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Strengthening Protective Skills Through SmartShield Web-based Interactive Modules

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ABSTRACT

Child sexual abuse is a serious public health issue, yet protective skills against sexual abuse are poorly addressed in the Malaysian primary school curriculum. This study evaluated the effectiveness of SmartShield modules in enhancing these skills among Malaysian primary school students. A quasi-experimental controlled trial used stratified multistage cluster sampling. Six government primary schools were randomly selected across five regions. Within each school, one lower- and one upper-primary class was selected. The sample size, calculated by comparing two means, included 912 children for SmartShield 1 and 912 children for SmartShield 2. SmartShield 1 consisted of two modules, while SmartShield 2 consisted of a single module. Skills were assessed at baseline, after Week 2, and after Week 4 based on validated questionnaires. Data were analysed using repeated measures analysis of variance (ANOVA), adjusted for sex and region. For lower primary, the response rates for the intervention and control groups were 96.5% (440/456) and 96.7% (441/456), respectively. For upper primary, the respective rates were 96.7% (441/456) and 95.6% (436/456). The intervention group showed significant improvements in skills scores across all modules ($p < 0.001$), indicating the effectiveness of the SmartShield programme. In lower primary, adjusted mean scores increased from 87.6% to 98.5% in the intervention group versus 90.3% to 94.8% in the control group. In upper primary, scores improved from 91.3% to 98.9% (intervention) versus 85.7% to 97.0% (control). The SmartShield programme was effective in enhancing child sexual abuse prevention skills among Malaysian primary school children.

Keywords: *Child sexual abuse, Effectiveness, Skills, Prevention, SmartShield*

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INTRODUCTION

Child sexual abuse (CSA) is a significant global public health issue with emotional, physical and other adverse health impacts (1). CSA refers to the involvement of an underage child in sexual activity, which minors do not fully comprehend, to which they cannot consent, for which they are not developmentally prepared, and which violates the laws or social taboos of society (2). Globally, an estimated 35.7% of girls and 17.4% of boys have been subjected to sexual abuse (3). CSA can have serious and wide-ranging long-term effects, including chronic health problems, mental disorders (e.g., depression and post-traumatic stress disorder [PTSD]) and risky behaviours (e.g., substance use and unsafe sexual activity) (4).

CSA prevention is most effective when started early and continued through primary school, which is a critical period for learning essential safety skills such as recognising danger, refusing inappropriate touch, and turning to trusted adults for help (5). In Malaysia, CSA remains a serious issue, with over 6,000 cases reported between 2017 and 2021, mainly involving rape, molestation and incest (6). These figures likely underestimate the true prevalence due to underreporting and limited awareness among children.

Many countries have responded to this widespread problem by introducing school-based programmes to build children's ability to recognise risky situations and protect themselves. For example, in Germany's Individuelle Gesundheitsleistungen (IGEL) programme, trained teachers helped children improve their awareness and resistance strategies (7). In China, picture books and structured classroom activities were used to improve children's understanding of personal boundaries and their confidence to speak out (8). In South Korea, a mobile-based learning tool raised students' awareness of personal safety through interactive digital content (9).

Despite growing concern, Malaysia still lacks a standardised school-based CSA prevention programme. This highlights the urgent need for culturally appropriate modules in schools (10). The innovative SmartShield programme was developed as a web-based, interactive educational tool to strengthen prevention skills among primary school children. Designed for lower and upper primary levels, the module integrates culturally relevant content, interactive learning methods and child-friendly teaching approaches. While SmartShield is a promising preventive education tool, its impact on children's understanding and practical skills related to CSA has not been thoroughly evaluated. This study aimed to assess the effectiveness of SmartShield modules in enhancing protective skills against sexual abuse among Malaysian primary school students.

METHODS

Population

A quasi-experimental controlled trial was employed. The target population consisted of students from government schools, covering both lower primary (ages 7–9) and upper primary (ages 10–12) levels. The exclusion criteria included student absence during intervention sessions or a diagnosed learning disorder (e.g., dyslexia or attention deficit disorder), as reported by their teachers or documented in school health records. Both the intervention and control groups were subject to similar inclusion and exclusion criteria, decreasing potential selection bias.

Sampling

A stratified multistage cluster sampling method was employed. Malaysian states were categorised into five geographic regions: Northern, Middle, Southern, Eastern and East Malaysia (Figure 1). Six government primary schools were randomly selected across the five regions. One lower-primary and one upper-primary class were randomly chosen from each school. All students in the selected classes were invited to participate in the study.

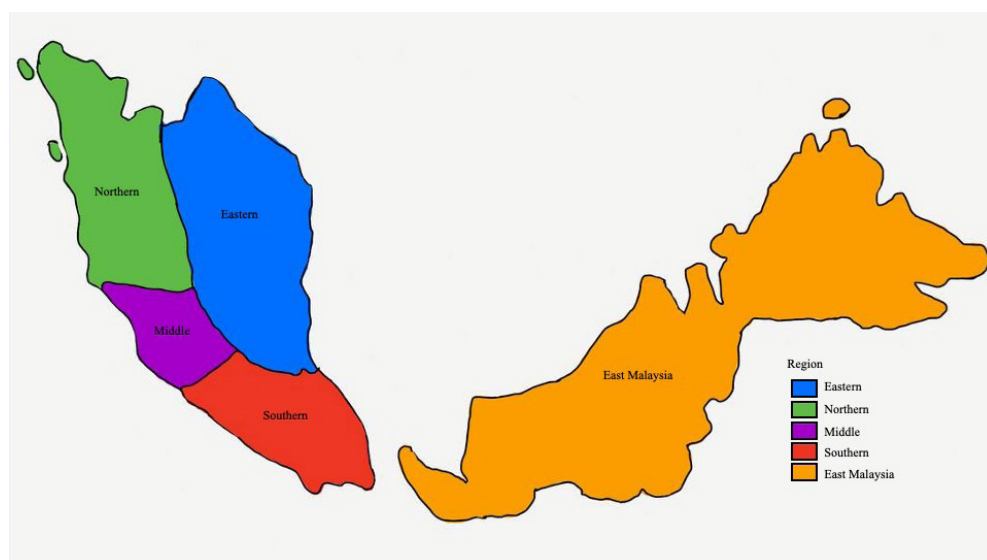


Figure 1: Malaysian states were categorised into five geographic regions including Northern, Middle, Southern, Eastern and East Malaysia

Sample Size

The required sample size was calculated using Power and Sample Size Calculation software (Microsoft Corp., 2012) based on a comparison of two means. The minimum detectable difference was set at 2, with a significance level of 0.05, statistical power of 80%, and a standard deviation (SD) of 3.47, derived from the 'Feeling Special, Feeling Safe' CSA prevention programme conducted in New Zealand (11). The ratio between the control and intervention groups was 1:1. After applying a design effect of 2, the minimum required sample size was 380 children. To allow for an anticipated non-response rate of 20%, the final estimated sample size was increased to 456 children per group for both lower and upper primary school students.

Interventions

The intervention consisted of two educational modules: SmartShield 1 for lower primary students and SmartShield 2 for upper primary students. The SmartShield programme was developed by consolidating content from the national Health Education textbooks published by the Ministry of Education Malaysia. The textbook content has formed part of the curriculum since 1994, with the most recent revision implemented in 2020. The materials were converted into animated videos, and their content was validated by experts in child education, psychology, school counselling and health education.

Both modules were designed with age-appropriate content tailored to the developmental needs of primary school children and aligned with the curriculum prescribed by the Malaysian Ministry of Education. SmartShield 1 consisted of 13 animated videos focused on communication, help-seeking skills, personal safety, privacy skills, situational awareness, and avoidance skills. The content of SmartShield 1 was divided equally between Modules 1A and 1B (Table 1). SmartShield 2, also consisting of 13 animated videos, addressed assertive communication, refusal, self-protection, escape, body safety, privacy, reporting and help-seeking skills. The content of SmartShield 2 was presented as Module 2 (Table 2). All modules were developed in the Malay language.

The SmartShield 1 and SmartShield 2 questionnaires were developed to assess CSA prevention skills among lower and upper primary school students, respectively. The SmartShield 1 skills questionnaire assessed content from Modules 1A and 1B and consisted of 5 items, with an internal consistency coefficient of 0.677 (12). The SmartShield 2 skills questionnaire encompassed a broad range of topics related to Module 2 and consisted of 10 items, demonstrating an internal consistency coefficient of 0.760 (12).

Table 1: Description of the contents in SmartShield 1 module

No.	Title	Description	Duration
Module 1A			
1.	Safe touch situations	Describe examples of safe touch situations. The situations include a mother bathing the baby, a doctor treating children, and a teacher helping an injured pupil.	2 min 40 sec
2.	Unsafe touch situations	Provides examples of unsafe situations, such as a strange man coming and holding your hand or touching your body parts.	1 min 52 sec
3.	Self-awareness	Emphasises to students the importance of protecting their body parts, being cautious in potentially dangerous situations, and deciding to act appropriately, if needed.	2 min 40 sec
Module 1B			
4.	Prioritise safety	Encourage students to take care of themselves, prioritise their safety, and take appropriate actions to protect themselves in dangerous situations.	1 min 26 sec
5.	Act quickly	Aims to educate children on the actions they must take if they find themselves in harmful or dangerous situations, emphasising the importance of reacting swiftly to protect their safety.	1 min 34 sec
6.	Act wisely	Describe the concept of acting wisely in different situations and provide examples where thoughtful decision-making is crucial.	1 min 28 sec

Table 2: Description of the topic in SmartShield 2 module

No.	Title	Description	Duration
Module 2			
1.	Self-awareness	Emphasises to students the importance of protecting their body parts, being cautious in potentially dangerous situations, and deciding to act appropriately, if needed.	2 min 40 sec

(Continued on next page)

Table 2. (continued)

No.	Title	Description	Duration
2.	Act quickly	Aims to educate children on the actions they must take if they find themselves in harmful or dangerous situations, emphasising the importance of reacting swiftly to protect their safety.	1 min 34 sec
3.	Act wisely	Describe the concept of acting wisely in different situations and provide examples where thoughtful decision-making is crucial.	1 min 28 sec
4.	Sexual grooming in children	Provides information on sexual grooming indicators and warning signs, enabling children to identify and defend against these harmful practices.	2 min 34 sec
5.	Situations of sexual grooming in children	Outlines the potential for sexual grooming, teaches about groomers' manipulation of victims, and highlights red flags to be aware of to prevent and address such incidents.	1 min 20 sec
6.	Prioritise safety	Emphasises the importance of personal safety and provides examples of dangerous situations.	1 min 26 sec

Outcomes

Skills in this study refer to students' ability to apply child sexual abuse prevention concepts in given scenarios, rather than only recalling factual knowledge. These were assessed using a structured questionnaire presented in scenario-based or applied items. Responses were rated using a 3-point scale: 2 for a correct response, 1 for 'not sure', and 0 for an incorrect response. Items that were negatively worded were reverse-coded to ensure consistency in scoring.

The SmartShield 1 skills questionnaire had a total score range of 0 to 10 (Table 3), while the SmartShield 2 skills questionnaire ranged from 0 to 20 (Table 4). All raw scores were summed and converted into percentage scores for ease of interpretation. Higher scores indicate a higher level of demonstrated child sexual abuse prevention skills, as measured by the questionnaire, among students.

Table 3: Items of SmartShield 1 skills questionnaire

No.	Items	Yes	No	Not sure
1.	Screams for help when the teacher asks to do schoolwork.	0	2	1
2.	Closes the door when changing clothes.	2	0	1
3.	Avoid walking alone through isolated places.	2	0	1
4.	Report to the teacher if someone tries to lift your shirt.	2	0	1
5.	Report to your parents if someone slaps your buttocks.	2	0	1

Table 4: Items of SmartShield 2 skills questionnaire

No.	Items	Yes	No	Not sure
1.	I say, 'don't touch' when a stranger touches my head.	2	0	1
2.	Run to a safe place if a stranger chases you.	2	0	1
3.	Say 'no' if someone online asks you to do something bad.	2	0	1

(Continued on next page)

Table 4. (continued)

No.	Items	Yes	No	Not sure
4.	Screams for help when the teacher asks to do schoolwork.	0	2	1
5.	Wear proper clothes to protect your body.	2	0	1
6.	Close the door when changing clothes.	2	0	1
7.	Avoid going through isolated places alone.	2	0	1
8.	Say 'no' if someone tries to touch your private parts.	2	0	1
9.	Tell your teacher if someone tries to lift your shirt.	2	0	1
10.	Tell your parents if someone slaps your bottom.	2	0	1

The recruitment period extended from June 2023 to August 2024. Informed consent forms were distributed to parents or guardians via the class teachers. Participants were informed that their involvement was voluntary and that they could withdraw without consequence.

Data collection spanned four weeks for lower primary students and two weeks for upper primary students. At Week 0, lower primary students completed a self-administered but guided questionnaire that included sociodemographic information and baseline items assessing SmartShield 1 skills. Following baseline assessment, the intervention group received SmartShield Module 1A, while the control group continued with the standard national curriculum without exposure to the intervention. In Week 2, both groups completed the SmartShield 1 questionnaire corresponding to Module 1A, after which the intervention group proceeded to SmartShield Module 1B. At Week 4, both groups completed the SmartShield 1 questionnaire related to Module 1B.

For upper primary students, data collection began at Week 0 with a guided, self-administered questionnaire that included sociodemographic information and baseline items assessing SmartShield 2 skills. Immediately thereafter, the intervention group received SmartShield Module 2, while the control group continued with the standard national curriculum without exposure to the intervention. At Week 2, both groups completed the SmartShield 2 questionnaire related to Module 2.

All assessments were conducted during school hours under the supervision of classroom teachers. During the study, the students remained seated together in their classrooms while the SmartShield content was displayed using a projector. They participated in the activities with guidance from research assistants, while the class teacher assisted in maintaining order. The SmartShield videos were designed to be engaging and accessible, incorporating cartoons, simple explanations, visual elements and sounds. Teachers did not deliver the sessions and therefore did not require specialised training; their role was limited to classroom management and supporting questionnaire administration.

The questionnaires were administered in a paper-and-pencil format, with students responding individually under the guidance of the classroom teacher. A research assistant read the items aloud, one sentence at a time, while students completed their responses independently. For lower primary students, the intervention was delivered in two 20-minute sessions (Modules 1A and 1B) to accommodate attention spans and enhance engagement. Each session featured interactive video content facilitated by classroom teachers within the school setting. The control group did not receive any component of the SmartShield modules during the study period and continued with the standard national curriculum, which refers to the mainstream education provided to all students in government schools using official textbooks and teacher-led classroom instruction.

In this study, effectiveness refers to the extent of improvement in child sexual abuse prevention skills following the SmartShield intervention. It was operationally defined as the difference in percentage scores between pre-intervention and post-intervention assessments using the SmartShield skills questionnaires. An increase in post-intervention scores compared to baseline indicates improvement in the targeted outcomes. This approach is consistent with quasi-experimental evaluation designs commonly used in educational and behavioural intervention studies, where effectiveness is assessed based on measurable changes in outcome scores over time (13).

Following the intervention, the SmartShield programme was made available for use by children in the classroom or at home under the guidance of teachers or parents. SmartShield was delivered via the OpenLearning platform, a massive open online course (MOOC) that is free, web-based and accessible to the public.

Statistical Methods

Data were analysed using IBM SPSS Statistics version 29.0 (SPSS Inc., 2019). Preliminary data cleaning was performed prior to analysis. Repeated-measures analysis of variance (RM ANOVA) was employed to evaluate changes in skills scores over time, both within and between groups. The analysis was adjusted for potential confounding variables, including sex and geographic zone.

RESULTS

SmartShield 1 (Lower Primary)

Participants in the intervention and control groups were successfully recruited, with response rates of 96.5% (440/456) and 96.7% (441/456), respectively. The distribution of sex was nearly equal between groups ($p = 0.944$), with males comprising 48.2% ($n = 212$) of the intervention group and 51.7% ($n = 228$) of the control group. Participants were evenly distributed across the five geographic zones ($p = 0.844$), with proportions ranging from 19.5% to 20.2% in the intervention group and from 19.7% to 20.4% in the control group. The majority of participants identified as Malay (95.9% in the intervention group and 94.3% in the control group).

Module 1A demonstrated good test-retest reliability with an intraclass correlation coefficient (ICC) of 0.89. Module 1B yielded an ICC of 0.78, and the overall ICC for SmartShield 1 was 0.69, indicating moderate reliability.

The group-time interaction from the RM ANOVA indicated a significant difference in mean skills score changes between the intervention and control groups, after adjusting for sex and geographic zone, for Module 1B ($p < 0.001$) and for the combined assessment of Module 1A and Module 1B ($p < 0.001$). However, no significant difference in mean skills score changes was observed between the intervention and control groups after adjusting for sex and geographic zone for Module 1A ($p = 0.503$) (Table 5).

Analysis of the main group effect of the RM ANOVA revealed a significant difference in mean skills scores between the intervention and control groups, after sex and zone adjustment, for Module 1B [mean (95% CI): 93.0 (92.1, 93.9) versus 92.3 (91.4, 93.1), $p < 0.001$] and the combination of Modules 1A and 1B [mean (95% CI): 93.0 (92.3, 93.9) versus 92.5 (91.8, 93.3), $p < 0.001$], but not for Module 1A [mean (95% CI): 93.5 (92.2, 94.7) versus 93.6 (92.4, 94.9), $p = 0.869$].

Table 5: Comparisons of sexual abuse prevention skills among lower primary school children between intervention and control groups

Group	n	Desc Mean ^a (SD ^b)		EMM ^c (95% CI ^d)		F stat ^e (d ^f)	η ² p ^g	p-value ^h
		Base ⁱ	Post ^j	Base ⁱ	Post ^j			
Module 1A								
Intervention	440	91.8 (19.70)	95.2 (16.43)	91.8 (90.0, 93.7)	95.1 (93.5, 96.7)	0.03 (1)	0.111	0.503
Control	441	92.6 (19.00)	94.7 (19.95)	92.6 (90.8, 94.4)	94.7 (93.1, 96.3)			
Module 1B								
Intervention	440	86.6 (15.06)	99.4 (3.68)	91.9 (90.0, 93.7)	99.4 (98.5, 100.3)	48.31 (1)	0.224	< 0.001
Control	441	89.7 (14.81)	94.8 (13.21)	92.6 (90.8, 94.4)	94.8 (94.0, 95.7)			
Overall								
Intervention	440	87.7 (14.06)	98.6 (4.40)	87.6 (86.4, 88.9)	98.5 (97.7, 99.4)	39.46 (1)	0.203	< 0.001
Control	441	90.3 (13.16)	94.8 (11.42)	90.3 (89.0, 91.5)	94.8 (94.0, 95.6)			

Notes: ^a Descriptive mean; ^b Standard deviation; ^c Estimated marginal mean; ^d Confidence interval; ^e F statistic; ^f Degree of freedom; ^g Partial Eta Squared; ^h Group-time interaction of repeated measure analysis of variance after adjusting for sex and zone; ⁱ Baseline; ^j Post-intervention

SmartShield 2 (Upper Primary)

The response rates for the intervention and control groups were 96.7% (441/456) and 95.6% (436/456), respectively. The distribution of sex was very similar between the two groups ($p = 0.421$), with males accounting for 47.4% ($n = 209$) of the intervention group and 51.1% ($n = 223$) of the control group. Participants were evenly distributed across the five geographic zones ($p = 0.799$), with proportions ranging from 19.7% to 20.2% in the intervention group and from 19.0% to 20.6% in the control group. Most participants identified as Malay (90.9% in the intervention group and 95.2% in the control group). SmartShield 2 showed good test-retest reliability, with an ICC of 0.94.

The group-time interaction in the RM ANOVA revealed a significant difference in mean skills score changes between the intervention and control groups, after adjusting for sex and zone, in Module 2 ($p < 0.001$) (Table 6). The main group effect also showed a significant difference in mean skills score changes between the intervention and control groups, after adjusting for sex and zone, for Module 2 [mean (95% CI): 95.1 (94.5, 95.8) versus 91.4 (90.7, 92.0), $p < 0.001$].

Table 6: Comparisons of sexual abuse prevention skills among upper primary school children between intervention and control groups

Group	n	Des ^c Mean ^a (SD ^b)		EMM ^c (95% CI ^d)		F stat ^e (d ^f)	η ² p ^g	p-value ^h
		Base ⁱ	Post ^j	Base ⁱ	Post ^j			
Module 2								
Intervention	441	91.3 (11.14)	98.9 (3.22)	91.3 (90.2, 92.4)	98.9 (98.4, 99.4)	63.83 (1)	0.369	< 0.001
Control	436	85.7 (12.88)	97.0 (6.69)	85.7 (84.6, 86.9)	97.0 (96.5, 97.5)			

Notes: ^a Descriptive mean; ^b Standard deviation; ^c Estimated marginal mean; ^d Confidence interval; ^e F statistic; ^f Degree of freedom; ^g Partial Eta Squared; ^h Group-time interaction of repeated measure analysis of variance after adjusting for sex and zone; ⁱ Baseline; ^j Post-intervention

DISCUSSION

This study provides empirical support for the effectiveness of the SmartShield programme in strengthening sexual abuse prevention skills among primary school children in Malaysia. Children in both lower and upper primary levels who participated in the intervention demonstrated significantly greater improvements in protective skills than those in the control group. These findings provide locally generated evidence for the programme's value in strengthening CSA prevention efforts within Malaysian primary schools.

Our findings align with international evidence showing that structured CSA prevention programmes can significantly enhance children's protective skills. The Childhelp Speak Up Be Safe (CHSUBS) programme for high school students in the United States significantly improved students' CSA prevention skills ($p < 0.001$) and strengthened their ability to use resistance strategies. Similarly, a school-based CSA prevention programme for primary school children in Beijing, China, reported significant improvement ($p < 0.001$) in self-protection skills (14). These findings support the approach adopted in the SmartShield programme (15). Notably, however, many existing programmes rely on trained facilitators or classroom teachers for delivery, whereas SmartShield achieved comparable outcomes using a digital format requiring minimal human facilitation.

The IGEL prevention programme, implemented by trained teachers, has been used with primary school children in Germany. IGEL means 'hedgehog' in German, connoting strong self-protection. The programme teaches children what abuse is and how to stay safe. Programme participants demonstrated better protective skills than non-participants (16). While SmartShield similarly focuses on developing self-protective skills, it differs in its delivery method, employing a video-based format with minimal teacher involvement.

Other interventions targeting younger children have also demonstrated positive outcomes. A picture book intervention in Zhejiang, China, designed to teach preschool children about sexual abuse prevention, compared stories with human and animal characters. Stories featuring animal characters and loss-framed messages were the most effective, significantly improving ($p < 0.001$) children's understanding of personal boundaries, their ability to express discomfort, and help-seeking skills (8). In Türkiye, the programme 'I Am Learning to Protect Myself with Mika,' which used a developmentally appropriate toy-based approach, produced significant improvements in self-protection skills among preschool children compared with a control group ($p < 0.05$) (17). Although SmartShield does not rely

on physical materials, such as books or toys, it integrates animated video scenarios, voice narration, and culturally familiar characters to create an engaging and developmentally appropriate experience.

Several digital and hybrid CSA prevention programmes further support the effectiveness of technology-based approaches. The IMpower programme, a 12-hour intervention implemented for elementary school children on an American Indian reservation, significantly increased children's confidence in escaping potentially abusive situations ($p < 0.001$) (18). In South Korea, a CSA prevention education programme using a hybrid application (CSAPE-H) was implemented for elementary school students. The programme, which combines mobile web access via smartphone and interactive internet content, significantly improved students' self-protective behaviours ($p = 0.01$) (19). Similarly, the Second Step Child Protection Unit, a comprehensive web-based programme, implemented in elementary schools in the Northeast region of the United States, significantly enhanced students' abilities to recognise, refuse and report unsafe touch (20). Consistent with these findings, the results of the present study demonstrated that internet-based digital content can effectively enhance children's CSA prevention skills.

By contrast, the Sexual Abuse Prevention Mobile Application (SAP_MobAPP), implemented among primary school children in Korea, yielded improvements in self-protective skills over time; however, no statistically significant differences were found ($p = 0.379$) between groups (9). This outcome was likely influenced by the small sample size ($n = 15$), which limited statistical power and the ability to assess the feasibility, acceptability and barriers experienced by the education recipients, despite the many advantages of the application. Unlike app-based interventions, SmartShield delivers digital content without the need for app installation, rendering it more user-friendly and better suited for primary school children.

The findings also support the broader objectives of the United Nations Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-Being), SDG 4 (Quality Education), and SDG 16 (Peace, Justice and Strong Institutions). By equipping children with essential knowledge and self-protection skills, the SmartShield programme contributes to better health outcomes and safer school environments. These efforts align with the United Nations' 2030 Agenda, which promotes healthy living, inclusive education and protection from violence (21).

The SmartShield module was originally developed as a flexible self-learning resource. It can be used by students at home with parental guidance or integrated into classroom instruction as a supplementary teaching tool. This flexibility supports accessibility and practical implementation for both teachers and parents, promoting long-term sustainability and cost-effectiveness, particularly in resource-constrained settings (22). Evidence from programmes such as the Doll Programme in China suggests that similar approaches can yield clear learning outcomes and improve programme implementation (23).

The SmartShield programme features interactive, developmentally appropriate and engaging elements that enhance engagement and learning effectiveness for primary school children. Prior research indicates that children are more likely to understand and respond to abuse risks when instruction is delivered through age-appropriate methods, including stories, games and structured lessons (24). Tailoring content to children's developmental levels is therefore a critical determinant of programme success (25).

Cultural relevance was a crucial component in the design of the SmartShield modules. The use of familiar settings, characters and language that reflected the local context enhanced student engagement and comprehension (26) and strengthened the impact and acceptance of the content. Such cultural adaptation is widely recognised as essential for increasing the effectiveness of CSA prevention programmes across diverse populations (23).

Despite its strengths, this study has several limitations. The reliance on self-reported questionnaires may have introduced response bias, particularly as primary school children could have been influenced by peers while completing the questionnaire. The relatively high scores observed in the control group suggest that the current measurement scale may lack sufficient sensitivity to detect differences in protective skills. In addition, the SmartShield programme was not delivered as a teacher-led intervention in the current study. Moreover, this study did not include a long-term follow-up to determine whether the skills gained were retained over time.

Future research should consider revising the skills scale to improve its sensitivity by examining item difficulty and discrimination, as well as exploring the use of other validated measurement tools. Greater involvement of teachers in the implementation and monitoring of the SmartShield programme in schools could enhance the programme's effectiveness and sustainability, particularly if accompanied by appropriate training. Finally, longer-term follow-up assessments are needed to determine whether the skills acquired through SmartShield are retained and translated into lasting behavioural changes as children progress into secondary school and beyond.

CONCLUSION

This study demonstrated that the SmartShield sexual abuse prevention programme significantly enhanced protective skills among both lower and upper primary school children in Malaysia. The findings support the effectiveness of age-appropriate, culturally contextualised, and video-based educational interventions in equipping children with essential self-protection knowledge. SmartShield can be used as an interactive self-learning resource within schools to complement the formal classroom curriculum and can also support parents in reinforcing CSA prevention at home. The programme is readily scalable through integration into the national curriculum and delivery via its online platform during existing class sessions. Its successful implementation within school settings highlights its strong feasibility and acceptability in the Malaysian context. Overall, the SmartShield programme presents a promising, evidence-based addition to Malaysia's national child protection strategy, offering a structured approach to preventing CSA at the foundational level of education.

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ETHICAL APPROVAL

Ethical clearance was granted by the Human Research Ethics Committee, Universiti Sains Malaysia (USM/JEPeM/20110554).

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