Electronic Journal of General Medicine
2025, 22(2), em635
e-ISSN: 2516-3507
https://www.ejgm.co.uk/

MODESTUM

Original Article

OPEN ACCESS

Validity and reliability of *SmartShield* questionnaire for sexual abuse prevention among primary school children

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Citation: Mat Pa MN, Norhayati MN, Nik Hussain NH, Sulaiman Z, Othman A, Aziz A. Validity and reliability of *SmartShield* questionnaire for sexual abuse prevention among primary school children. Electron J Gen Med. 2025;22(2):em635. https://doi.org/10.29333/ejgm/15995

ARTICLE INFO

Received: 02 Dec. 2024

Accepted: 01 Feb. 2025

ABSTRACT

Child sexual abuse is a critical public health issue, affecting one in eight children worldwide. This study evaluates the validity and reliability of the *SmartShield* questionnaires, designed to assess knowledge, attitudes, and skills related to sexual education and abuse prevention among primary school children. The *SmartShield* 1 and *SmartShield* 2 questionnaires underwent validation processes, including expert content validation, face validation with teachers, and internal structure assessment involving 167 children in Kota Bharu, Kelantan. The results indicated strong content validity index averages of 0.90 and 0.91, and face validity index averages of 0.87 and 0.89, both exceeding established cut-offs. Additionally, the internal consistency, measured by Cronbach's alpha, showed acceptable values for both questionnaires. Overall, the *SmartShield* questionnaires are validated tools for assessing children's knowledge, attitudes, and skills regarding sexual education and abuse prevention. These instruments are valuable for future research aimed at evaluating the effectiveness of sexual abuse prevention programs.

Keywords: children, reliability, sexual abuse, *SmartShield* questionnaire, validity

INTRODUCTION

World Health Organization labels child sexual abuse (CSA) a 'silent health emergency,' emphasizing its global impact on public health, society, and human rights, as it involves children in sexual acts without understanding or consent [1, 2]. One in eight children worldwide have experienced sexual abuse or exploitation at some time in their lives [3]. The global prevalence of CSA was estimated to be 11.8% [4]. Prevalences in Spain range from 2.8% to 18.5%, while in Iran, range from 1.5% to 32.5% [5, 6].

The prevalence of CSA is higher in boys than in girls (70.7% vs. 29.3%), with boys aged 6-12 accounting for the biggest group (47.7%) [7]. A systematic review and meta-analysis of 24 countries shows CSA rates range from 8% to 31% for girls and 3% to 17% for boys, with nine girls and three boys per 100 reporting forced intercourse [8]. CSA prevention programs focus on education, community awareness, training, legal support, services, and technology to protect children [9-13]. CSA affects about 10% of the USA population, highlighting its alarming prevalence [14]. CSA is a global issue, with research showing about 8% of males and 18% of females were sexually abused before 18, highlighting the need for increased awareness and action [15]. Creating a sex education curriculum helps children spot unsafe situations, promotes open discussions, and improves child protection, with lessons becoming more complex as they get older [16]. North America started CSA prevention programs in the 1970s, but there are few resources to assess these programs, mostly in primary schools [17].

Several questionnaires have been used to assess CSA, including the children's knowledge of abuse questionnaire (CKAQ), the child sexual abuse myth scale (CSAMS), the Arabic child sexual abuse questionnaire (CSAQ), and the child sexual abuse knowledge questionnaire (CSA-KQ). CKAQ evaluates changes in knowledge and attitudes related to abuse prevention concepts among elementary school-aged children. Its key feature is inclusion of items addressing positive touch, which helps differentiate between appropriate and inappropriate interactions, an essential component in teaching children about boundaries. The 24-item CKAQ is reliable and has been translated into many languages except Malay [17].

The CSAMS assesses attitudes toward CSA among adult populations. The 15-item scale encompasses three key factors: blame diffusion, denial of abusiveness, and restrictive stereotypes [18]. Meanwhile, the CSAQ evaluates child sexual victimization experiences and their related characteristics. It was initially developed in English as a self-report tool for

younger children aged 13 to 20, with the majority (97%) aged between 14 and 16.9 years. CSAQ is a reliable instrument for evaluating the prevalence of CSA, comprising 15 items to measure experiences related to these abuse., i.e., CSA with and without physical contact [19]. It was translated into other languages, including Arabic [20]. Another questionnaire, the CSA-KQ is about misconceptions on abuse offences, children's responses to CSA, and their ability to provide reliable evidence. The nine-item scale was administered to 875 jurors, but information on validity parameters, such as content validity or internal consistency, is unavailable [21].

Assessing knowledge, attitudes, and practices towards the prevention of CSA is crucial for developing effective interventions [22]. Existing tools to measure CSA in Malaysian context is limited. A culturally adapted and language-appropriate tool like *SmartShield* is necessary to ensure comprehension among children. This study intends to investigate the validity and reliability of the *SmartShield* questionnaire on assessing the knowledge, attitude and skills for sexual abuse prevention among primary school children in Kelantan.

MATERIALS AND METHODS

The *SmartShield* questionnaire underwent a literature search in PubMed using keywords such as *CSA*, *sexual education program*, and *primary school children*. It was written in Malay, drawing on UNESCO guidelines and the Malaysian Ministry of Education's health curriculum. The UNESCO guidelines provided age-appropriate content tailored to upper and lower primary school children, while the Ministry of Education's curriculum ensured alignment with standard topics taught in schools. Using the Malay language enhanced participants' comprehension and ease of understanding.

Content Validity of *SmartShield* Questionnaire

Expert panels

Employing the recommendations of Rubio, at least six subject matter experts are required [23, 24]. Six content experts in child education, psychology, psychiatry, school counseling, research methods, and community health were invited, excluding the research team involved in creating the questionnaire items.

Method

Six content experts received invitation letters explaining the goal of the study, their responsibilities, and the procedure for evaluating content validity. Experts could participate in a virtual meeting online with the principal researcher or self-administer the form. They assessed the clarity, arrangement, presentation, and relevancy of the items. The forms were to be filled out within two weeks, and once they were, the evaluations were sent back to the primary researcher. In recognition of their contribution to the content validation process, the experts received letters of appointment as panel members upon submission.

Rating

The content validity index (CVI) evaluated the relevance of items and the overall scale. Each item-content validity index (I-CVI) was determined using expert ratings on a 4-point scale: 1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant. Ratings were entered into Microsoft Excel, where scores of 3 or 4 were classified as valid ('1'), and scores of 1 or 2 as non-valid ('0'). The I-CVI for each item was then calculated by dividing the number of valid ratings by the total number of experts. For at least six raters, an I-CVI above 0.78 was considered acceptable [23, 25, 26]. The scale level content validity (S-CVI) was the proportion of total items judged content as valid [25, 27]. In this study, the S-CVI value was measured by calculating the S-CVI/Ave. This was determined by dividing the total sum of all I-CVI scores by the number of items (S-CVI/Ave = [sum of all I-CVI] / [number of items]). A cut-off value of greater than 0.90 was considered acceptable for the S-CVI/Ave [23, 25, 28].

Face Validity of *SmartShield* Questionnaires

Face validity refers to how well the target population interprets the items given the context the scale intends to measure [23, 29]. Face validity in this study was investigated by testing the items' clarity and comprehensibility on the items and language used.

Participants

At least seven to ten people are needed to have sufficient control over the chance agreement [23, 30, 31]. Ten government primary school teachers from Kota Bharu, Kelantan, were purposively invited for face validation, as they play a key role in assessing primary school children. Teachers with less than five years of experience were excluded.

Method

Primary school teachers were personally invited to participate in the study after being briefed about the purpose and objective of the face validity evaluation. Those who agreed filled out a face validity evaluation form and signed a consent form. In an about 20-minute session, each teacher evaluated the items' clarity.

Rating

The face validity index (FVI) measured the clarity of the item and scale. For each item, the item-level face validity index (I-FVI) was computed as the number of experts giving the rating on a 4-point scale: 1 = not clear, 2 = somewhat clear, 3 = quite clear, and 4 = highly clear. Then, the raw ratings for each item-level clarity were entered into Microsoft Excel. From here, the I-FVI of each item was calculated manually by dividing the sum of FVI scores by the maximum score multiplied by the number of raters (I-FVI = [sum of FVI scores] / [max score * number of raters]) [32]. The cut-off value for an acceptable item-level FVI would be more than 0.80 [23]. The scale-level face validity (S-FVI) was measured by calculating the S-FVI/Ave. The S-FVI/Ave was calculated by dividing the sum of all I-FVI by the number of items (S-FVI/Ave = [summation all I-FVI] / [number of items]). The cut-off value for an acceptable S-FVI/Ave would be more than 0.83 [33]. The questionnaire was refined based on FVI values.

Internal Structure Assessment of *SmartShield* Questionnaires

After finalizing the questionnaires for lower and upper primary school children, the internal structure was assessed. This step ensures adequate item variation, reliability, and validity (convergent or discriminant). Reliability measures how consistently a scale produces the same results and is a key source of validity evidence. Methods include inter-rater

reliability (different people), test-retest reliability (same person, different times), and internal consistency (items consistently producing similar scores) [34]. This study used internal consistency to check how well the items in a scale are related to each other [35]. The reliability of the questionnaires in this study was assessed by measuring internal consistency using Cronbach's alpha. All validity evidence supports construct validity, which includes content validity, response process validity, internal structure, relation to other variables, and consequences. The responses to the questionnaires were scored, as follows: Knowledge items were scored 2 for 'yes,' 0 for 'no,' and 1 for 'don't know.' Attitude items were rated on a 5-point scale: 5 = 'strongly agree,' 4 = 'agree,' 3 = 'not sure,' 2 = 'disagree,' and 1 = 'strongly disagree.' Skills items were scored 2 for 'yes,' 1 for 'don't know,' and 0 for 'no.' Raw scores were summed and converted to percentage scores for each domain. The researchers set cut-off points for each domain, with scores above these thresholds considered as high knowledge, positive attitude, and good skills.

Study design and population

A cross-sectional study was conducted with primary school children in Kota Bharu, Kelantan. Children in standard 2 and standard 4 from government schools were eligible to participate, representing lower and upper primary school children. Children with learning disorders, such as attention deficit disorder and dyslexia, as well as those who were absent during the program, were excluded from the study.

Sampling method

Multistage cluster random sampling was applied. There were 97 primary schools in Kota Bharu, Kelantan. Three schools were randomly selected based on logistic reasons using Microsoft Excel. Two classes from each lower and upper primary were randomly selected for each school. All children in the respective classes were invited.

Sample size

The study meets the recommendation to sample at least 150 subjects for exploring the initial structure [36]. After accounting for a 10% non-response rate, 167 primary school children were sampled for the internal structure assessment.

Data collection

The internal structure of the items was measured in four primary schools in Kota Bharu, Kelantan. Invitation letters were sent to the schools explaining the study's purpose. Parents or guardians received informed consent through teachers, and participation was voluntary. Those who agreed completed the consent form and the questionnaire, which took about 15 minutes.

Data entry and analysis

The Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity were used to measure sampling adequacy, with KMO values over 0.6 indicating sampling adequacy [37]. Cronbach's alpha coefficient was calculated to assess scale reliability. This coefficient measures the internal consistency of the item scores, indicating how well the items on a scale correlate with each other. It depends on the inter-item correlations and the total number of items on the scale [38]. An acceptable level of coefficient alpha to retain an item on a scale is at least 0.70 [39]. However, a minimum value of 0.60 is also acceptable for basic research or evaluation studies [40].

RESULTS

The validation of the *SmartShield* questionnaire includes content validation, face validation, and internal structure assessment.

SmartShield 1 Questionnaire For Lower Primary School Children

Content validity

The validation of the *SmartShield* 1 questionnaire by six experts indicates that the content is generally well-constructed across its three domains: knowledge, attitude, and skills. The knowledge domain, with 21 items, achieved an S-CVI/Ave of 0.85 and an S-CVI/UA of 0.43. The attitude and skills domains, with 7 and 11 items, respectively, demonstrated higher levels of content validity, with S-CVI/Ave scores of 0.98 and 0.95 and S-CVI/UA scores of 0.86 and 0.82, as shown in **Table 1**.

Table 1. Content validity of *SmartShield* 1 questionnaire

Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6	Expert in agreement	I-CVI	UA
K1	1	1	1	1	1	1	6	1	1
K2	1	1	1	1	1	1	6	1	1
K3	1	1	1	1	1	1	6	1	1
K4	1	0	1	1	1	0	4	0.67	0
K5	1	0	1	1	1	0	4	0.67	0
K6	1	1	1	1	1	1	6	1	1
K7	1	1	1	1	1	1	6	1	1
K8	1	0	1	1	1	0	4	0.67	0
K9	1	0	1	1	1	1	5	0.83	0
K10	1	1	1	1	1	1	6	1	1
K11	1	0	1	1	1	0	4	0.67	0
K12	1	1	1	1	1	1	6	1	1
K13	1	0	1	1	1	0	4	0.67	0
K14	1	0	1	1	1	1	5	0.83	0
K15	1	0	1	1	1	1	5	0.83	0
K16	1	1	1	1	1	0	5	0.83	0
K17	1	0	1	1	1	0	4	0.67	0
K18	1	1	1	1	1	1	6	1	1
K19	1	1	1	1	1	1	6	1	1
K20	1	0	1	1	1	0	4	0.67	0

Table 1 (Continued). Content validity of *SmartShield* 1 questionnaire

Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6	Expert in agreement	I-CVI	UA
K21	1	1	1	1	1	0	5	0.83	0
Proportion prevalence	1.00	1.00	1.00	1.00	0.52	0.57	S-CVI/Ave	0.85	
							S-CVI/UA		0.43
A22	1	1	1	1	1	1	6	1	1
A23	1	1	1	1	1	1	6	1	1
A24	1	1	1	1	1	0	5	0.83	0
A25	1	1	1	1	1	1	6	1	1
A26	1	1	1	1	1	1	6	1	1
A27	1	1	1	1	1	1	6	1	1
A28	1	1	1	1	1	1	6	1	1
Proportion prevalence	1.00	1.00	1.00	1.00	1.00	0.86	S-CVI/Ave	0.98	
							S-CVI/UA		0.86
S29	1	1	1	1	1	1	6	1	1
S30	1	1	1	1	1	1	6	1	1
S31	1	1	1	1	1	1	6	1	1
S32	1	0	1	0	1	0	4	0.67	0
S33	1	1	1	1	1	0	5	0.83	0
S34	1	1	1	1	1	1	6	1	1
S35	1	1	1	1	1	1	6	1	1
S36	1	1	1	1	1	1	6	1	1
S37	1	1	1	1	1	1	6	1	1
S38	1	1	1	1	1	1	6	1	1
S39	1	1	1	1	1	1	6	1	1
Proportion prevalence	1.00	0.91	1.00	1.00	0.91	0.82	S-CVI/Ave	0.95	
							S-CVI/UA		0.82
Proportion prevalence overall	1.00	0.97	1.00	1.00	0.72	0.69	S-CVI/Ave	0.90	
							S-CVI/UA		0.62

Face validity

Ten participants took part in the face validity assessment of the *SmartShield* 1 questionnaires. The group comprised six schoolteachers and four parents, ages 31 to 50 years. The group had an equal number of male and female participants. All were Malay. The face validity assessment of the *SmartShield* 1 questionnaire, with an FVI/Ave score of 0.87, indicates that the questionnaire is generally well-perceived by the participants in terms of clarity, relevance, and comprehensibility, as shown in **Table 2**.

Internal structure assessment

The total number of participants for lower primary school children is 167, with 53.5% (n = 89) males. All participants are Malay and Muslim. The KMO and Bartlett's test for knowledge was 0.681, which shows adequate sampling. For the attitude and skills domains, the KMO and Bartlett's values were 0.746 and 0.645, respectively, suggesting good sampling adequacy. The Cronbach's alpha for the final version of the *SmartShield* 1 questionnaire was 0.692 for knowledge (14 items), 0.786 for attitude (5 items), and 0.677 for skills (5 items).

The Cronbach's alpha and number of items for the initial and final version, as shown in **Table 3**.

Table 2. Face validity of *SmartShield* 1 questionnaire

Item	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Raters in agreement	I-FVI	UA
K1	1	0	1	1	1	1	1	1	1	1	9	0.9	1
K2	1	0	1	1	1	1	1	1	1	1	9	0.9	1
K3	1	1	1	1	1	1	1	1	1	1	10	1	1
K4	0	0	1	1	1	1	1	1	1	0	7	0.7	0
K5	0	0	1	1	1	1	1	1	1	0	7	0.7	0
K6	1	1	1	1	1	1	1	1	1	1	10	1	1
K7	1	1	1	1	1	1	1	1	1	1	10	1	1
K8	0	0	0	1	1	1	1	1	1	0	6	0.6	0
K9	0	1	1	1	1	1	1	1	1	1	9	0.9	0
K10	1	1	1	1	1	1	1	1	1	1	10	1	1
K11	0	0	0	0	0	1	1	0	0	1	3	0.3	0
K12	1	1	1	1	1	1	1	1	1	1	10	1	1
K13	0	0	1	1	1	1	1	1	1	1	8	0.8	0
K14	1	1	1	1	1	1	1	1	1	1	10	1	0
K15	1	1	1	1	1	1	1	1	1	1	10	1	0
K16	1	1	1	1	1	1	1	1	1	1	10	1	0
K17	1	1	1	1	1	1	1	1	1	1	10	1	0
K18	1	1	1	1	1	1	1	1	1	1	10	1	1
K19	1	1	1	1	1	1	1	1	1	1	10	1	1
K20	0	0	1	1	1	1	1	1	1	1	8	0.8	0
K21	1	1	1	1	1	1	1	1	1	1	10	1	0

Table 2 (Continued). Face validity of *SmartShield* 1 questionnaire

Item	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Raters in agreement	I-FVI	UA
A22	1	1	1	1	1	1	1	1	0	1	9	0.9	1
A23	1	1	1	1	1	1	1	1	0	1	9	0.9	1
A24	1	0	0	1	0	1	1	0	0	1	5	0.5	0
A25	1	1	1	1	0	1	1	1	0	1	8	0.8	1
A26	1	1	1	0	0	1	1	0	1	1	7	0.7	1
A27	1	1	1	0	0	1	1	0	1	1	7	0.7	1
A28	1	1	0	0	0	1	1	0	1	1	6	0.6	1
S29	1	1	1	1	1	1	1	1	1	1	10	1	1
S30	1	1	1	1	1	1	1	1	1	1	10	1	1
S31	1	1	1	1	1	1	1	1	1	1	10	1	1
S32	0	0	1	0	0	1	1	0	1	0	4	0.4	0
S33	0	1	1	1	1	1	1	0	1	0	7	0.7	0
S34	1	1	1	1	1	1	1	1	1	1	10	1	1
S35	1	1	1	1	1	1	1	1	1	1	10	1	1
S36	1	1	1	1	1	1	1	1	1	1	10	1	1
S37	1	1	1	1	1	1	1	1	1	1	10	1	1
S38	1	1	1	1	1	1	1	1	1	1	10	1	1
S39	1	1	1	1	1	1	1	1	1	1	10	1	1
Proportion clarity	0.77	0.74	0.90	0.87	0.82	1.00	1.00	0.82	0.87	0.87	S-FVI/Ave	0.87	
and comprehension											S-FVI/UA		0.54

Note. R: Rater

Table 3. Internal structure assessment of *SmartShield* questionnaire for primary school children

Domain	Initial version			Final version		
	KMO & Bartlett's test	Cronbach's alpha	Number of items	KMO & Bartlett's test	Cronbach's alpha	Number of items
SmartShield 1 questionnaire (lower primary school children)						
Knowledge	0.580	0.503	21	0.681	0.692	14
Attitude	0.769	0.664	7	0.746	0.786	5
Skills	0.665	0.554	11	0.645	0.677	5
SmartShield 2 questionnaire (upper primary school children)						
Knowledge	0.610	0.815	47	0.682	0.838	32
Attitude	0.756	0.796	11	0.784	0.808	10
Skills	0.725	0.744	11	0.738	0.760	10

The final items for the *SmartShield* 1 questionnaire (**Appendix A**) are described.

SmartShield 2 Questionnaire For Upper Primary School Children

Content validity

The content validation of the *SmartShield* 2 questionnaire by six experts shows that the module is well-constructed in its three domains: knowledge, attitude, and skills. The knowledge domain, with 47 items, achieved an S-CVI/Ave of 0.90 and an S-CVI/UA of 0.68. Both the attitude and skills domains, each with 11 items, received high validation scores, with an S-CVI/Ave of 0.94 and an S-CVI/UA of 0.82, as shown in **Table 4**.

Face validity

Ten participants took part in the face validity assessment of the *SmartShield* 2 questionnaires for upper primary school

Table 4. Content validity of *SmartShield* 2 questionnaire

Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6	Expert in agreement	I-CVI	UA
K1	1	1	1	1	1	1	6	1	1
K2	1	1	1	1	1	1	6	1	1
K3	1	0	1	1	1	0	4	0.67	0
K4	1	1	1	1	1	1	6	1	1
K5	1	0	1	1	0	0	3	0.5	0
K6	1	1	1	1	1	1	6	1	1
K7	1	1	1	1	1	1	6	1	1
K8	1	1	1	1	1	0	5	0.83	0
K9	1	1	1	1	1	0	5	0.83	0
K10	1	1	1	1	1	1	6	1	1
K11	1	1	1	1	1	1	6	1	1
K12	1	1	1	1	0	0	4	0.67	0
K13	1	1	1	1	1	0	5	0.83	0
K14	1	1	1	1	1	0	5	0.83	0
K15	1	1	1	1	1	1	6	1	1
K16	1	1	1	1	1	1	6	1	1
K17	1	1	1	0	0	0	3	0.5	0
K18	1	1	1	1	1	1	6	1	1
K19	1	1	1	1	1	0	5	0.83	0

Table 4 (Continued). Content validity of *SmartShield* 2 questionnaire

Item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6	Expert in agreement	I-CVI	UA
K20	1	1	1	1	1	1	6	1	1
K21	1	1	1	1	1	1	6	1	1
K22	1	1	0	1	1	1	6	1	1
K23	1	1	1	1	1	1	6	1	1
K24	1	1	1	1	1	1	6	1	1
K25	1	1	1	1	1	0	5	0.83	0
K26	1	1	1	1	1	1	6	1	1
K27	1	1	1	1	1	1	6	1	1
K28	1	1	1	1	1	1	6	1	1
K29	1	1	1	1	1	1	6	1	1
K30	1	1	1	1	1	1	6	1	1
K31	1	1	1	1	1	1	6	1	1
K32	1	1	1	1	1	1	6	1	1
K33	1	1	0	1	1	0	4	0.67	0
K34	1	1	1	1	1	1	6	1	1
K35	1	1	1	1	1	1	6	1	1
K36	1	1	1	0	0	0	3	0.5	0
K37	1	1	1	1	1	1	6	1	1
K38	1	1	1	1	1	1	6	1	1
K39	1	1	1	1	1	1	6	1	1
K40	1	1	1	1	0	1	5	0.83	0
K41	1	1	1	1	1	1	6	1	1
K42	1	1	1	1	1	1	6	1	1
K43	1	1	1	1	1	1	6	1	1
K44	1	1	1	0	0	0	3	0.50	0
K45	1	1	1	1	0	0	4	0.67	0
K46	1	1	1	1	1	1	6	1	1
K47	1	1	1	1	1	1	6	1	1
Proportion prevalence	0.96	0.94	0.85	1.00	0.96	0.70	S-CVI/Ave	0.90	
							S-CVI/UA		0.68
A48	1	1	1	1	1	1	6	1	1
A49	1	1	1	1	1	1	6	1	1
A50	1	1	1	0	0	0	3	0.5	0
A51	1	1	1	1	1	1	6	1	1
A52	1	1	1	1	1	1	6	1	1
A53	1	1	1	1	1	1	6	1	1
A54	1	1	1	1	0	1	5	0.83	0
A55	1	1	1	1	1	1	6	1	1
A56	1	1	1	1	1	1	6	1	1
A57	1	1	1	1	1	1	6	1	1
A58	1	1	1	1	1	1	6	1	1
Proportion prevalence	1	0.91	0.82	1	1	0.91	S-CVI/Ave	0.94	
							S-CVI/UA		0.82
S59	1	1	1	1	1	1	6	1	1
S60	1	1	1	1	1	1	6	1	1
S61	1	1	1	1	1	1	6	1	1
S62	1	1	1	1	0	0	4	0.67	0
S63	1	1	1	1	0	0	4	0.67	0
S64	1	1	1	1	1	1	6	1	1
S65	1	1	1	1	1	1	6	1	1
S66	1	1	1	1	1	1	6	1	1
S67	1	1	1	1	1	1	6	1	1
S68	1	1	1	1	1	1	6	1	1
S69	1	1	1	1	1	1	6	1	1
Proportion prevalence	1.00	1.00	0.82	1.00	1.00	0.82	S-CVI/Ave	0.94	
							S-CVI/UA		0.82
Proportion prevalence overall	0.97	0.94	0.84	1.00	0.97	0.75	S-CVI/Ave	0.92	
							S-CVI/UA		0.72

children. The group included six schoolteachers and four parents, with three participants aged between 31 and 40 and seven aged between 41 and 50. The participants were equal between males and females, and all were Malays. The face validity assessment of the *SmartShield* 2 questionnaire, with an FVI/Ave score of 0.89, indicates that the questionnaire is generally well-perceived by the participants in terms of clarity, relevance, and comprehensibility, as shown in **Table 5**.

Table 5. Face validity of *SmartShield* 2 questionnaire

Item	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Raters in agreement	I-FVI	UA
K1	1	1	1	1	1	1	1	1	1	1	10	1	1
K2	1	1	1	1	1	1	1	1	1	1	10	1	1
K3	1	1	0	1	1	1	1	0	0	1	7	0.7	0
K4	1	1	1	1	1	1	1	1	1	1	10	1	1
K5	1	0	1	1	1	1	1	1	1	0	8	0.8	0
K6	1	1	1	1	1	1	1	1	1	1	10	1	1
K7	1	1	1	1	1	1	1	1	1	1	10	1	1
K8	1	1	1	1	1	1	1	1	1	1	10	1	1
K9	1	1	0	1	1	1	1	0	0	1	7	0.7	0
K10	1	1	1	1	1	1	1	1	1	1	10	1	1
K11	1	1	1	1	1	1	1	1	1	1	10	1	1
K12	0	0	1	1	0	1	1	1	1	0	6	0.6	0
K13	1	1	1	1	1	1	1	1	1	1	10	1	1
K14	1	1	1	1	1	1	1	1	1	1	10	1	1
K15	1	1	0	0	0	1	1	0	0	1	5	0.5	0
K16	1	1	0	1	1	1	1	0	1	1	8	0.8	0
K17	0	0	0	1	1	1	0	0	0	0	3	0.3	0
K18	1	1	0	1	1	1	1	0	0	0	6	0.6	0
K19	1	1	1	1	1	1	1	1	1	1	10	1	1
K20	1	1	0	0	0	1	1	0	0	1	5	0.5	0
K21	1	1	0	1	1	1	1	0	0	1	7	0.7	0
K22	1	0	0	1	1	1	1	0	1	1	7	0.7	0
K23	1	1	0	1	1	1	0	0	0	1	6	0.6	0
K24	1	1	1	1	1	1	1	1	1	1	10	1	1
K25	1	1	1	1	1	1	1	1	1	1	10	1	1
K26	1	1	1	1	1	1	1	1	1	1	10	1	1
K27	1	1	1	1	1	1	1	1	1	1	10	1	1
K28	1	1	1	1	1	1	1	1	1	1	10	1	1
K29	1	1	1	1	1	1	1	1	1	1	10	1	1
K30	1	1	1	1	1	1	1	1	1	1	10	1	1
K31	1	1	1	1	1	1	1	1	1	1	10	1	1
K32	1	1	1	1	1	1	1	1	1	1	10	1	1
K33	1	1	1	1	1	1	1	1	1	1	10	1	1
K34	1	1	1	1	1	1	1	1	1	1	10	1	1
K35	1	1	1	1	1	1	1	1	1	1	10	1	1
K36	1	1	1	1	1	1	1	1	1	1	10	1	1
K37	1	1	1	1	1	1	1	1	1	1	10	1	1
K38	1	1	1	1	1	1	1	1	1	1	10	1	1
K39	1	1	1	1	1	1	1	1	1	1	10	1	1
K40	1	1	1	1	1	1	1	1	1	1	10	1	1
K41	1	1	1	1	1	1	1	1	1	1	10	1	1
K42	1	1	1	1	1	1	1	1	1	1	10	1	1
K43	1	1	1	1	1	1	1	1	1	1	10	1	1
K44	1	1	1	1	1	1	1	1	1	1	10	1	1
K45	1	1	1	1	1	1	1	1	1	1	10	1	1
K46	1	1	1	1	1	1	1	1	1	1	10	1	1
K47	1	1	1	1	1	1	1	1	1	1	10	1	1
A48	1	1	1	0	1	1	1	1	0	0	7	0.7	0
A49	1	1	1	0	1	1	1	1	0	0	7	0.7	0
A50	0	0	0	0	1	1	1	1	0	0	4	0.4	0
A51	1	1	1	0	1	1	1	1	0	0	7	0.7	0
A52	1	1	1	0	1	1	1	1	0	0	7	0.7	0
A53	1	1	1	0	1	1	1	1	0	0	7	0.7	0
A54	1	1	1	1	1	1	1	1	0	0	8	0.8	0
A55	1	1	1	1	1	1	1	1	1	1	10	1	1
A56	1	1	1	1	1	1	1	1	1	1	10	1	1
A57	1	1	1	1	1	1	1	1	1	1	10	1	1
A58	1	1	1	1	1	1	1	1	1	1	10	1	1
S59	1	1	1	1	1	1	1	1	1	1	10	1	1
S60	1	1	1	1	1	1	1	1	1	1	10	1	1
S61	1	1	1	0	1	1	1	1	1	0	8	0.8	0
S62	0	0	0	1	1	1	1	1	1	1	7	0.7	0
S63	1	1	0	1	0	0	1	1	1	1	7	0.7	0
S64	1	1	1	1	1	1	1	1	1	1	10	1	1

Table 5 (Continued). Face validity of *SmartShield* 2 questionnaire

Item	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Raters in agreement	I-FVI	UA
S65	1	1	1	1	1	1	0	1	1	1	9	0.9	0
S66	1	1	1	1	1	1	1	1	1	1	10	1	1
S67	1	1	1	1	1	1	1	1	1	1	10	1	1
S68	1	1	1	1	1	1	1	1	1	1	10	1	1
S69	1	1	1	1	1	1	1	1	1	1	10	1	1
Proportion clarity	0.94	0.90	0.75	0.96	0.94	0.99	0.97	0.75	0.77	0.91	S-FVI/Ave	0.89	
and comprehension											S-FVI/UA		0.67

Internal structure assessment

The total number of participants for upper primary school children is 167, with 49.1% (n = 82) males. All participants are Malay and Muslim. The KMO and Bartlett's test for knowledge was 0.682, which shows adequate sampling. For the attitude and skills domains, the KMO and Bartlett's values were 0.784 and 0.738, respectively, suggesting good sampling adequacy. The Cronbach's alpha for the final version of the *SmartShield* 2 questionnaire was 0.838 for knowledge (32 items), 0.808 for attitude (10 items), and 0.760 for skills (10 items). The Cronbach's alpha and number of items for the initial and final version, as shown in **Table 3**. The final items for the *SmartShield* 2 questionnaire (**Appendix B**) are described.

DISCUSSION

Six content experts evaluated the content validity of both questionnaires. The number of experts varies, with studies using three to six experts [25, 27], six to eight experts, and even more than nine experts [25]. Therefore, using six content experts in this study is considered adequate. Content validity evaluation for *SmartShield* 1 and *SmartShield* 2 questionnaires indicate good results, with the CVI averages (CVI/Ave) exceeding the acceptable threshold of 0.83 is considered acceptable for content validity [28]. CVI is an acceptable value to measure content validation [28]. The content of *SmartShield* is based on UNESCO guidelines, which are internationally recognized and provide age-appropriate frameworks for sexual education [41]. The *SmartShield* questionnaire is designed to assess knowledge, attitudes regarding sexual education, and skills for sexual abuse prevention. *SmartShield* is particularly suitable for primary school children compared to other available questionnaires as it aligns closely with topics taught in official classes under the Malaysia Ministry of Education's curriculum.

The FVI for *SmartShield* 1 and *SmartShield* 2 both exceed the acceptable threshold of 0.83 [28]. These scores indicate that people find the questionnaires clear, appropriate, and of good quality. Clear instructions and understandable language ensure that participants respond accurately, which is vital for research [42]. A good FVI of a questionnaire indicates the content is well adapted to the local context and translated using clear and understandable sentences [33].

The internal consistency of the questionnaire is indicated by the Cronbach's alpha values. For *SmartShield* 1, the Cronbach's alpha across domains ranges from 0.67 to 0.80, while for *SmartShield* 2, the range is from 0.76 to 0.83. An acceptable level of coefficient alpha to retain an item on a scale is at least 0.70 [39]. However, a minimum value of 0.60 is also acceptable for basic research or evaluation studies [40]. The *SmartShield* Cronbach's alpha compared with other questionnaires is within the range of CKAQ (0.75), CSAQ-Arabic (0.88), CSAQ-English (0.7), CSAM-Portuguese (0.86) and CSAM (0.74) [17, 18, 20, 21].

Initially, *SmartShield* 1 included 21 knowledge items. After evaluating internal consistency, this was reduced to 14 items. Items such as 'chairs are parts of the body', 'tables are parts of the body', and 'nails are sexual organs' were replaced with more relevant items like 'eyes are parts of the body', 'mouth is a part of the body', and 'chest is a part of the body'. The content on body parts is retained, so content validity is unaffected. Other items in knowledge domain, 'safe touches make me feel comfortable', 'uncomfortable touch is a touch that may be safe but is not welcomed by me', 'buttocks can be touched by others' are being replaced with the item 'unsafe touch makes me angry'.

In the attitude domain, the *SmartShield* 1 questionnaire originally included seven items, which were later reduced to five items. Among the removed items were statements such as, 'I believe parents would be happy if I went out with someone unfamiliar to me' and 'I believe sexual dignity represents the purity and sanctity of sexual organs that must be well preserved'. The items that remove is already backed up by items such as 'I believe there is a risk of being kidnapped if I get into a car with a stranger' and 'I believe that if I do not maintain the dignity of my sexual organs, my self-respect will be tarnished'. The content related to self-protection and dignity in the attitude domain remains intact, as the remaining items still cover the key concepts.

For domain skills in the *SmartShield* 1 questionnaire, it has 11 items and has moved to only five items. The items removed are 'I say 'Don't touch' when a stranger touches my head', 'run to a safe place if someone is unfamiliar is chasing me', 'say 'no' if an online conversation invites me to do something inappropriate',' riding in a car with a stranger', 'wear modest clothing to maintain self-respect', 'say 'No' if someone forces me to touch their sexual organs. All the skills related to preventing sexual abuse are addressed, and the remaining items still cover the necessary skills to prevent sexual abuse. These ensure that removing certain items does not compromise content validity, as the remaining items adequately cover the intended concepts.

SmartShield 2 questionnaire for domain knowledge has 47 items remaining 32 items. Among these items that were removed, 'the reproductive system is the system responsible for reproduction in both males and females', 'the uterus is an organ of the female reproductive system', 'sperm will enter the vagina through the vaginal opening', 'fertilization occurs when the sperm and egg unite in the fallopian tube', 'the zygote forms and grows into an embryo', 'the baby grows inside the mother's uterus for 9 months'. All these items are too technical and assess scientific knowledge, which may be too advanced for the students to understand; therefore, they were removed. The items such as 'hair growth in the armpits is a sign of puberty', 'the penis enlarges for boys after puberty', and

'pimples appear after puberty' are still maintained to preserve the removed items.

The *SmartShield* 2 questionnaire for the attitude domain originally had 11 items but one item was removed. The removed item was 'I believe parents would be happy if I go out for a walk with someone I don't know'. The item that covers the content of the removed item is 'I believe there is a risk of being kidnapped if I get into a car with someone I don't know'. The *SmartShield* 2 questionnaire for the skills domain also had 11 items, with 1 item removed. The removed item was 'getting in the car with someone I don't know'. However, this item is covered by the item 'I run to a safe place if a stranger chases me'.

There are several strengths in this study. The questionnaire is grounded in UNESCO guidelines, which offer internationally recognized, age-appropriate content for sexual education. The study engaged an adequate number of subject matter experts for content validation, ensuring robust evaluation. Both CVI and FVI were calculated to establish validity. Teachers, who are well-versed in children's behavior and comprehension, were involved as proxies for the face validity assessment, enhancing the questionnaire's relevance and clarity. The study employed a multistage cluster random sampling method with a sufficient number of participants to provide strength for this study.

This study is not without limitations. It was conducted in government schools in Kota Bharu, Kelantan, which may limit the generalizability of the findings to other regions or populations. A larger and more diverse sample would enhance the external validity of the results. The study did not account for children with learning disorders, which may limit understanding how the *SmartShield* questionnaire functions for children with different learning needs. Including such groups could provide a more comprehensive assessment of the questionnaire's applicability.

CONCLUSIONS

The *SmartShield* questionnaire shows good content validity, face validity, and acceptable internal consistency values for assessing knowledge, attitudes, and skills related to sexual education and sexual abuse prevention. It is designed to be answered by primary school children, making it highly suitable as a measurement tool to evaluate the effectiveness of sexual education and sexual abuse prevention programs. It is tailored to the Malay context, ensuring it is easy to understand and administer.

Author contributions: MNN & NHNH: conception and design of study; **MNMP & AA:** acquisition of data; **ZS, AO & MNN:** analysis and interpretation of data; **MNMP & AA:** drafting the manuscript; **MNN, NHNH, ZS & AO:** revising the manuscript critically for important intellectual content. All authors agreed with the results and conclusions.

Funding: This study was funded by the Fundamental Research Grant Scheme, Higher Education Department, Ministry of Education. Malaysia-Framework for sex abuse incest and SmartShield sex abuse prevention in primary school children FRGS/1/2020/SS0/USM/02/12 (203.PPSP.6171295).

Ethical statement: The authors stated that the study was approved by the Human Research Ethics Committee at Universiti Sains Malaysia on 25 March 2023 with the approval code USM/JEPeM/20110554. Written informed consents were obtained from the participants.

Declaration of interest: No conflict of interest is declared by the authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

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APPENDIX A

Table A1. Final items for the *SmartShield* 1 questionnaire for lower primary school children

No	Items
Knowledge	
1	Mata adalah anggota badan [Eyes are body parts].
2	Mulut adalah anggota badan [Mouth is a body part].
3	Dada adalah anggota badan [Chest is a body part].
4	Faraj adalah anggota seksual Perempuan [Vagina is a female sexual organ].
5	Zakar adalah anggota seksual lelaki [Penis is a male sexual organ].
6	Sentuhan tidak selamat membuatkan saya marah [Unsafe touches make me angry].
7	Payu dara tidak boleh disentuh oleh orang lain [Breasts should not be touched by others].
8	Rogol adalah perbuatan memperkosa kehormatan perempuan [Rape is the act of violating a woman's dignity].
9	Cabul adalah perbuatan tidak senonoh dilakukan terhadap kehormatan seseorang [Molestation is an improper act committed against someone's dignity].
10	Sumbang mahram adalah perbuatan zina yang berlaku antara dua orang seperti abang dan adik perempuannya sendiri [Incest is a sexual act that occurs between two people, such as a brother and his own sister].
11	Gangguan seksual adalah perlakuan yang tidak baik seperti berkata lucah yang dilakukan terhadap seseorang [Sexual harassment is inappropriate behavior, such as saying vulgar things to someone].
12	Menerima pemberian daripada orang yang tidak dikenali boleh mengancam keselamatan diri [Accepting gifts from strangers can threaten personal safety].
13	Bermain sendirian di taman permainan tanpa pengawasan ibu bapa boleh mengancam keselamatan diri [Playing alone in the playground without parental supervision can threaten personal safety].
14	Melayari internet tanpa pengawasan ibu bapa boleh mengancam keselamatan diri [Browsing the internet without parental supervision can threaten personal safety].
Attitude	
15	Saya percaya risiko diculik sekiranya saya menaiki kereta orang yang tidak dikenali [I believe there is a risk of being kidnapped if I get into a stranger's car].
16	Saya percaya risiko dianiaya sekiranya bergambar dengan pakaian yang tidak senonoh [I believe there is a risk of being harmed if I take photos in inappropriate clothing].
17	Saya percaya sekiranya saya tidak menjaga kehormatan anggota seksual, maruah diri saya akan tercalar [I believe if I do not protect the dignity of my sexual organs, my personal honour will be compromised].
18	Saya percaya sekiranya saya tidak menjaga kehormatan anggota seksual, maruah keluarga akan tercalar [I believe if I do not protect the dignity of my sexual organs, my family's honor will be tarnished].
19	Saya percaya sekiranya saya menjaga kehormatan anggota seksual, saya akan disukai rakan-rakan yang lain [I believe if I protect the dignity of my sexual organs, I will be liked by my peers].
Skills	
20	Menjerit meminta tolong jika guru menyuruh membuat kerja sekolah [Screaming for help if a teacher asks to do homework].
21	Menutup pintu ketika hendak menyalin pakaian adalah tindakan yang perlu [Closing the door when changing clothes is a necessary action].
22	Elakkan diri daripada melalui tempat yang sunyi seorang diri [Avoid going through deserted places alone].
23	Laporkan kepada guru jika ada orang ingin menyelak baju [Report to a teacher if someone tries to lift your shirt].
24	Laporkan kepada ibubapa jika ada orang menepuk punggung [Report to parents if someone slaps your buttocks].

APPENDIX B

Table B1. Final items for the *SmartShield* 2 questionnaire for upper primary school children

No	Items
Knowledge	
1	Sentuhan tidak selamat membuatkan saya marah [Unsafe touches make me angry].
2	Payu dara tidak boleh disentuh oleh orang lain [Breasts should not be touched by others].
3	Rogol adalah perbuatan memperkosa kehormatan perempuan [Rape is the act of violating a woman's dignity].
4	Cabul adalah perbuatan tidak senonoh dilakukan terhadap kehormatan seseorang [Molestation is an inappropriate act committed against someone's dignity].
5	Gangguan seksual adalah perlakuan yang kurang disenangi seperti berkata lucah yang dilakukan terhadap seseorang [Sexual harassment is an unwelcome behavior, such as making vulgar comments toward someone].
6	Menerima pemberian daripada orang yang tidak dikenali boleh mengancam keselamatan diri [Accepting gifts from strangers can threaten personal safety].
7	Bermain sendirian di taman permainan tanpa pengawasan ibu bapa boleh mengancam keselamatan diri [Playing alone at the playground without parental supervision can threaten personal safety].
8	Melayari internet tanpa pengawasan ibu bapa boleh mengancam keselamatan diri [Surfing the internet without parental supervision can threaten personal safety].
9	Akil baligh ialah peringkat kematangan anggota seksual [Puberty is the stage of sexual organ maturation].
10	Tanda akil baligh pada lelaki ialah ihtilam [A sign of puberty in boys is a nocturnal emission].
11	Ihtilam ialah pancutan air mani kali pertama ketika tidur bagi budak lelaki [Nocturnal emission is the first ejaculation during sleep for boys].
12	Ihtilam berlaku kerana penyakit [Nocturnal emissions occur due to illness].
13	Tumbuh bulu di ketiak merupakan tanda akil baligh [Growing armpit hair is a sign of puberty].
14	Zakar membesar bagi budak lelaki setelah akil baligh [The penis enlarges in boys after puberty].
15	Tanda akil baligh pada kepada perempuan adalah menarke [A sign of puberty in girls is menarche].
16	Menarke bermaksud haid kali pertama [Menarche means the first menstrual period].
17	Bersenam dapat mengurangkan senggugut [Exercising can reduce menstrual cramps].
18	Haid berlaku selama 3-7 hari [Menstruation lasts for 3-7 days].
19	Payu dara mula membesar setelah akil baligh pada budak perempuan [Breasts begin to grow after puberty in girls].
20	Muka berjerawat setelah akil baligh [Pimples appear after puberty].
21	Bersihkan pakaian setelah berihtilam [Clean clothes after a nocturnal emission].
22	Mandi untuk membersihkan diri [Bathe to clean oneself].
23	Membasuh dan menukar cadar [Wash and change bed sheets].
24	Menjaga kebersihan pakaian dalam [Maintain the cleanliness of underwear].
25	Kerap tukar tuala wanita jika pendarahan yang banyak semasa haid [Change sanitary pads frequently if there is heavy bleeding during menstruation].
26	Buang tuala wanita ke dalam tong sanitari [Dispose of sanitary pads in a sanitary bin].
27	Cuci tangan selepas membuang tuala Wanita [Wash hands after disposing of sanitary pads].
28	Kerap terjadi kepada kanak-kanak yang selalu menyendiri [Often occurs to children who are frequently alone].
29	Perbuatan memujuk kanak-kanak oleh seseorang yang tidak dikenali boleh menyebabkan pengantunan seksual [Persuading a child by a stranger can lead to grooming].
30	Melakukan sentuhan fizikal tanpa disedari mangsa adalah satu tindakan pengantunan seksual [Performing physical contact without the victim's awareness is an act of grooming].
31	Testis bukan organ sistem reproduktif lelaki [The testis is not part of the male reproductive system].
32	Persenyawaan tidak boleh berlaku semasa haid [Fertilization cannot occur during menstruation].
Attitude	
33	Saya percaya risiko diculik sekiranya saya menaiki kereta orang yang tidak dikenali [I believe there is a risk of being kidnapped if I get into a stranger's car].
34	Saya percaya risiko dianiaya sekiranya bergambar dengan pakaian yang tidak senonoh [I believe there is a risk of being harmed if I take pictures wearing inappropriate clothing].
35	Saya percaya kehormatan seksual adalah kemurniaan dan kesucian anggota seksual yang perlu dipelihara sebaiknya [I believe sexual dignity is the purity and sanctity of sexual organs that must be well-preserved].
36	Saya percaya sekiranya saya tidak menjaga kehormatan anggota seksual, maruah diri saya akan tercalar [I believe if I do not preserve the dignity of my sexual organs, my personal honour will be tarnished].
37	Saya percaya sekiranya saya tidak menjaga kehormatan anggota seksual, maruah keluarga akan tercalar [I believe if I do not preserve the dignity of my sexual organs, my family's honour will be tarnished].
38	Saya percaya sekiranya saya menjaga kehormatan anggota seksual, saya akan disukai rakan-rakan yang lain [I believe if I preserve the dignity of my sexual organs, I will be liked by my peers].
39	Saya perlu menerima perubahan diri setelah akil baligh secara positif [I need to embrace changes after puberty positively].
40	Saya perlu menghargai perubahan diri dengan hati yang terbuka [I need to appreciate bodily changes with an open heart].
41	Saya perlu berpakaian kemas untuk menambahkan keyakinan diri [I need to dress neatly to boost my self-confidence].
42	Saya perlu menjaga pergaulan sentuhan dengan rakan-rakan [I need to maintain appropriate physical boundaries with my peers].
Skills	
43	Saya berkata "Jangan sentuh" apabila orang yang tidak dikenali menyentuh kepala saya [I say "Don't touch" if a stranger touches my head].

Table B1 (Continued). Final items for the *SmartShield* 2 questionnaire for upper primary school children

No	Items
44	Berlari ke tempat yang selamat sekiranya ada orang yang tidak dikenali mengejar [Run to a safe place if a stranger chases you].
45	Katakan tidak jika berlaku perbualan di alam maya yang mengajak untuk melakukan perbuatan yang tidak baik [Say no if an online conversation invites you to engage in inappropriate behavior].
46	Menjerit meminta tolong jika guru menyuruh membuat kerja sekolah [Scream for help if a teacher forces you to do schoolwork].
47	Memakai pakaian yang sopan untuk menjaga kehormatan diri [Wear modest clothing to maintain your dignity].
48	Menutup pintu ketika hendak menyalin pakaian adalah tindakan yang perlu [Closing the door when changing clothes is necessary].
49	Elakkan diri daripada melalui tempat yang sunyi seorang diri [Avoid going through isolated places alone].
50	Berkata 'TIDAK' sekiranya ada seseorang memaksa menyentuh anggota seksual [Say 'NO' if someone tries to forcefully touch your sexual organs].
51	Laporkan kepada guru jika ada orang ingin menyelak baju [Report to a teacher if someone tries to lift your shirt].
52	Laporkan kepada ibubapa jika ada orang menepuk punggung [Report to your parents if someone pats your buttocks].