Development and validation of a sexual and reproductive health knowledge scale

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Article Info	ABSTRACT
	The purpose of this study was to develop a reliable and valid instrument to measure primary school students' sexual and reproductive health (SRH) knowledge. The instrument measures primary school students' knowledge in four domains: i) puberty; ii) human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS) and sexually transmitted diseases; iii) prevention of child sexual abuse; and iv) reproduction and reproductive systems. All items in the instrument were reviewed and screened by experts before they were administered to 125 primary five students. The instrument's dimensionality, fit statistics, hierarchical ordering of item difficulty, and item and person separation reliability were assessed using the rasch measurement model (RMM). The results showed that the instrument demonstrated unidimensionality, and the items exhibited a wide range of difficulty level. Misfitting items were removed from the questionnaire, and the remaining 36 items were retained. The RMM outputs showed good item's reliability (.97) with high separation index (5.52). However, the person reliability (.79) and the person separation index (1.94) were slightly the recommended value. Overall, the results show that the developed instrument can be used with confidence to assess sexual and reproductive health (SRH) knowledge among primary school students in Malaysia.

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1. INTRODUCTION

Young people aged between 10 and 24 years form about a quarter of the world's population, and 60% of these young people live in developing countries [1]. It is important to address the young people's need in health and development to achieve the global health goals, reduce the poverty gap, and progress towards gender equality [2]. Provision of good quality sexuality education is critical in improving young people's sexual health status and well-being.

In Malaysia, the National Population and Family Development Board (NPFDB) launched The National Reproductive and Social Health Education Policy (*PEKERTI*) in 2009. The policy was launched to educate Malaysians on sexual and reproductive health (SRH) and to encourage positive attitudes towards reproductive and social services [3]. In Malaysia, sexuality education has been incorporated into various subjects, including health education, science, moral studies, and Islamic studies. Sexuality education is mainly taught in health education subject under the section reproductive health and social education or (*Pendidikan Kesihatan Reproduktif dan Sosial (PEERS))* [4]. It has been shown that students' SRH knowledge is positively associated with their sexual behaviours and reproductive health outcomes [5]. However, previous relevant studies in Malaysia reported that the majority of secondary school students and

university students in Malaysia do not have adequate SRH knowledge [6]–[8]. Thus, adolescents in Malaysia may be exposed to higher reproductive health risks that could eventually lead them to negative SRH outcomes such as unintended pregnancy, unsafe abortion, sexually transmitted diseases, and trauma.

Although the elements of sexuality education have been introduced to the students since primary school, there is a lack of empirical evidence to indicate the level of SRH knowledge among primary schoolers. The notion echoed by Woog and Kågesten who underlined that SRH of very young adolescent who age between 10 to 14 years have received comparatively little attention [9]. Thus, it is imperative to investigate students' understanding of sexuality education as the students are progressively develop throughout their adolescence years. Without sufficient puberty knowledge, students may not be prepared for the drastic changes that occur during puberty, and this may lead them to be depressed and develop negative attitudes towards these puberty changes [10], [11]. An earlier study shows that the lack of knowledge about the consequences of unprotected premarital sex among female adolescents has predisposed them to unwanted pregnancies, unsafe abortion, and sexually-transmitted disease infections [12]. Moreover, a previous study also underlined that individuals with lack of SRH knowledge are more likely to opt-out from health examination [13].

A valid and reliable instrument is needed to evaluate primary school students' SRH knowledge based on PEERS curriculum used in Malaysia context. There are many studies that have attempted to investigate SRH knowledge among adolescents or young people [14]–[16]. Hence, numerous instruments had been developed to measure the domain. Nevertheless, these measurements are not appropriate to be used in evaluating SRH knowledge among primary schoolers since the SRH needs and educational focus of very young adolescents are distinct from older adolescents in secondary schools and young adults.

For example, Cleland had developed the illustrative questionnaire for interview-surveys with young people which is intended to be used to study SRH among teenagers or young people [17]. The survey is designed to document knowledge, beliefs, and behaviours in the domain of SRH and had been widely adapted into different cultural context [18], [19]. Nevertheless, the SRH knowledge domain of the instrument which caters for older adolescents and young adults are not age-appropriate for children who are attending primary schools. Often, one of the most important elements of sexuality education curriculum in primary schools which is about child sexual abuse prevention are neglected in these SRH knowledge instruments. Therefore, this study aims to develop a reliable and valid instrument to measure the level of SRH knowledge among primary school students in Malaysia. Subsequently, this study also examined the psychometric properties of the instrument using the person-item map provided by a Rasch measurement model (RMM).

2.   RESEARCH METHOD
2.1. Development of the instrument

Several factors, including social and cultural characteristics, were considered in developing a draft version of the SRH Knowledge Scale. The scale was developed based on sexual health research conducted elsewhere [20]–[22], reproductive health for adolescent module by the Federation of Reproductive Health Associations Malaysia (FRHAM), and the curriculum of PEERS. We acquired a total of 78 items that measure the primary school students' knowledge in four main domains: i) puberty; ii) AIDS/HIV and sexually transmitted diseases; iii) prevention of child sexual abuse; and iv) reproduction and reproductive systems. Each item is provided with three response options: 'Yes', 'No', and 'Not Sure'.

Three experts in educational psychology and health education reviewed the pilot version of the items to assess the content validity of the questionnaire. The assessment of content validity was to ascertain that the items were well-constructed and adequately represented students' knowledge of SRH. The multi-rater κfree was obtained by using the Online Kappa Calculator available at (http://justusrandolph.net/kappa/) which showed that there was a good agreement between the experts' evaluation, κfree=.77 (95% CI, .72 to .83). Following suggestions by the experts, the items were improved and refined to avoid ambiguity and confusion. Due to the sensitive nature of this study, the researcher consulted an officer from the state Ministry of Education to ensure that all items of the instrument have been specifically developed according to the curriculum and was also convenient to the students when answering the questionnaire. At this stage, a total of 38 items were retained for the pilot study and included in the statistical analysis. The study protocols, procedures, and informed consent documents were approved by the Education Planning and Research Division (EPRD) of the Ministry of Education (reference no.: KPM.600-3/2/3-eras (5910)).

2.2. Participants

A convenience sample of 125 adolescents was recruited for this study from three provinces in Johor, Malaysia. Inclusion criteria were primary five students studying in public primary schools and have been exposed to PEERS curriculum. Written informed consent was obtained from students and parents prior to this

study. The health education teachers distributed the SRH knowledge questionnaires because they were able to clarify the instructions to the students. The students were given 30 minutes to complete all the test items in the scale. Participation of the students in this study was voluntary and anonymous.

2.3. Rasch measurement model (RMM)

The acquired data were analysed using the RMM. It is a psychometric technique that allows the instrument developer to improve the precision of an instrument and to monitor its quality. Moreover, the RMM assumes that each item of the scale (continuum) has its distinct level of difficulty (item difficulty), and the output allows the researcher to illustrate the hierarchy of the items (their level of difficulty) on the scale [23]. The item difficulty and person ability are computed along the continuum. Also, the RMM allows the researcher to examine the measurement quality of the items by evaluating the data fit indicators. In the RMM analysis, there are two widely used mean-square fit statistics analysed based on two indices: infit mean-square and outfit mean-square. Both fit statistics are used to determine if each item fit the model. Any misfitting items are identified and removed from the model.

3. RESULTS

3.1. Dimesionality

Unidimensionality refers to the items in a questionnaire that measure only a single construct, and it is a fundamental requirement in the Rasch model. Linacre suggested that any negative-point biserial correlations should be examined to identify any potentially problematic items [24]. Therefore, an item, namely child sexual abuse (CSA) 4 ('If a stranger wants to look at your private parts, you should run away') with a correlation of 0.0, was removed from the questionnaire.

One of the most important criteria for unidimensionality was the variance explained by the measurement dimension. According to literature, raw variance explained by measures more than 40.0% is considered a strong dimension, higher than 30% is considered a moderately strong dimension, and higher than 20% is considered a moderate dimension [25]. The raw variance explained by measures in this study was 33.0%, indicating that the items represented the construct and showed good unidimensionality. Moreover, Fisher emphasised that the unexplained variance in the first factor should not be more than 15% [26]. In this study, the unexplained variance in the first factor was represented by an eigenvalue of 3 and 5.5%, respectively. Thus, this result indicated that there were no additional factors that were presented in this measurement instrument.

3.2. Item fit

In general, the acceptable range for infit and outfit mean-square (MNSQ) should be between 0.5 and 1.5. The items with MNSQ value between 0.5 and 1.5 are considered as productive items that are useful in the measurement [27]. If the persons and items in the data set are within the acceptable range of MNSQ, further investigation of the standardised fit statistics (ZSTD) values is not necessary [28]. The items statistics were carefully reviewed and showed in Table 1; the outfit mean-square of the items SYS 7 (MNSQ=1.54) and HIV1 (MNSQ=1.52) were beyond the benchmark value of 1.5. Boone, Staver and Yale proposed that unpredictable responses can impact the fit of the items [29]. Therefore, it is necessary to identify the person who responded unpredictably to specific items and subsequent action should be taken to remove any odd responses. The item PUB 11, however, appeared to be misfitted with an outfit mean-square of .15 after elimination of odd responses. This item (measure=5.82 logits) also appeared to be too difficult for the respondents. This result indicated that the item PUB 11 would not provide much useful information to the study.

3.3. Hierarchical ordering of item difficulty

The RMM Wright person-item maps provide insights regarding the order of the items (item difficulty hierarchy) as shown in Figure 1. From the RMM, the item measures in logits (or log-odds units) define the hierarchical order of the items along the continuum. The 36 items were mapped onto an item difficulty map based on their respective item calibrations. Items that are located at the more difficult end of the linear continuum is considered harder to answer correctly, than items that are located at the easy end of the linear continuum. In this study, the Wright map showed that there were 20 items located the mean logit. These items were, therefore, considered as the easy items in this questionnaire for participants to answer correctly. The remaining 16 items were located at the opposite end (difficult end) and the mean logit, indicating that these items were harder for participants to answer correctly. The range of locations of items in the questionnaire was distributed between -2.53 and 3.25, reflecting that the items were able to capture a wide range of students' ability in measuring their SRH knowledge.

Table 1. Item difficulty (measures), fit and misfit indices for the questionnaire that measure primary school students' SRH knowledge in Malaysia (n=125)

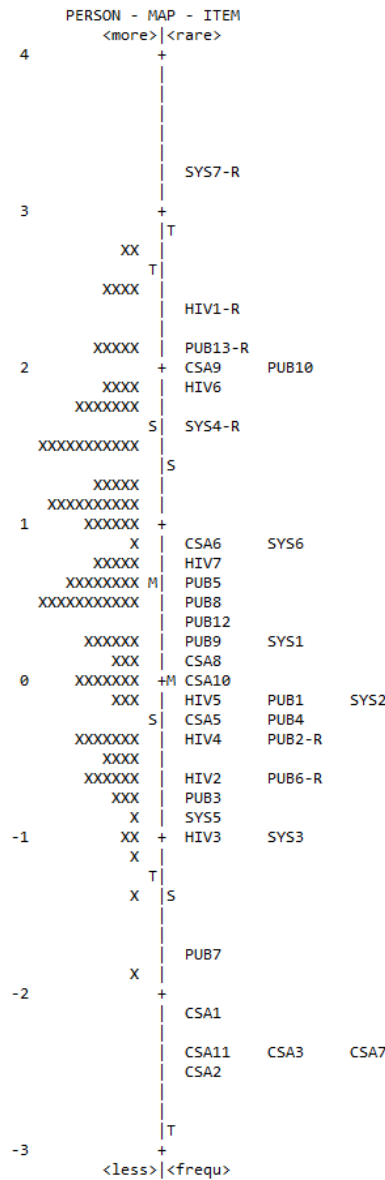| Item		Measure	Infit MNSQ	Outfit MNSQ	Infit ZSTD	Outfit ZSTD	PT-MEA
Puberty							
PUB1	Puberty is the transition period that happens when a child is becoming sexually mature and able to reproduce.	-.08	.87	.80	-1.60	-1.70	.53
PUB2-R	All individuals have the same rate of puberty changes.	-.39	1.18	1.15	1.80	1.00	.22
PUB3	Girls usually experience puberty earlier than boys.	-.73	1.00	.89	.10	-.50	.37
PUB4	During puberty, the hormone stimulates the growth of facial hair and hair around genitals among boys.	-.30	.97	.91	-.30	-.60	.43
PUB5	A wet dream is the body's natural way of releasing the sperm build up in the testes.	.64	.98	.96	-.20	-.40	.44
PUB6-R	It is not normal for boys to have wet dreams.	-.63	1.13	1.35	1.10	1.80	.21
PUB7	The menstrual cycle is a physiological and natural process that happens only on girls.	-1.71	1.01	1.05	.10	.30	.27
PUB8	Menstruation usually begins at about 12 years of age.	.48	1.19	1.22	2.40	2.20	.24
PUB9	Menstrual cycle marks that a girl is capable of becoming pregnant.	.29	1.06	1.00	.80	.10	.37
PUB10	A girl is possible to become pregnant before the first period.	1.94	.92	1.02	-.80	.20	.42
PUB12	The length of periods last three to seven days but can vary for others.	.41	.98	.94	-.30	-.60	.44
PUB13-R	All girls feel depressed during menstruation.	2.09	.90	.89	-.80	-.50	.44
HIV/AIDS and sexually transmitted diseases							
HIV1-R	There is a high chance of getting AIDS by kissing someone on the mouth who has AIDS.	2.42	1.18	1.15	1.3	.7	.17
HIV2	AIDS can be spread by sharing a needle with a drug user who has AIDS.	-.63	.88	.71	-1.00	-1.70	.50
HIV3	AIDS can be spread by having sex with someone who has AIDS.	-.95	.85	.70	-1.10	-1.40	.50
HIV4	Promiscuity can increase the chance of getting AIDS.	-.34	.99	.90	-.10	-.60	.41
HIV5	Sexually transmitted diseases are infections caused by bacteria or viruses which are spread by body contact and by sexual intercourse.	-.17	.94	.84	-.70	-1.20	.47
HIV6	The most common sexually transmitted diseases are gonorrhoea and syphilis.	1.88	.82	.80	-1.80	-1.20	.53
HIV7	Abstinence is an effective method to prevent sexually transmitted diseases.	.76	1.23	1.36	3.00	3.40	.17
Prevention of child sexual abuse							
CSA1	The private parts are the body parts covered by underwear.	-2.12	.86	.51	-.50	-1.20	.40
CSA2	You should not let all grown-up touch your private parts.	-2.53	.91	.52	-.20	-.90	.33
CSA3	You should inform your parents or the person you trust if a grown-up touches your private parts.	-2.34	.91	.50	-.20	-1.10	.35
CSA5	It is OK for the doctors and nurses to look at your private part if you hurt your private parts.	-.21	.98	.91	-.20	-.60	.42
CSA6	Most kids like to get a kiss from their parents before they go to bed at night. For them, that would be a good touch.	.91	1.35	1.44	4.30	4.10	.05
CSA7	You should say "no" and move away if someone touches you in a way you do not like.	-2.35	.97	.40	.00	-1.10	.33
CSA8	You can trust your feelings whether a touch is good or bad.	.13	1.09	1.13	1.10	1.20	.32
CSA9	It's OK to have a hug from a grown-up you like.	2.03	1.17	1.13	1.5	.80	.20
CSA10	A pat on the shoulder from a teacher you like after you've done a good job at school is a good touch.	.00	1.16	1.31	1.9	2.3	.23
CSA11	Boys also need to avoid someone touching their private parts.	-2.37	.88	.47	-.30	-1.20	.37
Reproduction and reproductive system							
SYS1	The male reproductive system consists of penis, testes, and scrotum.	.21	.85	.78	-2.0	-2.1	.56
SYS2	Testes are the male reproductive organ that produces millions of sperms.	-.17	1.05	1.10	.60	.70	.34
SYS3	The female reproductive system consists of ovaries, fallopian tubes, uterus, and vagina.	-1.01	.87	.69	-1.00	-1.40	.49
SYS4-R	Ovaries produce few ova each month.	1.56	.85	.80	-1.80	-1.60	.54
SYS5	Pregnancy occurs when a sperm fertilises the ovum.	-.84	.98	1.02	-.10	.20	.36
SYS6	Fertilisation occurs in fallopian tubes.	.87	.93	.91	-1.0	-.90	.48
SYS7-R	A foetus develops in the cervix of a woman.	3.25	1.02	1.00	.20	.25	.22

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Figure 1. Wright person-item Rasch map for the questionnaire that measures primary school students' SRH knowledge in Malaysia (n=125)

3.4. Reliability

The Winsteps programme generates both person reliability statistics and item reliability statistics. 'Item reliability' and 'person reliability' can be interpreted similarly to the traditional reliability indices-the Cronbach's alpha [28]. Both reliabilities are bounded by 0 and 1, with values closer to 1 indicate a more internally consistent measure. The other important information of reliability is represented by separation. Separation is the ratio of sample or test standard deviation to average estimation error. Separation can range from 0 to infinity, and thus, there is no ceiling to index. The person separation index refers to an estimate of the spread or separation of persons on the measured variable. It is used to classify person. Person separation index below two implies that the instrument lack sensitivity to distinguish between high and low performers. Thus, more items may be needed in the questionnaire. Linacre also pointed out that the item separation index is used to verify the item hierarchy, and the measure should be three [28]. Low item separation index (three) indicates that the person sample is insufficient to confirm the item difficulty hierarchy, which is equivalent to the construct validity of the instrument [29].

Winsteps output provides a summary of person and item information as show in Table 2. In this study, the analysis showed that the person separation index and reliability were 1.94 and .79, respectively. These values are very close to the recommended value. Thus, our results indicated that the instrument was

sensitive to differentiate the respondents with different level of abilities in responding to the instrument. On the other hand, the item separation index and reliability were 5.52 and .97, respectively. The high item separation index values further confirmed the construct validity of the instrument and its replicability in other samples with similar properties.

Table 2. Item fit statistics for primary school students' SRH knowledge questionnaire (n=125)

Item measure		Person measure		Average infit mean-square	Average outfit mean-square	Cronbach α
Reliability	Separation	Reliability	Separation			
5.52	.97	1.94	.79	1.01	.93	.81

4.   DISCUSSION

The main objective of this study was to develop a scale that can be used to measure primary school students' SRH knowledge and examined its psychometric properties using the Rasch analysis. As mentioned earlier, we developed a questionnaire based on the PEERS curriculum that entails the elements of sexuality education in Malaysia context. The scale consisted of four domains that measured the primary school students' knowledge on puberty, AIDS/HIV and sexually transmitted diseases, prevention of child sexual abuse, and reproduction and reproductive systems. Based on the results of RMM, the instrument exhibited good unidimensionality. Thus, it is possible to measure students' ability by formulating the total scores obtained by the students across the four domains.

The result of RMM also identified several items which did not match the fit criteria. Removal of misfit items from the RMM may improve the measurement properties of the instrument. The results showed that the item CSA 4, which measured student's knowledge on child sexual abuse prevention displayed minimum measure. The minimum measure was observed when all the participants involved in this study answered the item correctly, meaning that the items were considered too easy for the participants. The person separation of the item with maximum or minimum measure provides limited useful information. Thus, it was appropriate to remove the item. The health education curriculum in Malaysia has emphasised on the topic of child sexual abuse prevention starting in primary one. For this reason, one can predict that the students to have more awareness towards this topic, and therefore, were able to respond correctly to the items. The other item PUB 12 ('During menstruation, dirty blood releases out from the girl's body through the vagina') with 5.82 logits was also removed from the questionnaire due to misfit. This current study showed that almost all students were unable to answer this item correctly, suggesting that this item may be too difficult for the primary school students. Presumably, this finding may also reflect the Malaysian norms of viewing menstruation as a thing that is embarrassing and unhygienic. In support of this, a recent review highlighted that female adolescent in low- and middle-income countries often have knowledge gaps and misconceptions about menstruation [30]. Prior studies also indicated that people in some settings often hold beliefs that menstrual blood is 'dirty' and menstruating women are unclean [31], [32]. These beliefs and misconceptions that are rooted in the culture could be misleading for adolescents.

The Wright Person-Item map for the scale displays the conjoint distribution of the person ability logit scores against the item difficulty logit scores on the same continuum measured. The map provides a clear overview of the difficulty of items compatible with the respondents' ability in a hierarchical order. The results of the RMM showed that there was a reasonable distribution in the difficulty of the items measuring SRH knowledge among primary school students. Most of the items located the mean of the difficulty assessed students' knowledge in child sexual abuse prevention. As mentioned earlier, the skills and knowledge of child sexual abuse prevention have been introduced to the students starting in primary one. Moreover, the contents of the subject are further elaborated and discussed extensively in grade two and three. Therefore, the respondents were expected to have more exceptional ability to answer the items related to child sexual abuse prevention. We also identified several relatively distant gaps between the items in the Wright Person-Item map. Thus, it is recommended that more items should be added in future studies to fill the gap.

The RMM has been widely used to assess the validity and reliability of the research instrument. Based on the RMM results, it is expected that the items with high-reliability indices would show a high consistency in the item hierarchy and replicability when these items are used in another comparable sample. Our results showed that the person separation index (PSI=1.94) was slightly lower than the recommended criteria of 2.00. However, past literatures asserted that a person separation index of 1.50 represents an acceptable level of separation [29], [33]. Therefore, the items in our questionnaire are still sensitive to distinguish the ability of the respondents.

Despite the strengths of our instrument in measuring the students' SRH knowledge, there are several limitations of this pilot study that need to be considered. Firstly, our method of using a convenience sampling approach to recruit participants could introduce sampling bias. Secondly, this study was aimed to develop an

instrument that could be used to measure the SRH knowledge among primary schools' students in Malaysia. However, the current study only included respondents from Johor. We cannot, therefore, generalised our results to the population. Lastly, as we only included primary five students in this study, most of them may not have been exposed to the contents related to risks of having sexual intercourse such as contracting HIV/AIDS and sexually transmitted diseases. This is because the curriculum is only introduced to the students when they are in primary six. Hence, it is recommended that future studies may consider including students from different age-group and geographical region to provide empirical evidence to support the reliability and validity of the instrument.

5.   CONCLUSION

Based on the results, two items were removed from the originally developed 38-items scale due to misfit in the RMM. The remaining 36 items in all four domains were retained as they fulfilled the criteria of the RMM. This scale displayed appropriate reliability and validity in measuring the SRH knowledge among primary school students. Thus, it can be a useful and meaningful measurement tool to help policymakers and educators understand the status of students' SRH knowledge. It is important to have a clear overview of the present situation before designing and developing an intervention to promote students' SRH health knowledge that contributes to the adolescents' well-being. Nevertheless, additional analysis using a larger sample is needed to ascertain the replicability of the results and its robustness to further enhance the reliability of the scale as a measurement of students' knowledge in SRH.

REFERENCES

[1]   UNESCO, "Thematic Factsheet | Youth and Empowerment," 2021, [Online]. Available: https://en.unesco.org/culture-development/transversal-approaches/youth-and-empowerment.
[2]   I. H. Shah, O. F. Leal, and M. Bronfman, "Sexual and reproductive health of young people," *Salud Publica de Mexico*, vol. 50, no. 1, pp. 8–9, 2008, doi: 10.1590/S0036-36342008000100006.
[3]   LPPKN, "The National policy in reproductive health and social edecation and plan of action," *Lembaga Penduduk dan Pembangunan Negara*, 2021, [Online]. Available: https://www.lppkn.gov.my/index.php/en/dasar-modul/dasar-pkrs.
[4]   M. M. Mokhtar, D. A. Rosenthal, J. S. Hocking, and N. A. Satar, "Bridging the Gap: Malaysian youths and the pedagogy of school-based sexual health education," *Procedia - Social and Behavioral Sciences*, vol. 85, pp. 236–245, 2013, doi: 10.1016/j.sbspro.2013.08.355.
[5]   C. Li *et al.*, "The relationships of school-based sexuality education, sexual knowledge and sexual behaviors - A study of 18,000 Chinese college students," *Reproductive Health*, vol. 14, no. 1, 2017, doi: 10.1186/s12978-017-0368-4.
[6]   M. Anwar, S. A. S. Sulaiman, K. Ahmadi, and T. M. Khan, "Awareness of school students on sexually transmitted infections (STIs) and their sexual behavior: A cross-sectional study conducted in Pulau Pinang, Malaysia," *BMC Public Health*, vol. 10, 2010, doi: 10.1186/1471-2458-10-47.
[7]   H. Awang, L. P. Wong, R. Jani, and W. Y. Low, "Knowledge of sexually transmitted diseases and sexual behaviours among malaysian male youths," *Journal of Biosocial Science*, vol. 46, no. 2, pp. 214–224, 2014, doi: 10.1017/S0021932013000114.
[8]   L. P. Wong, C. K. L. Chin, W. Y. Low, and N. Jaafar, "HIV/AIDS-related knowledge among Malaysian young adults: Finding F nationwide survey," *MedGenMed Medscape General Medicine*, vol. 10, no. 6, p. 148, 2008, doi: 10.1186/1758-2652-10-6-148.
[9]   V. Woog and A. Kågesten, "The Sexual and Reproductive Health Needs of Very Young Adolescents In Developing Countries: what does the evidence show?," *Guttmacher Institute*, no. May, pp. 10–11, 2017, [Online]. Available: https://www.guttmacher.org/fact-sheet/srh-needs-very-young-adolescents-in-developing-countries.
[10]   S. Kar, A. Choudhury, and A. Singh, "Understanding normal development of adolescent sexuality: A bumpy ride," *Journal of Human Reproductive Sciences*, vol. 8, no. 2, pp. 70–74, 2015, doi: 10.4103/0974-1208.158594.
[11]   M. Rani, P. Sheoran, Y. Kumar, and N. Singh, "Evaluating the Effectiveness of Pubertal Preparedness Program in Terms of Knowledge and Attitude Regarding Pubertal Changes Among Pre-Adolescent Girls," *Journal of family & reproductive health*, vol. 10, no. 3, pp. 122–128, 2016.
[12]   C. I. Okereke, "Unmet reproductive health needs and health-seeking behaviour of adolescents in Owerri, Nigeria.," *African journal of reproductive health*, vol. 14, no. 1, pp. 43–54, 2010.
[13]   E. Åkerman, E. C. Larsson, B. Essén, and R. Westerling, "A missed opportunity? Lack of knowledge about sexual and reproductive health services among immigrant women in Sweden," *Sexual and Reproductive Healthcare*, vol. 19, pp. 64–70, 2019, doi: 10.1016/j.srhc.2018.12.005.
[14]   J. E. Finlay *et al.*, "Sexual and reproductive health knowledge among adolescents in eight sites across sub-Saharan Africa," *Tropical Medicine and International Health*, vol. 25, no. 1, pp. 44–53, 2020, doi: 10.1111/tmi.13332.
[15]   A. A. Rahman *et al.*, "Knowledge of sexual and reproductive health among adolescents attending school in Kelantan, Malaysia," *Southeast Asian Journal of Tropical Medicine and Public Health*, vol. 42, no. 3, pp. 717–725, 2011.
[16]   M. Zakaria, F. Karim, S. Mazumder, F. Cheng, and J. Xu, "Knowledge on, attitude towards, and practice of sexual and reproductive health among older adolescent girls in Bangladesh: An institution-based cross-sectional study," *International Journal of Environmental Research and Public Health*, vol. 17, no. 21, pp. 1–14, 2020, doi: 10.3390/ijerph17217720.
[17]   J. Cleland, "Illustrative Questionnaire for Interview - Surveys with Young people," *Human Reproduction*, pp. 3–56, 2001.
[18]   J. Lyu, X. Shen, and T. Hesketh, "Sexual knowledge, attitudes and behaviours among undergraduate students in China—implications for sex education," *International Journal of Environmental Research and Public Health*, vol. 17, no. 18, pp. 1–16,

2020, doi: 10.3390/ijerph17186716.

[19]　V. Vongxay *et al.*, "Sexual and reproductive health literacy of school adolescents in Lao PDR," *PLoS ONE*, vol. 14, no. 1, 2019, doi: 10.1371/journal.pone.0209675.

[20]　L. M. Tutty, "The revised children's knowledge of abuse questionnaire: Development of a measure of children's understanding of sexual abuse prevention concepts," *Social Work Research*, vol. 19, no. 2, pp. 112–120, 1995, doi: 10.1093/swr/19.2.112.

[21]　S. K. Wurtele, E. I. Gillispie, L. L. Currier, and C. F. Franklin, "A comparison of teachers vs. parents as instructors of a personal safety program for preschoolers," *Child Abuse and Neglect*, vol. 16, no. 1, pp. 127–137, 1992, doi: 10.1016/0145-2134(92)90013-H.

[22]　G. D. Zimet, "Reliability of AIDS knowledge scales: Conceptual issues," *AIDS Education and Prevention*, vol. 4, no. 4, pp. 338–344, 1992.

[23]　W. J. Boone, "Rasch analysis for instrument development: Why,when,and how?," *CBE Life Sciences Education*, vol. 15, no. 4, 2016, doi: 10.1187/cbe.16-04-0148.

[24]　J. M. Linacre, "Detecting multidimensionality: which residual data-type works best?," *Journal of outcome measurement*, vol. 2, no. 3, pp. 266–283, 1998.

[25]　J. M. Linacre, "Data variance explained by Rasch measures," *Rasch Measurement Transactions*, vol. 20, no. 1, p. 1045, 2006.

[26]　W. P. Fisher, "Rating Scale Instrument Quality Criteria," *Rasch Measurement Transactions*, vol. 21, no. 1, p. 1095, 2007.

[27]　J. M. Linacre, "What do infit and outfit, mean-square and standardized mean," *Rasch Measurement Transactions*, vol. 16, no. 2, p. 878, 2002.

[28]　J. M. Linacre, "Winsteps® Rasch measurement computer program. Beaverton, Oregon: Winsteps.com," *Beaverton, Oregon: Winsteps. com*, 2015.

[29]　W. J. Boone, M. S. Yale, and J. R. Staver, "Rasch analysis in the human sciences," *Rasch Analysis in the Human Sciences*, pp. 1–482, 2014, doi: 10.1007/978-94-007-6857-4.

[30]　V. Chandra-Mouli and S. V. Patel, "Mapping the knowledge and understanding of menarche, menstrual hygiene and menstrual health among adolescent girls in low- and middle-income countries," *Reproductive Health*, vol. 14, no. 1, 2017, doi: 10.1186/s12978-017-0293-6.

[31]　Burnett, "Menstrual hygiene management in Indonesia; Understanding practices, determinants and impacts among adolescent school girls. UNICEF Indonesia in collaboration with Burnet Institute, Survey METER," *Burnet Institute, Melbourne*, 2015.

[32]　Y. Mohamed *et al.*, "A qualitative exploration of menstruation-related restrictive practices in Fiji, Solomon Islands and Papua New Guinea," *PLoS ONE*, vol. 13, no. 12, 2018, doi: 10.1371/journal.pone.0208224.

[33]　B. D. W. and G. N. Masters, "Rating Scale Analysis," *Advances in Measurement in Educational Research and Assessment*, pp. 110–121, 1999, doi: 10.1016/b978-008043348-6/50008-5.

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