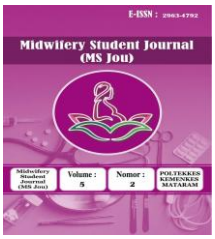
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Smart Box Education and Menstrual Hygiene Knowledge Among Adolescent Girls

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ABSTRACT

Menstrual hygiene knowledge is important for adolescent reproductive health. This pre-experimental one-group pretest–posttest study examined changes in knowledge after Smart Box education among 33 purposively selected female students at SMAN 1 Kediri. Knowledge was measured using a questionnaire before and after the intervention, and changes in categories were analyzed using the marginal homogeneity test. Before the intervention, 26 students (78.8%) had moderate knowledge and three (9.1%) had good knowledge. After the intervention, 30 students (90.9%) had good knowledge. The pre–post difference was statistically significant ($p < 0.001$). Smart Box may be a useful interactive resource for school-based menstrual hygiene education, although controlled research is required to establish causal effectiveness.

Keywords: Smart Box; menstrual hygiene; knowledge; adolescent girls; health education

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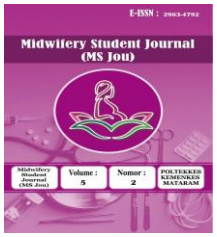
INTRODUCTION

Adolescent reproductive health is an important component of health development because experiences during adolescence can influence well-being in adulthood. Appropriate personal hygiene during menstruation is particularly relevant for comfort, infection prevention, and recognition of symptoms requiring healthcare. Inadequate knowledge may lead to inappropriate cleaning practices, infrequent changing of menstrual products, or unsuitable underwear hygiene.

The source manuscript cites Indonesian Ministry of Health data indicating complaints related to genital hygiene among some adolescent girls and describes reproductive-health problems reported in West Nusa Tenggara. These background figures suggest an educational need, although their exact indicators and denominators should be checked against original reports. Menstrual hygiene knowledge can be supported through family communication, school learning, and accessible health education resources.

Conventional instruction may not engage all learners effectively. Interactive media that combine visual material, reading, questions, and educational play may encourage active participation. Abral and colleagues (2020) reported improvements in dental-health knowledge using a Smart Dental Box. Research cited in the manuscript also associates educational Smart Box activities with better learning outcomes (Nurrochman, 2025; Mawarni et al., 2025). However, evidence specifically addressing menstrual hygiene education with this format remains limited.

A preliminary interview with ten girls at SMAN 1 Kediri found that five (50%) had low knowledge, four (40%) had moderate knowledge, and one (10%) had good knowledge. Students were uncertain about genital cleaning, when to replace menstrual pads, menstrual product selection, and underwear hygiene. Although educational boxes have been studied in other



learning areas, the original literature review did not identify a local evaluation of Smart Box education specifically for menstrual personal hygiene at SMAN 1 Kediri. This gap supports assessing knowledge changes following use of the medium.

The primary objective was to examine pre–post changes in knowledge about menstrual personal hygiene after interactive Smart Box education among girls attending SMAN 1 Kediri. The outcome was questionnaire-based knowledge, not observed hygiene practice.

METHODS

This quantitative, pre-experimental study used a one-group pretest–posttest design at SMAN 1 Kediri, West Lombok. The manuscript describes the observation period as December–June 2026; whether December fell in 2025 has not been established from the supplied record. Of 286 menstruating female students listed in the study population, 33 were included by purposive sampling according to the study-defined eligibility criteria. The source does not provide the detailed inclusion and exclusion criteria, so none are inferred. The observation concerns one school without a control group.

The educational exposure was the Smart Box, described as an interactive box containing written and illustrated menstrual hygiene material and educational question-and-answer activities. The intervention addressed genital cleaning, menstrual-pad replacement and selection, and underwear hygiene. Participants completed a knowledge questionnaire before and after the educational activity. The source states that the instrument was tested for validity and reliability, but coefficients, item counts, knowledge cutoff values, session duration, and timing of the posttest were not documented in the supplied manuscript and should be confirmed from the original study protocol.

Descriptive statistics summarized information sources and pretest/posttest knowledge categories. The paired category distributions were compared using the marginal homogeneity test, with a significance threshold of $p < 0.05$. The reported result was $p < 0.001$; a test statistic and its degrees of freedom were not provided in the original analysis, so these values are not introduced. Because no comparison group was used, statistical change is not equivalent to proof of causality.

RESULTS

Table 1. Previous information about menstrual personal hygiene (n = 33)

Information source	n	%
Family/parents	2	6.1
Never received information	31	93.9
Total	33	100.0

Most students (31/33, 93.9%) reported that they had not previously received information about menstrual personal hygiene; two had learned about it from family members.

Table 2. Knowledge categories before Smart Box education

Pretest knowledge	n	%
Good	3	9.1
Moderate	26	78.8
Low	4	12.1
Total	33	100.0

Table 3. Knowledge categories after Smart Box education

Posttest knowledge	n	%
Good	30	90.9
Moderate	3	9.1
Low	0	0.0
Total	33	100.0

Table 4. Pretest-to-posttest knowledge category transitions (n = 33)

Pretest category	Good after	Moderate after	Low after	Total
Good	3	0	0	3
Moderate	23	3	0	26
Low	4	0	0	4
Total	30	3	0	33

Table 4 contains 33 paired category transitions: 23 students moved from moderate to good and four from low to good; three remained good and three remained moderate. These values agree with the pretest totals (3 good, 26 moderate, 4 low) and posttest totals (30 good, 3 moderate, 0 low). There were no recorded downward category transitions. The source reports marginal homogeneity $p < 0.001$ but not the test statistic.

DISCUSSION

The finding that most respondents had never received information about menstrual personal hygiene points to a gap in adolescent reproductive-health education. Parents, especially mothers, may play an important role in early communication about menstruation, but school-based initiatives and health workers can provide additional evidence-based instruction. The source cites previous research connecting information access with menstrual hygiene knowledge and practice (Meinasari, 2019; Susilawati et al., 2022).

At baseline, 26 students (78.8%) were in the moderate knowledge category, while four were in the low category. Inadequate knowledge can involve practical issues such as cleaning techniques, correct menstrual-pad use and replacement, genital hygiene, and recognition of symptoms that merit clinical assessment. Similar concerns have been described in studies of menstrual personal hygiene among adolescent girls (Aprita & Susianawati, 2023; Pemiliana, 2019; Susanti & Lutfiyati, 2020).

Following Smart Box education, 30 of 33 students were categorized as having good knowledge. The transition table shows improvements from moderate and low categories, with no recorded downward transitions. Unlike a simple comparison of category proportions, the transition table makes the paired nature of the observations clear. The marginal homogeneity result ($p < 0.001$) is consistent with a change in the distribution of knowledge categories.

The Smart Box provided a combination of written information, images, opportunities to answer questions, and interactive educational activities. These elements may increase attention and make the material easier to recall, particularly for adolescents who benefit from visual and activity-based learning. Previous studies cited in the source reported favorable educational outcomes with related interactive box approaches (Abral et al., 2020; Rahayuningsih et al., 2022; Nurrochman, 2025). However, the present study did not directly measure engagement or memory mechanisms.

Three students remained in the good knowledge category; two of these were reported to have obtained health information from parents and one from the surrounding environment. Three remained in the moderate category despite the intervention. Differences in prior exposure, learning interest, and opportunities for attention could help explain variation, although such

explanations were not tested. It would be inappropriate to attribute these patterns to motivation without a direct measure.

This study offers initial evidence of improved knowledge following an interactive menstrual hygiene lesson. Nevertheless, the one-group design is vulnerable to testing effects, coinciding educational exposure, and short-term recall. The modest purposive sample and absence of follow-up also limit generalizability and conclusions about actual hygiene practices. Future work should report instrument testing, intervention fidelity, longer-term outcomes, and a comparison group.

Thirty-one of the 33 respondents reported no previous menstrual hygiene information, whereas two identified family members as a source. This highlights the need for accessible, nonjudgmental guidance through schools and families. The study did not assess whether information source predicted knowledge change.

Communication within families may help girls discuss menstrual products, hygiene, and discomfort. Previous literature relates information access to hygiene knowledge, but only two participants in this study reported information from their family, so no association with response to Smart Box can be established.

Before intervention, 26 girls were in the moderate knowledge category, four in the low category, and three in the good category. This distribution identifies specific opportunities for education about genital cleaning, menstrual-pad replacement, appropriate products, and underwear hygiene. The intervention aimed to respond to these reported knowledge gaps.

The Smart Box contained illustrated explanations and educational activities that encouraged participants to read, observe, and answer questions. Interactive materials may facilitate student attention and participation. A related Smart Dental Box intervention was reported by Abral et al. (2020), but results in another health topic cannot establish the effectiveness of this specific menstrual hygiene medium.

After intervention, 30 students (90.9%) had good knowledge and three (9.1%) remained in the moderate category. The paired transition table is informative: 23 students moved from moderate to good and four from low to good. Three students who began with good knowledge remained there. Notably, no participant showed a downward category transition. These changes explain why the marginal homogeneity test was statistically significant. Since this test addresses changes across categories, the report should clearly define the score cutoffs used to label knowledge as low, moderate, or good. The transition counts were checked against the marginal distributions and total 33 in each direction.

The original discussion suggests that the three students who remained in the moderate category may have differed in learning interest or concentration. Interest can influence attention and the amount of effort devoted to an educational activity, but these constructs were not separately measured. The observation should therefore be presented as a possible explanation, not an established result. An evaluation that adds brief engagement measures, a record of participation, or qualitative feedback could examine whether differences in attention are related to learning gains.

The source also reports that the three students who remained in the good category had previously received information from family or their surroundings. This observation is consistent with the possibility that earlier knowledge exposure contributed to baseline performance. Yet the small number of students limits interpretation, and the main information-source table lists only two family-sourced respondents. The precise coding of prior information should be checked to ensure that information from the environment was recorded consistently.

Other studies cited in the source found improvements after interactive educational activities or menstrual hygiene education. Examples include learning interventions using Smart Box or

other visual resources and health education studies that examined menstrual hygiene knowledge. These findings provide relevant context, but educational achievement in different curricula and health knowledge scores are not necessarily comparable. The distinctive contribution of the present study is the use of the Smart Box format specifically for menstrual personal hygiene in adolescent girls at SMAN 1 Kediri.

The study measured knowledge categories rather than actual menstrual hygiene practices, comfort, infection symptoms, or health-service use. Therefore, a higher posttest knowledge category cannot be interpreted as evidence of changed hygiene behavior. The one-group design, nonrandom sampling, repeated questionnaire exposure, and lack of longer follow-up also limit attribution and generalizability. Future research could incorporate a comparison group, knowledge retention assessment, and separately measured practices.

For reporting quality, the manuscript would benefit from detailed description of the number and content of questionnaire items, category thresholds, reported validity and reliability statistics, intervention session duration, and consent procedures. These omissions do not invalidate the observed tabulations, but filling them from actual study records will make the work easier to evaluate and reproduce. The current draft does not fabricate such details and retains the original categorical findings.

The choice of the marginal homogeneity test follows from the paired categorical outcome rather than a comparison of independent groups. For each individual, the baseline and follow-up knowledge categories can be cross-tabulated, as in the transition table. This is more appropriate than treating the posttest proportions as if they came from different participants. Nonetheless, the categories should be defined using a prespecified scoring system and applied consistently at both time points. Without clear cutoffs, differences in labels are more difficult to reproduce.

In interpreting the improvement, it is useful to distinguish between exposure to information and the ability to apply it. The Smart Box presented educational content on menstrual hygiene, but the study did not observe how students changed menstrual product use, cleaning practices, or help-seeking after the lesson. Such behaviors can depend on adequate supplies, sanitation facilities, privacy at school, family support, and cultural expectations. Future studies could therefore combine a knowledge questionnaire with carefully designed measures of feasible hygiene practice while respecting student privacy.

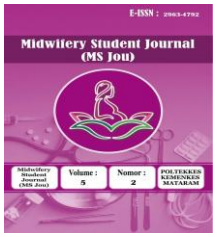
The observed result was obtained in a school environment with a relatively small study group. For implementation, teachers and health workers may need a facilitator guide so that all students receive the same educational messages. A short checklist of key Smart Box activities could help standardize delivery. Adding an assessment several weeks later would distinguish immediate recall from retained knowledge. These steps could strengthen the evidence for program adoption without compromising the interactive character of the original media.

CONCLUSION

After Smart Box education, the proportion of students with good menstrual hygiene knowledge increased from 9.1% to 90.9% (marginal homogeneity $p < 0.001$). The results indicate favorable pre–post changes among 33 adolescent girls and support further assessment of Smart Box as an interactive educational resource in schools.

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