How Can We Improve Knowledge and Perceptions of Menstruation? A Mixed-methods Research Study

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Abstract

Background Traditionally, menstrual education has been conducted in the form of lectures directed mainly towards women. This study aimed to design an innovative menstrual education (ME) program that reflects the needs of both young women and men, and to verify its effectiveness.

Methods A mixed-method design was used to determine the requirements of an ME program and to assess young adults’ knowledge and perceptions of menstruation and menstrual products. Focus group interviews were conducted with 17 young adults, and 150 young adults participated in an online survey. After developing the ME program, 10 young adults participated in an experiment to verify its effectiveness.

Results The interview results showed that young adults wanted more knowledge of various types of menstrual products. The online survey revealed significant differences in knowledge based on participants’ general characteristics and experience; exposure to menstruation and menstrual products had a positive impact on knowledge and perception. In addition, the results indicated that young adults would like ME content to be available on mobile devices and via in-person methods, to be designed for both genders, to draw on menstrual experts’ knowledge, and to incorporate multi-experimental methods. Considering the results, a multi-experimental menstrual education (MEME) program was designed, utilizing hands-on exposure to 60 menstrual products, simulations of the products’ use with a female perineal model, a YouTube video created by the researchers, a true-or-false quiz, and question-and-answer sessions with menstrual experts.

Conclusions This study clarified the requirements of an innovative menstrual education program. Consequently, the MEME program not only led to high satisfaction among participants, but also helped to improve knowledge and perceptions of menstruation and menstrual products. In the online survey, results showed a correlation between the extent of received ME, and respondents’ perception of menstrual products. This implies that MEME could change perceptions of menstruation and menstrual products when conducted systematically; by extension, it would contribute to addressing the cause of menstruation-related problems attributed to poverty. Future research could further verify the effectiveness of the MEME program, using a larger sample, for the program’s incorporation into
official ME curricula, such as at universities and companies.

Trial registration This trial was registered in a Clinical Research Information Service in Korea that was linked with the World Health Organization’s International Clinical Trial Registry Platform (WHO’s ICTRP) (no. KCT0004715), Registered 07 Feb 2020, 
https://cris.nih.go.kr/cris/search/search_result_st01.jsp?seq=15855

Background
Menstruation is a physiological process during which women’s bodies periodically discharge blood and endometrial tissue through the vagina.¹ Most women between the ages of 13 and 52 years old experience a menstrual period lasting an average of three to five days per month. Due to the fact that menstrual products are a necessity used regularly by women, many issues related to menstruation and menstrual products continue to arise.

Poverty leads to many problems concerning menstrual products around the world. During one menstrual cycle, a woman may need 12 to 30 disposable menstrual pads.²⁻⁵ A study in India found that only 40% of adolescent girls used commercially available menstrual pads to address menstrual blood, and more than half (60%) used old clothing due to price and accessibility issues.⁶ In addition, United Nations Children’s Fund published a study in which 10% of adolescent girls in Western Kenya engaged in sexual intercourse to acquire money for menstrual pads.⁷,⁸ In Korea, due to the high price of disposable menstrual pads, it has been reported that girls use shoe insoles instead.⁹ Period.org, a not-for-profit corporation, points out that 35 states in the United States have so-called “tampon taxes,” meaning that tampons are subject to value-added tax, unlike other necessities.⁸ To resolve these problems, the global perceptions of menstrual products need to change so that they are recognized as necessities.

With an increasing number of issues and amount of interest in menstruation and menstrual products, many regulations and legislations are actively changing. To date, the U.S. Food and Drug Administration (FDA) has limited restrictions on menstrual products such as menstrual pads and tampons. They are classified as “medical devices,” which do not require ingredient labeling.¹⁰,¹¹
However, in 2019, the New York City Council passed a senate bill that required the disclosure of ingredients for menstrual products.\textsuperscript{12} Menstruation and the use of menstrual products are fundamental components of life, and both women and men should have a thorough understanding of them.\textsuperscript{13} Therefore, it is necessary to examine and improve the current knowledge and perceptions of women and men related to menstruation and menstrual products. One method to accomplish this is education.

Although public school students receive sex education, the curriculum does not fully address menstruation or menstrual products and most students in Korea are left dissatisfied with its content.\textsuperscript{14} Jun and Lee\textsuperscript{15} revealed the negative impact of unilateral sex education (in the form of a lecture) on students’ attitudes toward menstruation. Another study has shown a tendency to provide more intensive menstrual education (ME) for girls than boys, which leads to misinformation among boys.\textsuperscript{16} Furthermore, boys’ misinformation about menstruation perpetuates misinformation about reproductive health in general, and opportunities to change this seldom arise as the information they receive continues to be limited at home and in school.\textsuperscript{17} These circumstances imply the need for innovative ME.

This study aimed to design an innovative ME program that reflects the needs of both young women and men and to verify its effectiveness.

**Methods**

**Research Design**

The current study used a mixed-methods design comprised of 3 elements: a focus group interview (FGI), an online survey, and an intervention (ME).

The FGIs aimed to investigate the needs of young adults related to ME. The FGIs were semi-structured and based on a questionnaire. The online survey was conducted to ascertain young adults’ current knowledge and perceptions of menstruation and menstrual products, as well as their needs relevant to the creation of ME content. The effects of a newly-designed ME program were determined by intervention. Figure 1 shows the current research design in detail.
Participants and Data Collection

Eligible participants were women and men aged 20 years or older who had graduated from high school and were unmarried. These criteria were applied to ensure a population with similar ME experience and because marriage and pregnancy could affect women’s and men’s experience with menstruation and menstrual products. Recruitment was conducted via snowball sampling using the social network platforms KakaoTalk and Facebook. The online survey was administered using Survey Monkey. To obtain information concerning the knowledge, perceptions, and needs of both women and men, we included equal proportions of women and men in the FGIs and the online surveys. Data were collected from December 2018 to January 2019.

Measures

The questionnaire contained items on general characteristics, ME experiences, knowledge of menstruation and menstrual products\textsuperscript{18,19,21,22}, and perceptions of menstruation and menstrual products\textsuperscript{23,24}, as well as five open-ended questions about their experiences and needs concerning ME.

Data Analysis

The collected data were analyzed using SPSS Statistics 25. The data were analyzed using frequency statistics, means, standard deviations, an independent t-test, Pearson’s correlation coefficient, the Wilcoxon signed-rank test, and Cronbach’s alpha.

Results

Focus Group Interviews

Fourteen unmarried young adults (7 women and 7 men) were included in the FGIs in groups of two regardless of gender.

ME needs. Regarding the limitations of traditional sex education, the FGI participants stated “\textit{nothing in particular about the information I had previously received through such education programs was useful to me.}” They also noted that “\textit{I had acquired little knowledge in these programs.}” Women participants were asked about their use of menstrual products; all of them said that “\textit{I have used only disposable menstrual pads because these were commonly used and familiar, and I am afraid of using...}
insertable products.” Elaborating upon this, they said “We need education related to the variety of menstrual products, as our knowledge centered mostly on disposable menstrual pads” and “I had no chance to see or touch the various menstrual products. It would be good if I could get a lot of information about the various types of menstrual products and the advantages, disadvantages, and side-effects of each product.” Furthermore, the participants preferred education using smartphones (e.g., through social networking services or apps) (n=6, 42.9%), because of the accessibility, convenience, diversity, and affordability of this mode, followed by an in-person lecture (n=5, 35.7%) in which an expert provides professional knowledge and offers opportunities for communication (e.g., question-and-answer [Q&A] sessions).

**Knowledge and perceptions of menstruation and menstrual products.** Regarding knowledge and perceptions of menstruation and menstrual products, the mean score for menstruation knowledge was 9.43 out of 13 (10.0, 76.9% for women and 9.0, 68.2% for men) and the mean score for menstrual product knowledge was 8.36 out of 14 (9.6, 68.4% for women and 7.1, 51.0% for men). The mean score for perceptions of menstruation was 5.02 out of 7 (5.1, 72.9% for women and 4.9, 70.6% for men) and the mean score for perceptions of menstrual products was 4.64 out of 7 (4.7, 67.0% for women and 4.6, 65.7% for men).

Interestingly, there were no large differences between the number of correct answers among women and that among men regarding menstruation and menstrual product perceptions. When answering the interview question related to menstruation and menstrual product perceptions, 5 men (71.4%) reported that “Dating had influenced my menstrual perception,” and that “I gained awareness of the actual symptoms of menstruation by observing my partners before and during menstruation.” Additionally, when asked about the situation of purchasing menstrual products, 7 women and 4 men participants (78.5%) answered “I am not conscious of others when purchasing menstrual products,” and “Because menstruation is a natural phenomenon, so it is not necessary to hide.” Three women and 4 men responded that they felt these items were difficult and confusing to answer, whereas 2 women and 1 man found the items easy. Based on participants’ responses, the questionnaire was revised to include words that were more clear and easier to understand (e.g.,
disposable menstrual product => disposable menstrual product (pad)).

**Online Survey**

**General characteristics.**

A total of 150 participants completed the survey. As noted in Table 1, the participants were similar regarding gender, university major, and presence of a sister. Furthermore, for the item evaluating experience of seeing menstrual products first-hand, disposable menstrual pads ($n = 136; 90.7\%$) were reported as the most seen and 10 men (6.7\%) had never seen such products.

Table 1. General Characteristics of Participants of the Online Survey *(N=150)*
| Classification                        | n (%)       |
|--------------------------------------|-------------|
| Gender                               |             |
| Women                                | 75 (50.0)   |
| Men                                  | 75 (50.0)   |
| Major                                |             |
| Health-related department            | 71 (47.3)   |
| Non-health-related department        | 79 (52.7)   |
| Year of university                   |             |
| 1<sup>st</sup> year                  | 14 (9.3)    |
| 2<sup>nd</sup> year                  | 29 (19.3)   |
| 3<sup>rd</sup> year                  | 40 (26.7)   |
| 4<sup>th</sup> year                  | 67 (44.7)   |
| Age (years)                          |             |
| 23.                                  |             |
| Presence of sister                   |             |
| Yes                                  | 74 (49.3)   |
| No                                   | 76 (50.7)   |
| Women - Yes                          | 39 (52.0)   |
| Women - No                           | 36 (48.0)   |
| Men - Yes                            | 35 (46.7)   |
| Men - No                             | 40 (53.3)   |
| Dating experience                    |             |
| Yes                                  | 125 (83.3)  |
| No                                   | 25 (16.7)   |
| Women - Yes                          | 59 (78.7)   |
| Women - No                           | 16 (21.3)   |
| Men - Yes                            | 66 (88.0)   |
| Men - No                             | 9 (12.0)    |
| Had experienced or seen              |             |
| Disposable menstrual pad             | 136 (90.7)  |
| Reusable menstrual pad (Cotton       | 55 (36.7)   |
| menstrual pad, Menstrual panties)    |             |
| Tampon                               | 59 (39.3)   |
| Menstrual cup                        | 15 (10.0)   |
| Panty liner                          | 74 (49.3)   |
| Never seen any                       | 11 (7.4)    |
Usage of menstrual products. All of the women participants had used disposable menstrual pads. Panty liners ($n=43, 57.3\%$), tampons ($n=17, 22.7\%$), reusable menstrual pads ($n=14, 18.7\%$), and menstrual cups ($n=1, 1.3\%$) were used with disposable pads. In terms of criteria for their selection of menstrual products, 44 women (58.7\%) prioritized convenience, followed by safety (i.e., not an insertable type) ($n=14, 18.7\%$), functionality ($n=10, 13.3\%$), and affordability ($n=6, 8\%$). Interestingly, disposable menstrual pads were perceived to be the most inconvenient ($n=43, 57.3\%$). The main reason for the discomfort of disposable menstrual pads was their association with dermatitis and vaginitis ($n=16, 37.2\%$), followed by anxiety about issues such as menstrual blood leaking out of the pad ($n=12, 27.9\%$), the high cost and the smell of menstrual blood ($n=5, 11.6\%$ for each), and concerns about potentially hazardous materials in the pad ($n=2, 4.7\%$).

ME experience. Regarding previous ME experience, 90 participants (60\%) had previous experience of menstruation education and 43 participants (28.7\%) had previous experience of menstrual product education. They received ME in kindergarten or a children’s home ($n=21, 14\%$), elementary school ($n=109, 72.7\%$), middle school ($n=138, 92\%$), high school ($n=130, 86.7\%$), and university ($n=46, 30.7\%$; statistics include duplicate responses). On average, participants underwent 2.96 [1.03] instances of ME.

Participants’ preferred pathways to receive information about menstruation and menstrual products were as follows: in-person lectures ($n=47, 31.3\%$), smartphones (e.g., social networking sites and apps; $n=41, 27.3\%$), and computers (e.g., portal services; $n=29, 19.3\%$).

General characteristics and knowledge and perceptions of menstruation and menstrual products. The mean scores of menstruation and menstrual product knowledge among women were significantly higher than those among men. Moreover, there was a statistically significant difference between participants’ majors. Menstruation and menstrual product knowledge increased as participants’ year of university increased. Interestingly, there were no significant correlations between age and menstruation or menstrual product knowledge (Table 2).

Participants’ perceptions of menstruation and menstrual products were statistically significant according to gender, major, year of university, and presence of a sister. Additionally, the number of
menstrual products seen first-hand had a statistically significant effect on menstruation and menstrual product knowledge and perceptions (Table 2). That is, those who had seen various menstrual products had significantly better menstrual product knowledge and perceptions than those who had not seen them.

Table 2. Menstruation and Menstrual Product Knowledge and Perceptions according to General Characteristics ($N = 150$)

| Classification | Menstruation Knowledge | | | Menstrual Product Knowledge | | |
|----------------|------------------------|---|---|-----------------------------|---|---|
|                | $M$ ($SD$)              | $t$ | $p$ | $M$ ($SD$)                  | $t$ | $p$ |
| **Gender**     |                        |     |     |                            |     |     |
| Men ($n = 75$) | 8.11 (3.32)            | -5.770 | < .01* | 5.04 (3.36) | -9.457 | < .01* |
| Women ($n = 75$)| 10.59 (1.69)           |      |     | 9.53 (2.43)               |     |     |
| **University major** |                  |     |     |                            |     |     |
| Health-related ($n = 71$) | 10.21 (2.46)  | 3.593 | < .01* | 8.30 (3.42) | 3.193 | < .01* |
| Non-health-related ($n = 79$) | 8.56 (3.06) | | | 6.42 (3.75) | | |
| **University year** |                        |     |     |                            |     |     |
| 1$^{st}$ year ($n = 14$) | 7.36 (3.08)   | F = 5.799 | < .01* | 4.79 (3.29) | F = 7.047 | < .01* |
| 2$^{nd}$ year ($n = 29$) | 8.48 (2.95)   | 5.59 (3.75) | | | | |
| 3$^{rd}$ year ($n = 40$) | 9.15 (3.26)   | 7.60 (3.09) | | | | |
| 4$^{th}$ year ($n = 67$) | 10.25 (2.28)  | 8.40 (3.66) | | | | |
| **Presence of sister** |                        |     |     |                            |     |     |
| Yes ($n = 74$) | 9.32 (3.07)   | -0.093 | .926 | 7.26 (3.76) | -0.162 | .871 |
| No ($n = 76$) | 9.37 (2.75)   |      |     | 7.36 (3.68) | |     |
| **Dating experience** |                        |     |     |                            |     |     |
| Yes ($n = 125$) | 9.42 (2.90)  | 0.653 | .515 | 7.48 (3.65) | 1.284 | .201 |
| No ($n = 25$) | 9.00 (2.97)   |      |     | 6.44 (3.93) | | |
| **Age**        | 23.18 (1.85)  | 0.083 | .311 | -0.036 | .666 |
| **Number of menstrual products seen** | 2.25 (1.37) | 0.356 | < .01* | 0.549 | < .01* |

*Note. * $p < .05$*
Participants who had received ME or menstrual product education had more knowledge and more positive perceptions than did participants who had not, but this difference was not statistically significant. Interestingly, the mean scores for menstruation and menstrual product knowledge were significantly higher among those who had received ME or menstrual product education.

To determine the effect of the ME received, correlation analysis was conducted. The amount of ME received was related to menstruation and menstrual product knowledge and perceptions (Table 3).

Table 3. Differences in Knowledge of Menstruation and Menstrual Products: Experience of ME (N = 150)

| Classification | Menstruation knowledge | Menstrual product knowledge | Menstruation perceptions | Menstrual product perceptions |
|----------------|-------------------------|-----------------------------|--------------------------|------------------------------|
|                | M (SD)      | t   | p  | M (SD)   | t  | p  | M (SD) | t  | p  | M (SD) |
| ME experience  |                         |     |    |          |     |    |         |     |    |        |
| Yes (n = 90)   | 10.18 (1.80) | 4.034 | <.01* | 8.09 (3.19) | 3.106 | <.01* | 27.01 (3.15) | 1.347 | .180 | 30.08 (4.89) |
| No (n = 60)    | 8.10 (3.71)  | 6.13 | (4.12) | 26.25 (3.73) | 29.23 | (4.44) |           |     |    |        |

Menstrual product education experience

| Classification | Menstruation knowledge | Menstrual product knowledge | Menstruation perceptions | Menstrual product perceptions |
|----------------|-------------------------|-----------------------------|--------------------------|------------------------------|
|                | M (SD)      | t   | p  | M (SD)   | t  | p  | M (SD) | t  | p  | M (SD) |
| Yes (n = 43)   | 10.07 (1.93) | 2.383 | .019* | 8.47 (2.93) | 2.780 | <.01* | 27.41 (3.44) | 1.635 | .104 | 30.91 (5.06) |
| No (n = 107)   | 9.06 (3.17)  | 6.84 | (3.89) | 26.42 (3.36) | 29.33 | (4.51) |           |     |    |        |

Amount of ME received

|                | M (SD) | r  | p  | r  | p  | r  | p  |
|----------------|--------|----|----|----|----|----|----|
|                | 2.96 (1.03) | 0.193 | .018* | 0.065 | .430 | -0.038 | 0.645 |

Note. *p < .05

Note. ME = menstrual education

A statistically significant correlation was found between the knowledge of and the perceptions of menstruation and menstrual products (Table 4).

Table 4. Correlation between Menstruation and Menstrual Product Knowledge and Perceptions (N = 150)
|                          | Menstruation knowledge | Menstrual product knowledge | Menstruation perceptions | Menstrual product perceptions |
|--------------------------|------------------------|----------------------------|--------------------------|-----------------------------|
| Menstruation knowledge   | 1                      |                            |                          |                             |
| Menstrual product knowledge | 0.627*               | 1                          |                          |                             |
| Menstruation perceptions | 0.095                  | 0.137                      | 1                        |                             |
| Menstrual product perceptions | 0.281*            | 0.347*                     | 0.517*                   | 1                           |

Note. * p < .05

**ME needs.** The largest proportion of participants had needs related to education contents on the use of menstrual products (n=96, 64%), followed by the various types of menstrual products and their advantages and disadvantages (n=89, 59.3%). Participants also needed information on the management of menstruation (n=89, 59.3%), the side effects of menstrual products (n=72, 48%), and the physiological mechanism of menstruation (n= 53, 35.3%; statistics include duplicate responses).

In terms of the method of ME, participants expressed desire to see menstrual products first-hand (n=80, 53.3%) or through watching a video (e.g., a YouTube video; n=79, 52.6%). Other preferred methods were slideshow presentations (n=52, 34.7%), pamphlets (n=43, 28.7%), face-to-face discussions (n = 21, 14%), and in-person lecture by menstruation experts (n = 20, 13.3%; statistics include duplicate responses).

**MEME**

Finally, the two-hour ME program was designed based on the needs of young adults: a multi-experiential menstruation education (MEME). The MEME program was conducted by providing in-person lectures using a YouTube video. This approach was implemented to allow participants to view the lecture content on their smartphones at any time after the lecture. The features of the MEME program were as follows:

A. Watching a YouTube video that we created: The YouTube video focused on the mechanism of menstruation and the types, methods of use, and side effects of menstrual products

B. Mini quiz about video contents
Hands-on experience with 60 menstrual products

Simulation on the use of these products using a female perineal model

Q&A sessions with menstruation experts.

Figure 2 shows details of the MEME program. The video was uploaded to YouTube to enable other young adults to access them after the MEME program had been completed (https://www.youtube.com/watch: This link will be open after review).

General characteristics. This experiment included 10 participants (8 women and 2 men). All participants were university students. Their mean (SD) age was 22.90 (±0.88) years old. Their majors were within health-related departments (n=6, 60%) or within non-health-related departments (n=4, 40%). Six participants had a sister (60%) and 4 did not (40%); 7 participants had dating experience (70%) and 3 (30%) did not. Regarding their experience of seeing menstrual products first-hand, all of the participants had seen disposable menstrual pads (100%), three had seen reusable menstrual pads (30%), four had seen tampons (40%), three had seen menstrual cups (30%), and seven had seen panty liners (70%).

Effect on the MEME program. After the MEME program, participants had significantly higher mean scores for knowledge of menstruation and menstrual products compared to pre-intervention. Perceptions of menstruation and menstrual products were also higher after the MEME program, although the differences were not significant (Table 5).

Table 5. Changes in Menstruation and Menstrual Product Knowledge and Perceptions after the MEME program (N = 10)

| Classification            | Before MEME | After MEME | Z     | p    |
|---------------------------|-------------|------------|-------|------|
| Menstruation knowledge    | 8.70 (2.63) | 11.30 (1.49) | -2.820 | < .01* |
| Menstrual product knowledge | 8.70 (2.95) | 13.00 (1.05) | -2.812 | < .01* |
| Menstruation perceptions  | 39.70 (4.24) | 43.20 (4.42) | -1.588 | .112 |
| Menstrual product perceptions | 18.10 (2.77) | 19.60 (1.27) | -1.479 | .139 |

Note. MEME = multi-experiential menstruation education; * p < .05
In the Q&A sessions with the menstruation expert, the most frequently asked questions were related to the management and side effects of menstrual cups (n=4, 40% each), followed by the selection (n=3, 30%) and purchasing of a menstrual cup (n=1, 10%; statistics include duplicate responses). The participants stated that “the YouTube video and Q&A sessions with menstruation experts were very helpful,” “Previous education was unengaging with studying theory using PowerPoint Presentation. Today, I am very pleased to be able to touch the various real menstrual items after a detailed video and to receive a demonstration with a model,” and “Education in high school was a group education so I could not ask any questions personally. But as today’s education had a small number of people, I was able to ask the experts questions.” Specifically, two men answered “I learned more detail about menstruation and if these kinds of ME are held in the future, I would like to attend again.”

Discussion
In the current study, the response from our participants regarding their need for ME and first-hand experience of various menstruation products overwhelmingly suggest that even women who use only one type of menstrual product may feel limited and have a high interest in and demand for other menstrual products. The usage rate of various menstrual products in South Korea—especially menstrual cups (1.3%)—was remarkably low compared with other countries. In this study, all female participants reported using disposable menstrual pads. However, a study in the United States found that 31% of women used tampons, 18% used disposable menstrual pads, and 51% used both products together. More recently, in France, only 21% of women were using disposable menstrual pads alone, while 9% were using menstrual cups; moreover, the different menstrual products were often used together, especially tampons, disposable menstrual pads, and panty liners. These findings highlight the fact that Korean women appear to show a bias regarding the use of disposable menstrual pads. The persistence of this bias is interesting, given that more than half of the female participants in our study said disposable menstrual pads were uncomfortable to use. This result echoes the findings of Kim and Choi regarding women’s complicated relationship with disposable
menstrual pads; while these pads are frequently used, consumers tend to be dissatisfied with the product. The researchers attributed the persistent use to the ease of purchase and lack of suitable alternatives. That is, education that allows participants to touch, demonstrate, and discuss with an expert, such as the MEME program, could lower the barrier to finding alternatives for menstrual supplies that women currently use.

The mean scores for knowledge of menstruation and menstrual product were significantly higher among women which is consistent with the findings of similar studies conducted with college students. Additionally, knowledge scores were higher among students majoring in a health-related direction and among those at a higher university level. Interestingly, there were no significant correlations between age and menstruation knowledge or menstrual product knowledge. However, this is not directly related to age. Rather, it means that knowledge and perception about menstruation and menstrual products do not simply increase with age, but with education and experience in society. Furthermore, the knowledge and perception were higher among those who had various experience of menstruation products, suggesting that exposure to menstruation and menstrual products enhances their knowledge and perception. This implies an increased need for experiential education on menstruation and menstrual products like MEME, consistent with the findings of other studies.

Even though women’s perceptions tended to be more positive, both men and women had positive perceptions of menstruation and menstrual products. Kang obtained similar results. However, Hwang found significantly more negative attitudes in women than in men. This contradiction indicates the need for further research on menstrual perception based on sex. Moreover, given the low usage rates of insertable menstrual products in previous research and in the current study, it may be necessary to explain in further studies why individuals perceive insertable menstrual products in a positive way but as not usable.

We found a significant positive correlation between knowledge and perception of menstruation and menstrual products, suggesting that greater knowledge facilitates a less prejudicial perception. The
factors contributing to this tendency need to be examined in more detail in future studies.

The MEME was found to facilitate an increase in both knowledge and perception of menstruation and menstrual products. Changes in only knowledge was statistically significant. Participants noted that the unconventional education style was interesting and informative, that their perception of menstrual products other than disposable menstrual pads had positively changed, and that the program had provided them with the opportunity to correct their misunderstandings. Moreover, the use of a female perineal model with various menstrual products and a Q&A with an expert helped to resolve their personal questions, unlike previous education in school. These findings are similar to the results found by Yoon, showing that non-traditional forms of education, such as demonstrations or debates, were more effective in this context. In our study, the MEME facilitated positive growth in both knowledge and perception, suggesting that this might also be a useful strategy in sex education.

Conclusion

This study aimed to design an ME based on young adults’ needs that differs from conventional sex/menstruation education, and to verify its effectiveness. To understand young adults’ needs, we conducted FGIs and an online survey. Based on their needs, we then created ME content available on mobile and in-person education for both genders with menstruation experts and multi-experimental methods. Finally, we developed a MEME program, which consisted of YouTube video that we created, a mini quiz about video contents, hands-on experience with 60 menstrual products, simulations of the use of these products using a female perineal model, and Q&A sessions with menstruation experts.

After implementation, it was found that the program not only led to high satisfaction among participants, but also helped to improve their knowledge and the perception of menstruation and menstrual products. More specifically, participants’ knowledge of menstruation and menstrual products showed a statistical increase. Additionally, the online survey results showed the amount of ME received to have a correlation with respondents’ perception of menstrual products, as well as with menstruation and menstrual knowledge, and menstruation perception. This implies that reiterative application of MEME could change perceptions and, by extension, it could clarify and address the causes of poverty-related problems regarding menstrual products. To achieve the latter, MEME should
be further verified, using a larger sample, which would also enable its use in the field, for example at universities and companies.

Abbreviations
ME
Menstruation Education
MEME
Multi-Experiential Menstruation Education

Declarations

Ethics approval and consent to participate
This study involved a total of 174 participants and was approved by the institutional review board of the Catholic University of Busan (CUPIRB-2018-047). Written informed consents were obtained from all participants.

Consent for publication
Not applicable.

Availability of data and materials
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Competing interests
The authors have no competing interests to declare.

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Authors’ contributions
Jisan Lee designed this study, received IRB approval, and analyzed all data. Gayoung Moon wrote the background and analyzed online survey data, Inkyung Kim wrote background and method, and
Habhin Kim analyzed focus group interview data. Suwan Cho conducted the online survey and FGIs and Soyeon Jeon was a major contributor in writing the tables and figures. Jeonghun Cho interpreted the MEME participants data and Sujeong Hong delivered the MEME program and collected data at that time. All authors read and approved the final manuscript.

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References

1. Sapkota D, Sharma D, Pokharel HP, Budhathoki SS, Khanal VK. Knowledge and practices regarding menstruation among school going adolescents of rural Nepal. J Kathmandu Med Coll. 2013;2(3):122–8.

2. Moon J, Jeon E. Ilhoeyong mich dayongdo saenglidaeui sayongja sayong pyeong-ga [Analysis on user sensitive evaluations of disposable and reusable sanitary pads]. Korean J. Sci. Emot. Sensibility. 2014;17(2):77–84. Retrieved from http://db.koreascholar.com/article?code=315494.

3. Jones LL, Griffiths PL, Norris SA, Pettifor JM, Cameron N. (2009). Age at menarche and the evidence for a positive secular trend in urban South Africa. Am. J. Human. 2009;21(1):130–132.

4. Kaur R, Kaur K, Kaur R. (2018). Menstrual hygiene, management, and waste disposal: Practices and challenges faced by girls/women of developing countries. J. Environ. Pub. Health. 2018;1730964.

5. Tehrani FR, Solaymani-Dodaran M, Tohidi M, Gohari MR, Azizi F. Modeling age at menopause using serum concentration of anti-mullerian hormone. J Clin Endocr Met. 2013;98(2):729–35.

6. Rani P, Reddy RG. Menstrual Knowledge and Hygiene Management of Adolescent Girls. Cur. J. Appl. Sci. Tech. 2019;1–6. Retrieved from
7. Oppenheim M. Kenyan girls forced into sex in exchange for sanitary products. The Independent. 2018. Retrieved from https://www.independent.co.uk/news/world/africa/kenya-girls-sex-sanitary-products-pads-period-poverty-a8533081.html.

8. Tull K. Period poverty impact on the economic empowerment of women. 2019. Retrieved from https://opendocs.ids.ac.uk/opendocs/handle/123456789/14348.

9. Kang N. 20dae daehagsaeng namnyeoui wolgyeong-e daehan jisig mich taedo bigyo yeongu [A comparative study of knowledge and attitude about menstruation among men and women in their twenties]. ATE. 2018;8:193–213. Retrieved from http://www.riss.kr/link?id=A105090057.

10. Johnson ME. Menstrual Justice. UC Davis Law Review, Forthcoming. 2019. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3389773.

11. U.S. Food & Drug Administration. Menstrual Tampons and Pads: Information for Premarket Notification Submissions (510(k)s) - Guidance for Industry and FDA Staff. 2005. Retrieved from https://www.fda.gov/MedicalDevices/ucm071781.htm.

12. The New York State Senate. Assembly Bill A164B Relates to menstrual product labeling. 2019. Retrieved from https://www.nysenate.gov/legislation/bills/2019/A164.

13. House S, Mahon T, Cavill S. Menstrual hygiene matters: a resource for improving menstrual hygiene around the world. Rep Health Mat. 2013;21(41):257–9.

14. Woo MJ. Godeunghagsaeng-ui seongjisig mich taedowa seong-gyoyug yogudo-e gwanhan yeongu [Study on sexual knowledge of high school students and their demands for sex education] (Unpublished master’s degree). Yeungnam University Graduate School of Education. 2011. Retrieved from http://www.riss.kr/link?id=T12338058.
15. Jun JH, Lee H. Effects of experience based menstrual education program on menstrual attitude and menstrual discomfort among female elementary students. Korean J Health Edu Prom. 2007;24(2):93-109. https://www.kci.go.kr/kciportal/ci/sereArticleSearch/ciSereArtiView.kci? sereArticleSearchBean.artiId=ART001081962. Retrieved from.

16. Allen KR, Kaestle CE, Goldberg AE. More than just a punctuation mark: How boys and young men learn about menstruation. J Fam Iss. 2011;32(2):129-56.

17. Chang YT, Hayter M, Lin ML. (2012). Pubescent male students’ attitudes towards menstruation in Taiwan: Implications for reproductive health education and school nursing practice. J. Clin. Nurs. 2012;21(3-4):513-521.

18. Jung S 20dae namnyeoui seong-gyeongheom mich seong-gyoyug siltae josa [A survey on state of sexual experience and sexual education of 20 s men and women] (Unpublished master’s thesis). Graduate School of Research Science, Kyungpook National University. 2014. Retrieved from http://www.riss.kr/link?id=T13552649.

19. Yoon J. Chodeunghaggyoui wolgyeong-gyoyughyeonhwang-e ttaleun yeohagsaengdeul-ui wolgyeongjisiggwa taedo [Menstrual knowledge and attitude of female students according to the current status of menstrual education in elementary school]. Unpublished master’s thesis. Seoul National University, Seoul. 2006. Retrieved from http://www.riss.kr/link?id=T10327030/.

20. Lee Y. CAlleul hwal-yonghan hugi haglyeong-gi adong-ui mongjeong-gwa wolgyeong gyoyug peulogeulaem gaebal mich hyogwa [Development and effects of nocturnal emission and menstruation education program using cai for Korean elementary school children] (Unpublished doctoral thesis). Ewha Womans University, Seoul. 2010. Retrieved from http://www.riss.kr/link?id=T12115510.

21. Korean Ministry of Food and Drug Safety. Physiological supplies, usage and
precautions are different for each product type. 2018. Retrieved from http://www.mfds.go.kr/brd/m_99/view.do?seq=42963.

22. Gnaran. Laundry - Wrong information and effective washing methods. 2016. Retrieved from https://www.gnaran.com/board/view.php?bdId=notice&sno=268.

23. Yang DO, Youn GH. Chogyeong hu gyeong-gwa sigan-e ttaleun wolgyeong-e daehan taedo [The relationship between increased years after menarche and attitudes toward menstruation]. Korean J. Woman Psychol. 2001;6(3):37-48. Retrieved from http://www.dbpia.co.kr/journal/articleDetail?nodeId=NODE06371897&language=ko_KR#none.

24. Min YK. Cheongsonyeon chogi yeohagsaeng-ui wolgyeongtaedo gujo [Menstrual attitude structure of postmenarcheal girls]. J. Inst. Soc. Sci. 2003;14:69-88. Retrieved from http://www.riss.kr/link?id=A40009212.

25. North BB, Oldham MJ. Preclinical, clinical, and over-the-counter postmarketing experience with a new vaginal cup: menstrual collection. J Women’s Health. 2011;20(2):303-11.

26. French Agency for Food, Environmental and Occupational Health & Safety. Opinion on the safety of feminine hygiene products. Maisons-Alfort: French Agency for Food, Environmental and Occupational Health & Safety. 2018. Retrieved from https://www.anses.fr/fr/search/site/2016-SA-0108?iso1=fr&iso2=en.

27. Kim HJ, Choi SY. Status of menstrual use and sanity control of unmarried women. Korean J Women Health Nurs. 2018;24(3):265-75. https://doi.org/10.4069/kjwhn.2018.24.3.265.

28. Hwang RI. Comparison of menstrual knowledge, attitudes and education needs of male and female university students. J Korea Converg Soc. 2018;9(10):497-505. https://doi.org/10.15207/JKCS.2018.9.10.497.
29. Min J, Ahn S. Effects of menstrual self-management education program on knowledge and behavior of menstrual self-management in high school girls. Korean J Women Health Nurs. 2018;24(3):310-21.

Figures

*Participants: Young women and men*

1. **Focus Group Interview**
   - Quantitative method
   - To investigate the needs of young adults in ME
   - To review questionnaire items

2. **Online Survey**
   - Quantitative method
   - To investigate the needs of young adults in ME
   - To check the current status of knowledge and perceptions of menstruation and menstrual products

3. **ME**
   - Intervention
   - To determine the effects of a newly-designed ME based on young adults’ needs

Figure 1

The design of this study and method. Note. ME = menstruation education
Educational contents of MEME in the form of a slideshow presentation and video. Note 1.

MEME = multi-experiential menstruation education