

Bridging reproductive health literacy and sustainability: Deaf students' knowledge of reusable menstrual pads

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Abstract: Limited access to reproductive health information and environmental education may affect deaf students' understanding of reusable menstrual pads as sustainable menstrual products. This study aimed to describe the knowledge of deaf female students regarding reusable menstrual pads from the perspectives of reproductive health and environmental sustainability. A quantitative descriptive design was employed involving 13 deaf female students from five special schools (Sekolah Luar Biasa/SLB) in Bandung City. Data were collected using a visual-based multiple-choice knowledge test and analyzed using descriptive statistics. The findings showed that the overall level of knowledge was categorized as moderate (57.88%). Factual knowledge was also categorized as moderate (67%), whereas conceptual knowledge remained low (44%), indicating that students demonstrated better understanding of practical aspects of reusable menstrual pads than broader concepts related to sustainability and environmental responsibility. In conclusion, deaf students' knowledge of reusable menstrual pads remains stronger at the factual level than at the conceptual level, indicating the need for more integrated reproductive health education that strengthens conceptual understanding of environmental sustainability within special education.

Keywords: menstrual hygiene management; reusable menstrual products; deaf female students in special education; reproductive health literacy; green curriculum integration

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Introduction

Menstruation is a biological process experienced by women as an indicator of the functioning of the reproductive system. During menstruation, women are required to maintain personal hygiene and use appropriate menstrual products to ensure reproductive health. Within the concept of menstrual hygiene management (MHM), effective menstrual management extends beyond the mere use of menstrual products to include hygiene practices, comfort, and women's overall well-being. Arunachalam et al. emphasize that menstrual hygiene is an essential component of women's dignity and well-being (Arunachalam et al., 2020), while Maky et al highlight that proper menstrual hygiene practices can help prevent infections and enhance comfort and self-confidence during menstruation (Maky et al., 2025). However, the type of menstrual products commonly used also raises broader concerns. Disposable sanitary pads remain the most widely used menstrual product. Despite their practicality, disposable pads pose several challenges, particularly in relation to environmental impact. Masyithah and Mariyanti report that plastic-based materials contained in disposable pads may take up to 500 years to decompose, making menstrual waste a significant contributor to long-term environmental pollution (Masyithah T & Mariyanti, 2024).

In response to these concerns, alternative menstrual products have been increasingly introduced. One such alternative is reusable menstrual pads. Reusable menstrual pads are washable menstrual products designed for repeated use over an extended period. Compared with disposable sanitary pads,

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they offer health benefits through the use of skin-friendly materials while also reducing menstrual waste and long-term costs (Hariyanti et al., 2025; Masyithah T & Mariyanti, 2024). These characteristics make reusable menstrual pads a sustainable alternative that supports both reproductive health and environmental sustainability.

The growing relevance of environmental sustainability has also influenced educational practices. UNESCO (2024) emphasizes that education should equip learners with the knowledge, attitudes, and awareness necessary to promote sustainable behavior (UNESCO, 2024). Within this framework, education about reusable menstrual pads can serve as an effective learning medium for integrating reproductive health literacy with environmental responsibility. By introducing students to reusable menstrual products, educators not only promote healthy menstrual hygiene practices but also foster awareness of sustainable consumption and menstrual waste reduction. Consequently, reusable menstrual pads become a contextual learning topic that supports the objectives of a green curriculum by linking personal health behaviors with environmental sustainability.

Nevertheless, the effectiveness of such educational efforts depends on learners' access to information, which is not always equal. Access to reproductive health information remains limited for certain groups, including deaf students. Communication barriers experienced by individuals with hearing impairments may affect their access to various forms of information, including reproductive health information (Rahmah & Kholiq, 2018). Arasshifa found that some deaf students still experience difficulties in understanding menstrual pad use, pad care, and menstrual hygiene practices (Arasshifa, 2023). These findings indicate that reproductive health education for deaf students requires further attention and development that is better aligned with their specific characteristics. This concern is supported by preliminary reproductive health education activities conducted by the researchers, which revealed that 7 out of 25 deaf students demonstrated limited understanding of basic reproductive health concepts, including body privacy and menstrual hygiene. Although reusable menstrual pads were not specifically assessed, these findings indicate that deaf students' foundational reproductive health literacy remains insufficient and may influence their understanding of menstrual health products. This highlights the need for reproductive health education that is better adapted to the communication characteristics and learning needs of deaf students.

Several recent studies have demonstrated the benefits of reusable menstrual pads from health, educational, and environmental perspectives. Diniyati et al. found that reusable menstrual cloth pads were more effective than conventional disposable pads in reducing urinary tract infection risks among young women (Diniyati et al., 2021). Nayoan et al. reported that educational training on reusable menstrual pads successfully improved participants' knowledge and practical skills while simultaneously promoting environmentally sustainable menstrual practices (Nayoan et al., 2024). Masyithah and Mariyanti showed that reusable menstrual pads provide ecological advantages by reducing non-biodegradable waste and utilizing materials that are safer for prolonged skin contact (Masyithah T & Mariyanti, 2024). In the context of reproductive health education for students with disabilities, Maky et al. demonstrated that structured menstrual hygiene education significantly improved menstrual hygiene management among deaf adolescent girls (Maky et al., 2025). Similarly, Fatimatuzzahra et al. reported that digital learning media specifically designed for students with disabilities effectively enhanced menstrual hygiene knowledge and independent self-care skills (Fatimatuzzahra et al., 2025). Collectively, these studies suggest that educational support plays a critical role in promoting healthy and sustainable menstrual practices.

Despite these findings, several important research gaps remain. Existing studies have primarily focused on improving menstrual hygiene behaviors, evaluating educational interventions, or examining health outcomes among adolescents, including students with disabilities. However, little is known about how deaf students construct their knowledge of reusable menstrual pads, particularly by distinguishing factual knowledge from conceptual knowledge. Furthermore, the integration of reproductive health

literacy and environmental sustainability in understanding reusable menstrual pads within special education remains largely unexplored. Addressing these gaps is important because comprehensive knowledge is essential for supporting informed menstrual health practices and environmentally responsible behavior.

Building upon these identified gaps, this study differs from previous research in three important ways. First, it examines the knowledge structure of deaf students regarding reusable menstrual pads rather than focusing solely on menstrual hygiene practices or educational interventions. Second, it distinguishes factual knowledge from conceptual knowledge to provide a more comprehensive understanding of students' cognitive development. Third, it integrates reproductive health literacy with environmental sustainability by positioning reusable menstrual pads as both menstrual health products and contextual learning resources within special education. These contributions provide new empirical evidence to support the development of inclusive and sustainability-oriented reproductive health education.

Therefore, this study aims to describe deaf students' knowledge of reusable menstrual pads by distinguishing factual and conceptual knowledge from the perspectives of reproductive health and environmental sustainability. The findings are expected to provide evidence for developing more inclusive and sustainability-oriented reproductive health education for deaf students.

Method

This study employed a quantitative approach with a descriptive research design. A descriptive design was selected because the study aimed to describe the level of knowledge among deaf students regarding the use of reusable menstrual pads without examining relationships or causal effects between variables (Sugiyono, 2023). Through this approach, data were collected and analyzed in numerical form to obtain an objective overview of students' knowledge of reusable menstrual pads based on factual and conceptual knowledge aspects. The population in this study comprised of all deaf female students who had experienced menstruation and were enrolled in special schools (Sekolah Luar Biasa/SLB) in Bandung City and met the research criteria. Initial identification indicated that six SLBs had students who met the research criteria, with a total target population of 40 students. However, due to research access constraints, one school with a larger number of eligible students did not grant permission to participate. Consequently, the accessible population consisted of 13 deaf female students from five SLBs. The inclusion criteria were as follows: (1) deaf students who were able to communicate using sign language and/or oral communication, (2) had experienced menstruation for at least three cycles, and (3) were willing to participate in the entire research process. Given the relatively limited number of students who met these criteria, all eligible participants within the accessible population were included as research respondents using a total sampling technique (Etikan, 2016; Sugiyono, 2023). Based on this process, a total of 13 respondents from five schools were involved: SLB ABCD Caringin, SLB B Sumbersari, SLB B YPLAB Wartawan, SLB BC Hikmat, and SLBN Sukapura.

The research instrument was a visual-supported multiple-choice knowledge test developed based on the factual and conceptual knowledge dimensions of the revised Bloom's Taxonomy proposed by (Anderson & Krathwohl, 2001). The instrument consisted of 40 items derived from 26 indicators covering knowledge of the definition, function, materials, types, use, care, health benefits, and the importance of reusable menstrual pads from the perspectives of reproductive health and environmental sustainability. Instrument development also referred to Green Curriculum principles, which emphasize ecological awareness, clean and healthy living behaviors, and environmental responsibility.

Instrument validity was assessed through content validity using expert judgment involving three validators: two lecturers in special education and one teacher experienced in teaching deaf students. The validators evaluated the alignment of indicators, conceptual accuracy, clarity of language, and comprehensibility of the items for deaf students. Feedback from the validators was used to revise and

Dikomentari [P1]: Add a reliability test (Cronbach's Alpha or KR-20 for multiple-choice questions).

refine the instrument prior to data collection. Following the content validity process, the reliability of the 40-item multiple-choice instrument was examined using the Kuder–Richardson Formula 20 (KR-20), yielding a coefficient of 0.84, which indicates high internal consistency. In addition, a limited readability test was conducted with several female university students aged 18–22 years who had experienced menstruation to ensure clarity of language, instructions, and visual presentation (Boateng et al., 2018).

Data collection was carried out by administering the knowledge test directly to respondents at their respective schools. Prior to the test administration, the researcher explained the purpose of the study and the procedures for completing the instrument. Assistance was provided when necessary to ensure that each question was understood by the respondents without influencing their answers. Data were analyzed using descriptive statistics with the assistance of Microsoft Excel. The analysis procedures included editing, coding, data tabulation, calculation of total scores, mean scores, percentages, frequency distributions, and standard deviations. Knowledge level percentages were calculated using the formula: $\left[P = \frac{f}{N} \times 100\%\right]$, while mean scores were calculated using $\left[X = \frac{\sum X}{N}\right]$, and standard deviation was calculated using $\left[SD = \sqrt{\frac{\sum (X - \bar{X})^2}{N}}\right]$. The results were then categorized into knowledge levels based on the criteria proposed by Arikunto (2013): good (76%–100%), moderate (56%–75%), and low (<56%). Finally, the data were presented in tables and figures to illustrate deaf students' levels of knowledge regarding the use of reusable menstrual pads across factual and conceptual knowledge aspects.

Results and Discussion

Knowledge Level of Deaf Students on Reusable Menstrual Pads

This study aimed to describe the level of knowledge among deaf female students regarding reusable menstrual pads from the perspectives of reproductive health and environmental sustainability. Data were collected using a 40-item test developed based on 26 indicators, seven sub-dimensions, and two knowledge domains: factual and conceptual knowledge. A total of 13 deaf female students from five special schools (SLB) in Bandung City who had experienced menstruation participated in the study.

Table 1. Level of Knowledge of Deaf Students on Reusable Menstrual Pads

Statistic	Score
Number of respondents	13
Maximum score	33
Minimum score	18
Mean score	23,15
Standard deviation	3,82
Knowledge percentage	57,88%
Category	Moderate

As presented in Table 1, the overall level of students' knowledge was categorized as moderate, with a knowledge percentage of 57.88%. Based on the analysis of 13 respondents, the obtained scores ranged from a minimum of 18 to a maximum of 33, with a mean score of 23.15 and a standard deviation of 3.82. These results indicate that, in general, the students' knowledge was at a moderate level, with relatively low variability among respondents. The mean score of 23.15 out of 33 reflects the central tendency of students' knowledge across all assessed items. In addition, the total score of 301 out of 520 further confirms that the overall knowledge level falls within the moderate category. The standard deviation value of 3.82 indicates that the distribution of scores among participants was relatively

homogeneous, suggesting that the differences in knowledge levels between students were not highly pronounced.

Factual Knowledge

Table 2. Overview of Deaf Students' Factual Knowledge of Reusable Menstrual Pads

Question	Average per Indicator	Average per Aspect	Average per Sub-Dimension	Average per Dimension
1	19%	44%	66%	67%
2				
3	69%			
4				
5	88%	88%		
6				
7	46%	46%	68%	
8	69%	77%		
9	85%			
10				
11	77%			
12	77%	82%		
13	77%			
14	92%			
15				

Factual knowledge was categorized as moderate (67%), with notable variation across indicators. Higher achievement was observed in knowledge related to the function of reusable menstrual pads (88%) and their use (82%), indicating that students were more familiar with the practical and experiential aspects of menstrual pad utilization. Knowledge regarding pad materials also reached a relatively good level (77%), suggesting that students had a basic awareness of fabric characteristics associated with absorbency and comfort. In contrast, lower scores were found in basic knowledge of reusable menstrual pads (44%) and in understanding their structural composition (46%), reflecting limited recognition of the product's fundamental characteristics and layered design. Overall, these findings indicate that students' factual knowledge was more developed in applied and functional domains than in foundational and structural aspects, highlighting an uneven distribution of factual understanding across content areas.

Conceptual Knowledge

Table 3. Overview of Deaf Students' Conceptual Knowledge of Reusable Menstrual Pads

Question	Average per Indicator	Average per Aspect	Average per Sub-Dimension	Average per Dimension
16	35%	29%	29%	44%
17				
18	23%			
19	73%	66%	52%	
20				
21	54%			
22	46%			
23				
24	92%			
25	35%	44%		
26				
27	54%			
28	8%	27%		
29	46%			
30				
31	69%	69%		

Question	Average per Indicator	Average per Aspect	Average per Sub-Dimension	Average per Dimension
32				
33	69%			
34	50%	60%	51%	
35				
36	69%			
37	54%	54%		
38				
39	38%	38%		
40				

Conceptual knowledge was categorized as low, with an overall achievement of (44%), indicating limited development of higher-order understanding related to reusable menstrual pads. Achievement across indicators varied considerably. The highest scores were observed in clean and independent living behavior (69%), reproductive health concepts (66%), and the human–environment relationship (60%), suggesting that concepts closely linked to personal routines and daily experiences were more readily understood. Moderate achievement was found in economic sustainability (54%) and environmental sustainability (44%), reflecting partial awareness of long-term use and waste reduction. In contrast, substantially lower scores were recorded for social and environmental responsibility (38%), classification of menstrual pad types (29%), and sustainable consumption behavior (27%), indicating difficulties in grasping abstract concepts involving categorization, responsibility, and consumption patterns. Overall, conceptual knowledge was markedly weaker than factual knowledge, with students demonstrating stronger understanding of health- and habit-oriented concepts than of sustainability-related and classification-based concepts, highlighting fragmented conceptual comprehension within this domain.

Discussion

The findings of this study reveal a pronounced disparity between factual and conceptual knowledge among deaf female students regarding reusable menstrual pads, with important implications for reproductive health and sustainability education in special education settings. Factual knowledge was categorized as moderate (67%) and was strongest in indicators related to function (88%) and usage (82%), indicating that students possessed relatively well-developed experience-based understanding of menstrual pad utilization. This pattern aligns with previous findings suggesting that deaf adolescent girls tend to demonstrate stronger mastery of practical menstrual hygiene behaviors than broader reproductive health concepts following educational interventions (Maky et al., 2025). Such outcomes are likely influenced by instructional practices that prioritize observable routines and hygiene-related behaviors, which are more easily reinforced through visual demonstration and repeated practice.

Knowledge related to pad materials also showed a relatively good level of achievement (77%), suggesting a basic awareness of absorbency and comfort-related fabric properties. This finding is consistent with (Diniyati et al., 2021), who emphasized the health benefits of reusable menstrual pads and highlighted that material comfort and skin safety are among the most readily understood aspects by young women. However, lower scores in basic product recognition (44%) and structural understanding (46%) indicate that students' factual knowledge remains uneven. Although students know how to use reusable menstrual pads, they demonstrate limited understanding of the product's physical composition and defining characteristics, suggesting that factual knowledge has not yet formed a fully coherent foundation for more advanced learning.

These limitations become more evident at the conceptual level. Conceptual knowledge was categorized as low overall (44%), with substantial variation across indicators. Higher achievement was observed in clean and independent living behavior (69%) and reproductive health concepts (66%),

indicating that concepts closely tied to personal routines, bodily comfort, and independence are more accessible to deaf learners. This pattern reflects the learning characteristics of deaf students, who tend to process information more effectively through visual representations, contextual experiences, and explicit instructional support than through abstract verbal explanations (Marschark et al., 2017). Similarly, Fatimatuzzahra et al., (2025) reported that visually supported learning materials were more effective in improving practical knowledge than abstract conceptual understanding among students with disabilities.

Moderate achievement in understanding the human-environment relationship (60%) and economic sustainability (54%) suggests that students possess partial awareness of the broader implications of menstrual product choices, particularly when these concepts are presented in concrete or experience-based terms. However, markedly lower scores in environmental sustainability (44%), social and environmental responsibility (38%), classification of menstrual pad types (29%), and sustainable consumption behavior (27%) indicate significant difficulties in grasping abstract concepts that require categorization, systems thinking, and long-term perspective. These findings suggest that while students may recognize immediate personal or environmental effects, they struggle to integrate these insights into coherent conceptual frameworks related to sustainability and responsible consumption.

The contrast between relatively stronger factual knowledge and weaker conceptual understanding reinforces the notion that adequate practical knowledge does not necessarily translate into well-developed conceptual learning. Although training programs have been shown to improve knowledge and practical skills related to reusable menstrual pads while promoting environmentally sustainable behavior (Nayoan et al., 2024), the present findings suggest that without explicit conceptual scaffolding, such improvements may remain behavior-oriented rather than conceptually integrated. In this study, students' limited understanding of product structure and classification further constrains their ability to conceptualize sustainability-related issues, as foundational factual gaps may hinder the formation of higher-order concepts.

Therefore, special education curricula need to reinforce foundational knowledge of menstrual product characteristics while gradually integrating sustainability concepts through structured and visually supported instruction. Strengthening the linkage between factual, conceptual, and contextual learning may contribute to a more coherent and meaningful understanding of reproductive health within broader environmental and social frameworks. Unlike previous studies that primarily focused on menstrual hygiene practices or intervention outcomes, the present study offers a more comprehensive understanding of how deaf students organize their knowledge by distinguishing between factual and conceptual domains. This distinction demonstrates that reproductive health education for deaf learners should place greater emphasis on conceptual integration, particularly within sustainability-oriented learning environments. Future research should explore the development and effectiveness of green curriculum based instructional models specifically designed for deaf learners, while also considering contextual factors such as teacher competence, school support systems, and home learning environments. Addressing these factors may enhance the development of sustainability-related conceptual understanding and support deaf students in becoming independent, health-literate, and environmentally responsible individuals.

Nevertheless, this study has several limitations that should be acknowledged. The number of participants was relatively small due to research access constraints, as one special school (SLB B) with a larger eligible student population was unable to participate because the data collection period coincided with the school's final examination schedule. Consequently, the findings represent the accessible population of deaf female students in SLB B in Bandung City and should be interpreted with caution when considering broader generalization. Future studies are encouraged to involve a wider range of

schools and a larger sample size to strengthen external validity and allow comparative analysis across different educational contexts.

Conclusion

This study found that the overall knowledge of deaf female students regarding reusable menstrual pads was categorized as moderate (57.88%), with clear disparities across knowledge domains. Factual knowledge reached a moderate level (67%), whereas conceptual knowledge remained low (44%), indicating that students were more proficient in understanding practical and procedural aspects of reusable menstrual pads than in grasping broader reproductive health and environmental sustainability concepts. This imbalance suggests that current reproductive health education in special education settings has been more effective in promoting routine-based menstrual hygiene practices than in fostering higher-order conceptual understanding.

These findings underscore the need for reproductive health education to move beyond a predominantly procedural focus toward the systematic development of conceptual knowledge related to sustainable menstrual products and environmental responsibility. Instructional approaches should strengthen foundational knowledge of menstrual product characteristics while integrating sustainability concepts through visual, contextual, and experiential learning strategies that are aligned with the learning profiles of deaf students. Theoretically, this study contributes to the literature by highlighting the differentiated development of factual and conceptual knowledge in reproductive health learning among deaf students, emphasizing that practical competence does not necessarily indicate conceptual understanding. Practically, the findings provide a critical foundation for designing more integrated reproductive health education models that link menstrual health with environmental sustainability, supporting the implementation of green curriculum approaches in special education contexts.

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