information about sexual abuse (29). Developing this tool is relatively cost-effective compared to producing printed materials, and it offers the added advantage of easy updates to ensure information remains current. Parents and teachers can utilize this content to enhance their children's understanding of the topic. Leveraging the web, which aligns with contemporary information-seeking trends, is a strategic move to educate the public and enhance their knowledge. Freely accessible on OpenLearning, *SmartShield*'s social media-friendly features facilitate wider community outreach. However, a limitation of this study is that the assessment of the web-based prototype was conducted solely through computers and smartphones with internet access.

Future Recommendation

In the future, *SmartShield* web-based educational module should be available in English, Chinese dan Tamil as these languages are frequently used in Malaysia and to broaden its reach, thereby enhancing knowledge transfer and improving user understanding. Future research should also focus

on evaluating the effectiveness of this web-based educational module in enhancing knowledge about sexual abuse, as well as its impact on attitudes and practices related to the prevention of sexual abuse.

Conclusion

The newly developed *SmartShield* Level 1 and *SmartShield* Level 2, which are web-based educational module for sexual abuse prevention, have undergone usability testing and emerged as potentially valuable tools in the modern technological era.

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Supplementary Files

Figures

Interface of SmartShield Level 1.

Interface of SmartShield Level 2.