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Flashcard-Supported STI Education and Short-Term Knowledge Change among Grade X Vocational Students in Sleman, Indonesia: A One-Group Pretest–Posttest Study

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Abstract

Background: Adolescents need accurate, age-appropriate information about sexually transmitted infections (STIs). School-based education can improve knowledge, but the contribution of a brief flashcard-supported session should not be inferred from uncontrolled pretest–posttest data.
Objective: To assess short-term within-student change in STI knowledge scores from baseline to one week after a facilitator-led educational session using flashcards.
Methods: This one-group pretest–posttest study included all 50 participating Grade X students at SMK Muhammadiyah 2 Moyudan, Sleman. Students completed a 30-item dichotomous STI knowledge questionnaire immediately before a 45-minute facilitator-led flashcard discussion and again one week later. Descriptive statistics and the Wilcoxon signed-rank test were used.
Results: Before the session, 5 students (10%) were classified as having good knowledge, 25 (50%) moderate knowledge, and 20 (40%) low knowledge; at one week, the respective counts were 28 (56%), 19 (38%), and 3 (6%). Mean scores increased from 49.34 (SD 20.552) to 64.16 (SD 19.078). Forty-eight paired scores increased, none decreased, and two were tied ($Z = -6.050$, $p < 0.001$; standardized Wilcoxon $r = 0.86$).
Conclusion: STI knowledge scores were higher one week after the educational session in this single group. Because there was no comparison group and the same questionnaire was repeated, the study cannot establish a causal flashcard effect, comparative effectiveness, or longer-term retention.

Keywords: Adolescent health; health education; sexually transmitted infections; vocational students; pretest–posttest

INTRODUCTION

Sexually transmitted infections (STIs) remain an important sexual and reproductive health concern. The World Health Organization estimates that more than one million curable STIs are acquired each day among people aged 15-49 years, and many infections are asymptomatic (1). Adolescents therefore need accurate, age-appropriate information that supports recognition of risk, informed decision-making, and appropriate use of health services. Recent Indonesian evidence also documents persistent gaps in adolescent sexual and reproductive health knowledge, awareness, and service utilization (2-4).

School-based sexuality and reproductive-health education can improve knowledge, although effects vary with program content, duration, delivery, population, and outcome measurement. A meta-analysis of comprehensive sexuality-education programs and a recent scoping review both reports generally favorable effects on knowledge and related cognitive outcomes while emphasizing substantial heterogeneity across interventions (5,6). More recent synthesis likewise suggests that education can influence selected sexual and reproductive health outcomes, although behavioral effects are not uniformly demonstrated (7). Indonesian studies have evaluated comprehensive sexuality education, online modules, messaging platforms, and text-message interventions, showing that locally adapted and interactive approaches can improve short-term knowledge or related competencies (8-12).

Controlled studies in other settings provide stronger causal evidence that structured educational programs can improve sexual and reproductive health knowledge. Cluster-randomized trials using handbooks, mHealth, school-linked modules, and online programs have reported gains in intervention groups (13-15), while a randomized brief online sexual-health program and a cluster-randomized blended digital/in-person program also demonstrated measurable educational benefits for adolescents (16,17). A peer-based randomized intervention likewise improved sexual and reproductive health outcomes in young people (18). These studies support the plausibility of educational benefit but are not directly comparable with a single 45-minute session because they differ in duration, medium, population, facilitator contact, and outcome measurement.

Flashcards may provide concise visual cues that structure attention, retrieval, peer discussion, and facilitator clarification. In the present study, however, the intervention was a combined educational package: flashcards were embedded within small-group discussion and facilitator support. An Indonesian controlled study has reported favorable reproductive-health outcomes after flashcard-based education (19), but its population, outcome, and delivery schedule differed from those in this study. Other contemporary interventions using interactive learning and social media further show that educational medium can be feasible and engaging, but they do not establish a flashcard-specific mechanism (20,21). Accordingly, the present design can evaluate short-term within-group change after the session, not the isolated causal effect of the cards.

The present study was designed as a preliminary within-group evaluation of short-term change in STI knowledge among Grade X vocational students. The primary outcome was within-student change in the 30-item knowledge score from baseline to one week after the session. Knowledge categories were treated as secondary descriptive summaries. The study did not test comparative effectiveness, sustained retention, or behavioral outcomes.

METHODS

Study design and setting

This quantitative study used a one-group pretest–posttest design at SMK Muhammadiyah 2 Moyudan, Sleman Regency, Special Region of Yogyakarta, Indonesia. Study procedures were conducted from 7 to 22 May 2024. The design measures change within the same participants over time but does not provide a concurrent counterfactual; therefore, causal attribution to the educational session is not warranted.

Participants and sampling

The accessible population was the Grade X cohort at the school. Fifty Grade X students participated and had complete pretest and one-week posttest data. The study used total sampling of the accessible Grade X cohort. Grade XI and XII students were outside the prespecified target cohort because of field practice and end-of-semester examinations. No formal a priori power calculation was reported; consequently, precision and statistical power should be considered when interpreting the findings.

Educational session

Students received a 45-minute session after regular classes. The flashcards covered STI definitions, causes, transmission, signs and symptoms, risk factors, complications, and prevention. Two classes were divided into four discussion groups of 12–13 students. Each group was accompanied by the researcher or one of three female research assistants as a facilitator. The assistants were briefed in advance to align their understanding of the study and data-collection procedures, monitored group

discussions, and assisted when questions could not be resolved by students. The flashcard material underwent expert judgment by two experts in health promotion and school education before implementation; based on that review, the illustration on card 21 was revised to better represent STI complications. Students discussed the cards, answered facilitator questions, and were given an opportunity to ask for clarification.

The session therefore constituted a combined educational package rather than an isolated flashcard exposure: visual prompts, peer discussion, and facilitator clarification occurred together. The study design cannot separate the contribution of these components.

Instrument and outcomes

Knowledge was measured with a 30-item dichotomous questionnaire originally developed by Nur Triningtyas Putri in 2015 (22). Verification of the original instrument and the study thesis shows 18 favorable and 12 unfavorable items. Correct responses were scored 1 and incorrect responses 0, with reverse scoring for negatively worded items; the total was converted to a percentage score. The primary outcome was the within-student change in total percentage score from baseline to one week. Knowledge categories (low, moderate, good) were secondary descriptive summaries using the thresholds specified in the study protocol.

The original instrument was evaluated using content validation and split-half reliability with the Spearman-Brown formula rather than Cronbach's alpha. The reported Spearman-Brown reliability coefficient was r11 = 0.616 (22). This indicates modest reliability evidence and does not establish strong measurement precision. Reliability was not re-estimated in the present sample, so measurement error in the administered version cannot be quantified. The item blueprint in the original instrument and in the study identifies the 18 favorable items as 1, 2, 5, 7, 8, 9, 10, 13, 15, 16, 20, 21, 22, 24, 25, 26, 27, and 29; the remaining 12 items are unfavorable. This item-level verification resolves the narrative inconsistency in the thesis text that elsewhere described 19 favorable and 11 unfavorable items.

Data collection

School coordination occurred on 7 May 2024. Parent/guardian information and permission forms were sent home on 8 May, and permission and student consent were collected on 13 May. Students completed the pretest and educational session on 15 May and the posttest on 22 May 2024, one week later. The same questionnaire was used at both assessments.

Statistical analysis

Participant characteristics and knowledge categories were summarized descriptively. Paired pretest–posttest scores were compared using the Wilcoxon signed-rank test because the original analysis reported non-normality on Shapiro–Wilk testing. Statistical significance was defined as two-sided $p < 0.05$; software output of 0.000 is reported as $p < 0.001$. In addition to Z and p, a standardized Wilcoxon effect-size estimate was calculated as $r = |Z|/\sqrt{N}$, using N = 50 paired participants. With Z = −6.050, r = 0.86. Forty-eight participants had positive differences, none had negative differences, and two were tied. The effect size quantifies the magnitude of the within-group rank shift but does not establish a causal treatment effect in the absence of a comparison group.

The reported mean score change was 14.82 percentage points (49.34 to 64.16). Means and SDs are retained as descriptive summaries, while inference is based on the paired Wilcoxon test. From the reported Z statistic and n = 50, the standardized Wilcoxon effect-size index is $|r| = |Z|/\text{sqrt}(n) = 6.050/\text{sqrt}(50) = 0.86$, indicating a large standardized within-sample shift. Because raw paired scores were not available in the manuscript record, medians, interquartile ranges, a Hodges-Lehmann paired-location estimate, and its confidence interval cannot be reconstructed without inventing data.

Ethical considerations

Ethical approval was granted by the Health Research Ethics Committee of Universitas Jenderal Achmad Yani Yogyakarta (Approval No. SKep/96/KEP/V/2024; 3 May 2024). Study information emphasized voluntary participation and confidentiality. Parent/guardian permission was obtained for minors, and students provided informed consent/assent according to the study procedure. Data were coded for reporting.

RESULTS

Table 1. Participant characteristics (n = 50). Each participant selected one primary source of STI information

Characteristic	n (%)
Age 15 years	2 (4.0)
Age 16 years	18 (36.0)
Age 17 years	24 (48.0)
Age 18 years	6 (12.0)
Male	21 (42.0)
Female	29 (58.0)
Teachers as primary STI source	27 (54.0)
Parents	4 (8.0)
Mass media	11 (22.0)
Peers	3 (6.0)
Health professionals	2 (4.0)
Other	3 (6.0)

Table 2. STI knowledge before and one week after the educational session (n = 50). SD = standard deviation. Wilcoxon inference is based on paired ranks; the standardized effect-size index derived from Z and n is |r| = 0.86.

Outcome	Pretest	One-week posttest
Knowledge score, mean (SD)	49.34 (20.552)	64.16 (19.078)
Score range	23–100	30–100
Good knowledge, n (%)	5 (10.0)	28 (56.0)
Moderate knowledge, n (%)	25 (50.0)	19 (38.0)
Low knowledge, n (%)	20 (40.0)	3 (6.0)
Paired Wilcoxon result	48 positive, 0 negative, 2 ties	Z = −6.050; p < 0.001

Participant characteristics

All 50 participating Grade X students had complete pretest and one-week posttest records. Twenty-nine (58%) were female and 21 (42%) male. The largest age group was 17 years (24/50, 48%). Teachers were the most frequently selected primary source of STI information (27/50, 54%).

STI knowledge scores

The mean knowledge score increased from 49.34 (SD 20.552) at baseline to 64.16 (SD 19.078) one week after the session, a raw mean increase of 14.82 percentage points. Forty-eight paired scores increased, none decreased, and two were tied. The reported Wilcoxon signed-rank statistic was Z = -6.050 with p < 0.001. The derived standardized effect-size index was |r| = 0.86 using n = 50. This effect size describes the magnitude of the within-sample rank shift; it does not remove the design limitations created by the absence of a comparison group.

Knowledge-category distributions shifted from 5/50 (10%) good, 25/50 (50%) moderate, and 20/50 (40%) low at baseline to 28/50 (56%) good, 19/50 (38%) moderate, and 3/50 (6%) low at one week. These categories are secondary descriptive summaries and should not replace analysis of the paired score.

DISCUSSION

In this one-group study, STI knowledge scores were higher one week after a 45-minute facilitator-led educational session that used flashcards. Most paired scores increased, and the proportion of students classified as having good knowledge was higher at follow-up. These findings document short-term within-student change, but the design cannot establish that the session caused the change or that flashcards were the active component.

The direction of change is consistent with a broad body of sexual and reproductive health education research. Meta-analytic and scoping-review evidence indicates that structured education can improve adolescent knowledge, although programs differ markedly in intensity, content, pedagogy, and outcome measurement (23,24). Controlled trials using handbooks, mHealth, modules, online learning, and blended digital approaches have reported educational gains among adolescents (24). Indonesian studies using comprehensive sexuality education, text messaging, messaging applications, and interactive learning similarly report improvements in knowledge or related competencies. These findings support the plausibility of a short-term knowledge increase after education but do not validate the exact magnitude observed in this uncontrolled study.

The intervention should be interpreted as a combined educational package rather than a flashcard-only intervention. Visual cards may have helped organize attention and retrieval, while peer discussion and facilitator clarification may have supported comprehension. None of these mechanisms was measured. The Indonesian flashcard study provides context-specific support for the feasibility of this medium, while recent interactive, online, and social-media educational studies show that brief or digitally supported formats can improve knowledge in some populations. However, the present design cannot distinguish the contribution of the cards from facilitator contact, group discussion, repeated testing, or other learning processes.

Several alternative explanations remain plausible. Repeating the same 30-item questionnaire after one week may produce testing or recall effects. Students may also have encountered STI information from teachers, media, peers, or other sources during the interval. The one-week period reduces but does not eliminate maturation or concurrent-exposure explanations. These threats to internal validity are especially important because randomized and controlled studies demonstrate that comparison groups can materially change interpretation of educational effects. The observed shift should therefore be described as within-group change rather than efficacy or effectiveness.

The practical implication is limited but useful: a brief, school-delivered STI education package was feasible to administer to this cohort and was followed by higher short-term knowledge scores. Indonesian qualitative work from Yogyakarta highlights sociocultural sensitivities surrounding adolescent sexual and reproductive health education, reinforcing the importance of locally acceptable language, trusted facilitators, and context-sensitive delivery. Indonesian online-module and interactive-learning studies similarly emphasize accessibility, clarity, and engagement. These findings support continued development and controlled evaluation of contextually appropriate school-based education rather than immediate claims of superiority over lecture, video, digital media, or usual instruction.

The study has strengths, including complete paired data for all 50 participating students, a clearly defined one-week assessment interval, and an intervention focused specifically on STI knowledge. However, important limitations reduce causal and external validity. The absence of a comparison group leaves the study vulnerable to testing effects, concurrent exposure, and other temporal explanations. The single-school sample limits generalizability. No a priori sample-size calculation was reported. The instrument has only modest prior reliability evidence, and reliability was not assessed in the present sample. Reuse of the same questionnaire may inflate apparent improvement. Facilitator-specific delivery and fidelity were not quantified with a formal checklist. Finally, the study measured knowledge only; it provides no evidence about attitudes, preventive behaviour, service use, STI incidence, or sustained retention. This distinction is important because reviews and trials show that gains in knowledge do not automatically translate into consistent behavioral effects.

A stronger next study would use a concurrent comparison group or cluster-randomized design, prespecify a primary outcome, verify or improve the measurement instrument, document intervention fidelity, and include longer follow-up. If the scientific question concerns the specific value of flashcards, the comparator should hold facilitator contact and educational content constant while varying the medium.

CONCLUSION

Among 50 Grade X students at one vocational school, STI knowledge scores were higher one week after a facilitator-led educational session using flashcards. The finding represents short-

term within-group change and does not establish a flashcard-specific causal effect, comparative effectiveness, sustained retention, or behavioral impact. Controlled evaluation with a verified measurement instrument, standardized delivery, effect-size estimation, and longer follow-up is needed.

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Conflict of Interest

The authors declare that they have no financial, professional, or personal conflicts of interest related to this study.

Author Contributions

HR contributed to the study conceptualization, research design, methodology, data collection, data analysis, interpretation of findings, and preparation of the original manuscript draft. DY contributed to research supervision, methodological guidance, interpretation of findings, manuscript review, and critical revision for important intellectual content. Both authors reviewed and approved the final version of the manuscript.

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