

Development and Pilot Evaluation of “Cut Nyak”: A Comic-Based Reproductive Health Education Medium for Adolescents in Aceh, Indonesia

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ABSTRACT

Background: Adolescent reproductive health remains a pressing public health concern in Indonesia, particularly in educational settings where access to accurate, culturally appropriate, and engaging information may be constrained. These challenges underscore the need for innovative health communication approaches that can address sensitive reproductive health issues in ways that are accessible and contextually relevant to adolescents, including those in Islamic boarding schools (*pesantren/dayah*).

Objective: This study aimed to develop and preliminarily evaluate the acceptability of Cut Nyak, a comic-based reproductive health education medium designed for adolescents in Aceh Province, Indonesia, using a Research and Development (R&D) approach.

Methods: The development process involved two focus group discussions (FGDs) with stakeholders comprising lecturers, midwives, health office personnel, reproductive health facilitators, an Islamic boarding school representative, educators, and visual communication design specialists. The FGDs informed the comic's conceptual framework, characters, narrative structure, visual language, and priority health content. Ten candidate topics were integrated into a coherent narrative and subsequently developed into a 56-page A5 comic entitled *Sepatu Sebelah Kiri (One Left Shoe)*. The comic uses a contemporary anime- and manhwa-influenced visual style, featuring modestly dressed, hijab-wearing characters and a boarding-school setting. Rather than presenting health information through explicit didactic instruction, reproductive health messages are embedded within the storyline and conveyed through characters' experiences, interpersonal relationships, and problem-solving processes. A preliminary acceptability assessment was conducted among 30 female adolescents, comprising 15 students from a non-boarding Islamic junior high school and 15 students from a boarding *pesantren*. Acceptability was assessed descriptively using positive and negative response categories.

Results: Participatory development resulted in a culturally contextualized comic centred on Cut Putri Ashtanti, a boarding-school student navigating identity-related conflict, family tension, and social stigma, with support from peers. The narrative incorporated ten priority topics, including puberty, bullying, LGBT-related stigma, sexual harassment, premarital sexual behaviour, personal hygiene, substance use, adolescent nutrition, mental health, and violence against children. The resulting 56-page comic was accompanied by intellectual property outputs, including a patent-related application and a copyright certificate. Overall acceptability was favourable across both educational settings. Positive responses ranged from 67% to 93% among adolescents in the non-boarding school and from 80% to 87% among those in the boarding *pesantren*. Boarding-school adolescents showed higher positive responses to LGBT-related stigma content (87% vs. 73%), whereas non-boarding adolescents showed higher positive responses to mental health content (93% vs. 80%). Responses to violence-related content were identical in both groups (80%).

Conclusion: The findings indicate that participatory, entertainment-education-informed comic development is feasible for creating culturally responsive reproductive health communication media for adolescents in Islamic educational settings. The generally favourable preliminary acceptability supports further refinement and larger-scale evaluation. However, the findings should be interpreted as exploratory because of the small, non-probability pilot sample and the absence of controlled measures of educational effectiveness. Future studies should assess whether the intervention improves reproductive health knowledge, attitudes, self-efficacy, stigma-related perceptions, and health-related behaviours using validated instruments and controlled pre-test/post-test designs.

KEYWORDS: reproductive health education; comic-based intervention; graphic medicine; adolescents; entertainment-education; Aceh, Indonesia

INTRODUCTION

Adolescence represents a critical developmental period during which health-related knowledge, attitudes, self-care practices, and behavioral patterns are established and may persist into adulthood.[1], [2] Nevertheless, adolescent reproductive health remains

Development and Pilot Evaluation of “Cut Nyak”: A Comic-Based Reproductive Health Education Medium for Adolescents in Aceh, Indonesia

insufficiently addressed by conventional health education in many parts of Indonesia. National evidence from the 2017 Indonesian Demographic and Health Survey (*Survei Demografi dan Kesehatan Indonesia*, SDKI) indicated that 61% of female adolescents aged 15–19 years had limited or no knowledge of reproductive health, while 21% reported inadequate knowledge regarding appropriate care of their reproductive organs. The same report identified substantial deficiencies in personal hygiene practices among adolescent girls, underscoring persistent gaps in reproductive health literacy and self-care. These challenges are particularly important because inadequate menstrual and genital hygiene may contribute to preventable reproductive and urogenital health problems[3], [4]. More broadly, the continued under-addressing of menstrual and genital hygiene in health communication reflects a global challenge in ensuring that girls and young women receive accurate, accessible, and contextually appropriate reproductive health information

One potentially effective strategy for addressing this educational gap is the use of entertainment-education (E-E), an approach that integrates health information into engaging narrative formats rather than relying exclusively on didactic instruction[5], [6]. Comics and webtoons are particularly promising E-E media for adolescent audiences because they integrate visual and textual communication, facilitate identification with relatable characters, and allow information to be accessed asynchronously and privately. These characteristics may be especially advantageous when addressing sensitive reproductive health issues, for which embarrassment, stigma, and concerns about social judgment can inhibit adolescents’ willingness to seek information through conventional channels[7], [8]. The theoretical relevance of narrative visual media is also supported by Social Cognitive Theory, which emphasizes observational learning and symbolic modeling as mechanisms through which media representations can influence knowledge, beliefs, and health-related behavior[9], [10], [11]. Similarly, the Health Belief Model proposes that preventive behavior is influenced by perceptions of susceptibility, severity, benefits, and barriers, which may be shaped through narrative portrayals of characters experiencing health-related situations. Empirical evidence increasingly supports the educational potential of visual narrative media. For example, a digital comic intervention was associated with improvements in reproductive health behavior among senior high school students in Jambi, Indonesia[10], [12]. In addition, a recent scoping review identified cartoon-, comic-, and animation-based interventions as promising approaches for sexual health promotion and education across diverse populations and settings[13], [14].

Despite this emerging evidence, an important contextual gap remains in the Indonesian literature. Most reproductive health comics and other visual educational media have been developed for adolescent populations in general and have not been explicitly designed around the sociocultural, religious, and educational characteristics of Islamic boarding schools (*pesantren/dayah*). This limitation is particularly relevant in Aceh, where *dayah* constitutes an important educational environment for adolescents and integrates formal learning with Islamic religious instruction and community-based values. Within such settings, reproductive health education may require greater sensitivity to prevailing religious norms, cultural expectations, gender relations, and institutional practices. Topics related to sexuality, gender, menstruation, and sexual violence may be perceived as particularly sensitive and therefore require communication strategies that are both scientifically accurate and culturally legitimate. Consequently, educational media developed without meaningful engagement with *pesantren* stakeholders may encounter barriers to acceptance, implementation, or sustained use. Cultural adaptation should therefore extend beyond translating or modifying existing materials; it should involve stakeholders in defining educational priorities, narrative boundaries, character representations, language, and modes of delivery from the outset. . This article addresses that gap by reporting the development and pilot evaluation of Cut Nyak, a reproductive health education medium for Acehnese adolescents realised through the comic *Sepatu Sebelah Kiri* (‘One Left Shoe’). Specifically, this article aims to: (1) describe the participatory, stakeholder-informed process through which the comic’s concept, characters, and content priorities were developed; (2) describe the resulting comic itself — its narrative structure, cast, visual language, physical format, and the way health content is embedded in the story; (3) report the intellectual property and production outcomes achieved; and (4) present preliminary acceptability findings from a pilot test comparing adolescents in a non-boarding Islamic junior high school and a boarding *pesantren*. In doing so, the article offers both a replicable process model for culturally grounded health-comic development and early evidence on how boarding-school context may shape adolescents’ receptivity to sensitive reproductive health content.

METHODS

Study Design and Research Framework

This study employed a research and development (R&D) design to systematically develop, refine, and preliminarily assess a culturally responsive reproductive health education medium for adolescents. R&D methodology is appropriate for studies in which an educational product is developed through sequential stages of needs identification, stakeholder consultation, design, production, refinement, and preliminary testing (Sugiyono, 2018). The present article reports the activities undertaken during the first year of a three-year development program. The overall program comprises three sequential phases: (1) concept development and production of the educational comic (Year 1, 2024); (2) adaptation of the print comic into an electronic webtoon (*e-webtoon*) format (Year 2,

Development and Pilot Evaluation of “Cut Nyak”: A Comic-Based Reproductive Health Education Medium for Adolescents in Aceh, Indonesia

2025); and (3) quasi-experimental evaluation of educational effectiveness using a pre-test/post-test design (Year 3, 2026). Accordingly, the findings presented in this article should be interpreted as evidence from the development and preliminary acceptability phases rather than as evidence of intervention effectiveness.

Study Setting and Target Population

The study was conducted in junior high schools (*Sekolah Menengah Pertama*, SMP) and Islamic boarding schools (*dayah/pesantren*) located in five districts/cities of Aceh Province, Indonesia: Aceh Besar, Aceh Barat, Aceh Utara, Aceh Tengah, and Kota Langsa. These sites were purposively selected to provide representation of the eastern, western, and central geographical regions of Aceh and to capture variation in educational contexts, particularly between conventional school-based and Islamic boarding-school environments. The target population for the subsequent effectiveness evaluation comprised female adolescents aged 10–19 years residing in Aceh Province ($N = 466,167$). The sample size for the planned Year 3 effectiveness study was estimated using the method proposed by Lwanga and Lemeshow (1991) for comparing two population proportions. The calculation assumed a 50% proportion of adolescents with high reproductive health knowledge and appropriate personal hygiene practices compared with an estimated 38.1% proportion with low knowledge. The resulting minimum sample size was 297 participants. Allowing for an anticipated 10% attrition or loss to follow-up increased the target sample to 327 participants. For operational implementation across the five study areas, the planned recruitment was subsequently rounded to approximately 65 participants per district/city, with approximately equal allocation between the two planned intervention formats (print comic and *e-webtoon*), resulting in an anticipated total recruitment of approximately 340 adolescents. Importantly, this sample-size calculation pertains to the planned Year 3 effectiveness evaluation and does not represent the sample used for the Year 1 acceptability pilot reported in the present article.

Participatory Development of the Educational Comic

The conceptualization and development of the comic were informed by two rounds of stakeholder focus group discussions (FGDs) conducted at different stages of the development process. The FGDs were designed to incorporate perspectives from health professionals, educators, religious-education stakeholders, communication and design experts, and representatives with knowledge of adolescent needs. The first FGD was conducted on 8 March 2023 at the Khadijah Auditorium and involved eight of 11 invited participants. The participants comprised university lecturers, representatives of professional health organizations, midwives affiliated with the district health office and community health centers (*Puskesmas*), a reproductive health facilitator, a representative of an Islamic boarding school, and a lecturer in Visual Communication Design from the Indonesian Arts and Culture Institute (ISBI) Aceh. The FGD was facilitated by a member of the research team and focused on establishing the preliminary conceptual and design parameters of the educational medium. The discussion resulted in several initial design specifications. These included a six-character narrative structure consisting of a boarding-school student as the central protagonist, three peers, a grandmother figure, and a female religious teacher (*ustazah*); a visual identity combining contemporary anime-inspired elements with modest Islamic aesthetics; and a narrative progression from the protagonist's home environment to everyday life in a boarding-school setting, followed by the emergence of a personal-hygiene-related problem and its resolution through health education. The physical prototype was specified in A5 format with six panels per page. A second FGD was conducted on 2–3 July 2024 and involved a broader stakeholder group comprising educators, health professionals, and representatives of the intended adolescent audience. The first day focused on content prioritization. Participants ranked 10 candidate reproductive health and adolescent well-being topics according to their perceived relevance and priority for inclusion in the educational medium: puberty, bullying, LGBT-related stigma, sexual harassment, premarital sexual behavior, personal hygiene, substance use, adolescent nutrition, mental health, and violence against children. On the second day, stakeholders reviewed the proposed visual composition, narrative structure, and character development in light of the prioritized topics. Iterative discussion and refinement during this process led to the adoption of the working title *Sepatu Sebelah Kiri* (“One Left Shoe”).



Development and Pilot Evaluation of “Cut Nyak”: A Comic-Based Reproductive Health Education Medium for Adolescents in Aceh, Indonesia

Data Collection and Study Instruments

Data were collected using two primary instruments. First, a structured FGD discussion guide was developed to facilitate systematic exploration of the comic's conceptual framework, character development, narrative structure, visual presentation, and prioritization of reproductive health topics. Second, a structured perception questionnaire was administered during the subsequent pilot acceptability assessment. The FGD sessions were documented through written meeting records (*notulensi*) that captured participants' contributions and the outcomes of the discussions, supplemented by photographic documentation. The qualitative material generated during the FGDs was used to inform iterative decisions concerning the educational content, narrative framing, character representation, and visual design of the comic.

Preliminary Acceptability Assessment

Following completion of the comic manuscript and artwork, a preliminary acceptability assessment was undertaken on 4 December 2024. A convenience sample of 30 female adolescents was recruited from two educational settings in Aceh Besar District representing contrasting school environments: 15 students from SMPIT Nurul Qur'an, a non-boarding Islamic junior high school, and 15 students from Pesantren Samudra Pasai, an Islamic boarding school. Participants were first provided with the completed comic and asked to read the material. They subsequently completed a structured perception questionnaire assessing their overall response to the educational medium and their perceptions of four thematic domains: (1) general acceptability of the comic, (2) LGBT-related content, (3) violence-related content, and (4) mental-health-related content. Responses were categorized as positive or negative for descriptive analysis. The pilot was intended to provide preliminary evidence of user acceptability and contextual receptivity, rather than to establish intervention efficacy or generate causal estimates. The inclusion of two contrasting educational environments also enabled an exploratory comparison of adolescents' perceptions across boarding and non-boarding Islamic school contexts.

Ethical Considerations

Ethical approval was obtained before commencement of participant recruitment and data collection in accordance with applicable ethical standards for research involving human participants. Written informed consent was obtained from adult stakeholders participating in the FGDs and from the parents or legal guardians of adolescent participants. Adolescents provided written assent before participation. No personally identifying information was recorded on the perception questionnaires, thereby preserving participant confidentiality and anonymity during data analysis and reporting.

Data Analysis

Qualitative data generated through the FGDs were analyzed using a thematic approach. The analysis focused on identifying recurring stakeholder perspectives concerning reproductive health priorities, culturally appropriate content, narrative boundaries, character representation, visual design, and implementation requirements. The resulting themes and topic priorities were subsequently translated into specific design and content decisions for the comic and are presented descriptively in the Results section. Quantitative data from the Year 1 pilot assessment were analyzed using descriptive statistics. Responses were summarized as frequencies and percentages of positive and negative perceptions for each assessed domain. Results were additionally stratified by educational setting to provide a preliminary comparison between adolescents attending the non-boarding Islamic junior high school and those attending the Islamic boarding school. Given the exploratory purpose and small convenience sample of the pilot, no inferential statistical testing was undertaken, and the findings are interpreted as preliminary indicators of acceptability rather than estimates of generalizable intervention effects.

RESULTS

The findings are presented across three complementary domains: (1) participatory development of the comic concept, narrative, and content priorities; (2) product and intellectual-property outputs achieved during the first year of development; and (3) preliminary acceptability of the completed comic among adolescents attending boarding and non-boarding Islamic schools.

Participatory Development of the Comic Concept and Content

The first stakeholder focus group discussion (FGD), conducted on 8 March 2023, generated initial specifications for the comic's conceptual, narrative, and visual development. At this stage, participants did not reach consensus on a final title and instead recommended that the educational content and storyline be established before determining the title. One provisional suggestion was *Petualangan Bersih-Bersih* (“The Cleanliness Adventure”). Participants reached greater convergence regarding the narrative cast, visual identity, and general storyline. The proposed six-character structure comprised a female adolescent protagonist, three peers, a grandmother figure (*uti*), and a female religious teacher (*ustazah*). Participants also recommended the use of locally recognizable Acehnese names to enhance contextual familiarity. Regarding visual presentation, stakeholders favored a contemporary illustration style influenced by Japanese or Korean popular visual culture, while simultaneously emphasizing modest dress, hijab use, and a

Development and Pilot Evaluation of “Cut Nyak”: A Comic-Based Reproductive Health Education Medium for Adolescents in Aceh, Indonesia

recognizable *pesantren* environment. Several participants noted that the depiction of human figures should be handled sensitively to remain compatible with local Islamic visual norms. The proposed narrative structure followed the protagonist from her home environment to the *pesantren*, where a personal-hygiene-related problem emerges after approximately one to two weeks and is subsequently addressed through educational dialogue involving the *ustazah*. Participants further recommended an A5 format with approximately six panels per page and a minimum length of 50 pages.

Table 1. Stakeholder Input on the Initial Comic Concept, First FGD (8 March 2023)

Aspect	Representative stakeholder input
Title	No final title was established. Participants recommended finalizing the health content and storyline before selecting the title. One provisional suggestion was <i>Petualangan Bersih-Bersih</i> (“The Cleanliness Adventure”).
Characters	A six-character structure was proposed: one female protagonist, three same-cohort peers, a grandmother figure (<i>uti</i>), and a female religious teacher (<i>ustazah</i>). Localized character naming was recommended to strengthen cultural familiarity.
Cover design	Stakeholders favored contemporary anime-influenced visual elements combined with modest, hijab-wearing characters and a <i>pesantren</i> setting. Some participants emphasized sensitivity in depicting human figures in accordance with local Islamic visual norms.
Storyline	The proposed narrative progressed from the protagonist's home environment to her arrival at the <i>pesantren</i> , followed by the emergence of a personal-hygiene-related problem and its resolution through educational dialogue with the <i>ustazah</i> .
Format	An A5 format with approximately six panels per page was recommended, with a minimum length of approximately 50 pages.

The second FGD, conducted on 2–3 July 2024, expanded the development process from general conceptualization to content prioritization and narrative refinement. Stakeholders considered 10 candidate topics: puberty, bullying, LGBT-related stigma, sexual harassment, premarital sexual behavior, personal hygiene, substance use, adolescent nutrition, mental health, and violence against children. Rather than treating these topics as independent educational units, participants emphasized the need for an overarching narrative structure through which sensitive issues could be presented in a coherent and contextually acceptable manner. The discussion identified identity, stigma, interpersonal relationships, and social support as potentially useful narrative threads for integrating several of the prioritized topics. This process ultimately contributed to the selection of the working title *Sepatu Sebelah Kiri* (“One Left Shoe”), which reflected the emerging emphasis on identity, difference, and social experience within the narrative. The FGD also generated stakeholder perspectives concerning the broader communication environment in which adolescent reproductive health education is delivered. These perspectives are summarized in Table 2.

Table 2. Priority Themes Emerging from the Second FGD (2–3 July 2024)

Priority	Theme	Key finding
High	Knowledge acquisition	Stakeholders emphasized the importance of accessible educational media in strengthening adolescents' reproductive health knowledge, including information concerning contraception and sexually transmitted infections.
High	Attitudinal development	A more supportive school and family environment was considered important for facilitating adolescents' comfort in discussing sensitive sexual and reproductive health issues.
Moderate	Access to information	Interactive and digitally mediated features, including video, quizzes, and discussion functions, were viewed as potentially improving the accessibility and attractiveness of reproductive health information.
Moderate	Risk-related behavior	Stakeholders perceived educational media exposure as having potential to support reductions in risk-related behaviors, although this was identified as an anticipated rather than empirically established outcome of the present development phase.
Low	Parent and teacher involvement	Stakeholder involvement was considered supportive of reinforcing health messages and facilitating adolescents' informed decision-making.
Low	Implementation constraints	Limited internet connectivity in some areas and the need for additional educator capacity-building were identified as potential barriers to implementation, particularly for digitally delivered content.

Taken together, the two FGDs established a participatory design framework in which educational relevance, adolescent appeal, cultural appropriateness, and feasibility were considered concurrently. The first FGD primarily established the foundational parameters of the product, including its characters, visual identity, narrative setting, and physical format, whereas the second FGD refined the substantive content and narrative direction. This iterative process culminated in the development of *Sepatu Sebelah Kiri*

Development and Pilot Evaluation of “Cut Nyak”: A Comic-Based Reproductive Health Education Medium for Adolescents in Aceh, Indonesia

as the principal Year 1 educational product.

Product and Intellectual-Property Outcomes

By the end of the first year, the participatory development process had resulted in a completed 56-page print comic, *Sepatu Sebelah Kiri*. The narrative centers on Cut Putri Ashtanti, known as “Cutnyak,” a reserved yet resilient adolescent living within a boarding-school context. The protagonist is supported by two close friends, Alif and Laila, as she encounters interpersonal and identity-related challenges and experiences social stigma associated with sexual orientation. The narrative subsequently addresses these challenges through peer support, interpersonal dialogue, and guidance within her social environment. The completed product generated two intellectual-property outcomes. First, a simple patent application was submitted to the Directorate General of Intellectual Property (DJKI), Indonesia, under registration number S00202408684 on 30 August 2024. At the time of reporting, the application had progressed to the substantive examination stage. Second, the comic received a copyright certificate under registration number EC00202496752, issued on 31 August 2024. These outputs constituted the principal intellectual-property and product deliverables specified in the Year 1 project plan. The development and preliminary dissemination of the comic were further supported through five formal institutional partnerships. CV Azzia Karya Bersama contributed printing capacity, editorial and layout support, and co-financing for reproduction, with an agreed revenue-sharing arrangement. Madrasah Tsanawiyah Samudra Pasai Madani and SMP Islam Karakter Nurul Qur'an provided venues for product testing, access to adolescent participants, and support for printed reproduction. The Aceh Besar District Health Office facilitated stakeholder engagement during the development process and indicated its potential role in dissemination through school health (*Usaha Kesehatan Sekolah*, UKS) and adolescent-friendly health service (*Pelayanan Kesehatan Peduli Remaja*, PKPR) programs. In addition, Sagoe TV supported dissemination through its YouTube platform. Collectively, these partnerships provided an initial institutional pathway for production, testing, and dissemination beyond the research team.

Preliminary Acceptability of the Comic

A preliminary acceptability assessment was conducted on 4 December 2024 among 30 adolescents, comprising 15 students from SMPIT Nurul Qur'an, representing a non-boarding Islamic junior high school, and 15 students from Pesantren Samudra Pasai, representing a boarding Islamic educational setting. The assessment examined adolescents' responses to the comic as an educational medium overall and to three sensitive thematic domains: LGBT-related content, violence-related content, and mental-health content.

Table 3. Adolescent Acceptability of the Comic by Educational Setting (n = 15 per school)

Content domain	SMPIT Nurul Qur'an (non-boarding) Positive / Negative	Pesantren Samudra Pasai (boarding) Positive / Negative
Comic as an educational medium	67% / 33%	80% / 20%
LGBT-related content	73% / 27%	87% / 13%
Violence-related content	80% / 20%	80% / 20%
Mental-health content	93% / 7%	80% / 20%

Positive responses predominated across all assessed domains in both educational settings. For the comic as an educational medium, positive responses were reported by 80% of students in the boarding school and 67% in the non-boarding school. Positive responses to LGBT-related content were reported by 87% and 73%, respectively. Responses to violence-related content were identical across the two settings, with 80% of participants reporting positive perceptions in each group. Mental-health content received the highest positive response in the non-boarding school (93%) and a lower but still majority-positive response in the boarding school (80%). The observed differences between educational settings should be interpreted cautiously because of the small sample size and the descriptive, convenience-based nature of the pilot. Nevertheless, the pattern provides preliminary evidence that the comic was generally acceptable across both settings, including for content addressing potentially sensitive issues. Negative responses to LGBT-related content were reportedly associated primarily with discomfort or limited personal identification with the topic rather than rejection of the comic as an educational format. Qualitative feedback from participating educators provided additional contextual interpretation of these findings.

Educators perceived that students in the boarding-school setting appeared relatively receptive to narrative content addressing stigmatized issues, whereas students in the non-boarding setting appeared particularly responsive to mental-health-related content. These observations were understood by stakeholders in relation to differences in students' everyday educational and social environments. However, because these interpretations were based on educator observations rather than independently measured contextual variables, they should be regarded as hypothesis-generating rather than explanatory evidence. A minority of participants across both settings expressed a preference for video or digitally mediated educational content over a conventional print comic, citing perceived advantages in visual engagement and interactivity. This feedback provided an important design consideration for

Development and Pilot Evaluation of “Cut Nyak”: A Comic-Based Reproductive Health Education Medium for Adolescents in Aceh, Indonesia

the subsequent development phase and informed the project's decision to prioritize adaptation of the print comic into an e-webtoon format in Year 2. The Year 1 findings demonstrate that a participatory development process involving health, education, religious, design, and adolescent stakeholders can produce a culturally situated reproductive health education product that achieves preliminary acceptability across contrasting Islamic educational environments. The findings also identify digital adaptation and further evaluation of educational effectiveness as logical subsequent stages of the intervention development pathway.

DISCUSSION

The development process reported here illustrates how a reproductive health comic can be built from the ground up through stakeholder participation rather than adapted after the fact to a pre-existing product. Involving lecturers, health providers, a boarding-school representative, and a visual-design specialist from the earliest concept stage allowed cultural and religious considerations — modest character design, conservative handling of full-figure human depiction, and the choice of a pesantren setting — to be built into the comic's visual language rather than retrofitted to finished artwork. This matters for a comic in particular, because visual conventions cannot be edited out of a drawn page as easily as a sentence can be rewritten: a panel drawn in a style that a pesantren gatekeeper finds objectionable has to be redrawn. Participatory design therefore functions as a production efficiency as well as an ethical commitment, and is consistent with entertainment-education scholarship, which emphasises that narrative health media are most effective when they are co-created with, rather than merely delivered to, the intended audience and its gatekeepers[15], [16].

The most consequential design decision in the process was the second FGD's move from a topic-by-topic treatment to a single dramatic problem. Ten candidate topics could not have been covered in 56 pages without reducing the comic to an illustrated syllabus, and the shift to identity, stigma, and social support as an integrating thread allowed several of the ranked topics to be carried by one storyline. That choice is what makes the medium do work that a leaflet could not: the reader learns what the protagonist learns, in the order she learns it, which is the mechanism by which narrative reduces counter-arguing and sustains attention to material a reader might otherwise avoid[17], [18]. The pilot findings are broadly consistent with prior evidence that comic- and cartoon-based media are well received as reproductive and sexual health education channels for adolescents[15], [16] (Abu-Ras et al., 2024; McNicol, 2017) and can improve reproductive health behaviour when delivered digitally. [19], [20]The high overall acceptance recorded in both school types (67–80% positive for the comic in general) suggests that the participatory design process succeeded in producing a medium adolescents found engaging rather than didactic or alienating, in line with social cognitive theory's emphasis on relatable, identification-worthy characters for observational learning through media

The difference in perception between boarding and non-boarding adolescents is a noteworthy, if preliminary, finding. Pesantren students responded somewhat more positively to LGBT-related content than their non-boarding peers, despite operating within a more religiously and socially structured environment that might be expected to be less receptive to such content. One plausible explanation lies in how the comic frames the topic. Cutnyak's experience is presented as exclusion and the restoration of friendship rather than as a position on sexual orientation, and a narrative about being left out may be easier to engage with in a communal boarding setting where belonging is a daily concern than an explicit discussion of the same subject would be. Conversely, non-boarding students' greater openness to mental-health content may reflect their comparatively wider exposure to varied media and peer discourse on mental health outside school[21], [22], [23]. Both readings are speculative at this sample size and are offered as hypotheses for the planned larger evaluation rather than as conclusions.

The consistently high acceptance of violence-related content (80% positive at both schools) suggests that difficult material is not in itself what adolescents reject; the minority of negative responses recorded across all four content areas came, on the accounts respondents gave, from discomfort with a topic rather than from rejection of the comic. Two practical implications follow for the artefact. First, the small group who preferred video-based media points to a limit of the print format rather than of the story, and suggests that the same narrative would benefit from a digital presentation for part of the readership. Second, the negative responses were concentrated in the two most sensitive content areas, which argues for a further round of revision to the panels concerned rather than for treating the comic as finished after a single test. The intellectual-property outcomes are not evidence of educational effectiveness, but they are practically significant: legal protection for the comic's content and characters supports its transition to commercial distribution without exposing the work to unauthorised reproduction, and the multi-sector partnership structure assembled around it — a publisher, two schools, a district health office, and a local broadcaster — suggests a plausible pathway to sustained distribution beyond the life of the research funding, which is often a limiting factor for health-education media developed on short-term grants.

LIMITATIONS

This study has several limitations that should be considered when interpreting its findings. First, the acceptability pilot involved a small convenience sample ($n = 30$) drawn from only two schools in a single district, which limits generalisability to Aceh Province as a whole. Second, the pilot measured self-reported perception only, using a brief structured questionnaire, rather than validated

Development and Pilot Evaluation of “Cut Nyak”: A Comic-Based Reproductive Health Education Medium for Adolescents in Aceh, Indonesia

knowledge, attitude, or behavioural outcome measures; it therefore provides evidence of acceptability, not of educational effectiveness. Third, no pre-test/post-test or control comparison was conducted, so claims about the comic’s impact on reproductive health knowledge or behaviour cannot yet be made. Fourth, the pilot recorded perception of the comic as a whole and of three thematic contents, but not of specific narrative or visual elements, so it cannot identify which panels, characters, or plot points drove the responses observed — the information most useful for revising the artwork. Finally, because the first-round concept (a personal-hygiene-focused storyline) evolved substantially by the second FGD into a broader narrative addressing identity, stigma, and social support, the process reported here reflects an emergent, iteratively negotiated design rather than a fixed protocol, which is a strength for cultural responsiveness but a limitation for direct replication.

CONCLUSIONS

This article reported the development and pilot evaluation of Cut Nyak, a reproductive health education medium for Acehese adolescents realised through the comic *Sepatu Sebelah Kiri*. Using a participatory Research and Development approach across two rounds of stakeholder FGD, the project produced a culturally grounded, religiously attentive 56-page comic in which ten candidate health topics were condensed into a single storyline about identity, stigma, and friendship, drawn in a contemporary style that adolescents in the target setting already read and within visual conventions that pesantren gatekeepers accept. The comic secured both a simple patent application and a copyright certificate, supported by partnerships spanning publishing, education, government health services, and broadcast media. A preliminary acceptability pilot with 30 adolescents across a non-boarding school and a boarding pesantren found generally positive reception of the comic overall and of its treatment of sensitive topics including LGBT-related stigma, violence, and mental health, with boarding and non-boarding adolescents showing distinct patterns of receptivity that merit further investigation. These findings support continued investment in participatory, entertainment-education-informed comic media as a culturally responsive channel for adolescent reproductive health communication in Indonesia, while underscoring that acceptability is a necessary but not sufficient basis for claims of effectiveness. A controlled pre-test/post-test evaluation is required to establish whether the comic measurably improves reproductive health knowledge and behaviour.

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DECLARATION OF CONFLICTING INTERESTS

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REFERENCES

- 1) S. Sumaryani, H. Purwaningsih, K. Kunci, A. Remaja, K. Reproduksi, and P. Kesehatan, “Adolescents and reproductive health: Promoting healthy habits for reproductive well-being,” *Journal of Community Service and Empowerment*, vol. 5, no. 1, pp. 199–204, Mar. 2024, doi: 10.22219/JCSE.V5I1.27646.
- 2) G. Nayak *et al.*, “Knowledge, attitude, and practices of adolescents and peer educators in relation to the components of the National Adolescent Health Program in India: findings from a cross-sectional survey,” *Front. Public Health*, vol. 12, p. 1378934, 2024, doi: 10.3389/FPUBH.2024.1378934/FULL.
- 3) School of Pharmacy, RK University, Kasturbadham, Rajkot, Gujarat- 360020, India. Kiran Dudhat, “Hygienic Challenges in Women’s Health: An Overview of Vaginal Discharge and Related Conditions,” *Women Health Care Issues*, vol. 7, no. 3, pp. 01–06, Mar. 2024, doi: 10.31579/2642-9756/196.
- 4) C. Mlambo, “Do Women Have Bodies with Problems? Menstrual Health, Period Poverty, and the Deprivation of Dignity,” *Women 2025, Vol. 5*, vol. 5, no. 4, p. 39, Oct. 2025, doi: 10.3390/WOMEN5040039.
- 5) E. Ergonul and S. Buyukcoban, “Fostering interactive medical education: integrating Web 2.0 tools through a universal design for learning framework,” *Med. Educ. Online*, vol. 31, no. 1, Dec. 2026, doi: 10.1080/10872981.2026.2639193.
- 6) S. Tjorven, M. Nora, S. Jost, G. Mathilde, and F. Kristina, “The role of digital teaching methods in supporting practical skills training in the academic training of health professions – a scoping review,” *BMC Med. Educ.*, vol. 26, no. 1, p.

Development and Pilot Evaluation of “Cut Nyak”: A Comic-Based Reproductive Health Education Medium for Adolescents in Aceh, Indonesia

- 361, Dec. 2026, doi: 10.1186/S12909-026-08785-9.
- 7) J. Álvarez Ariza and C. Hernández Hernández, “Investigating the Impact of Education 4.0 and Digital Learning on Students’ Learning Outcomes in Engineering: A Four-Year Multiple-Case Study,” *Informatics 2026*, Vol. 13, vol. 13, no. 2, Jan. 2026, doi: 10.3390/INFORMATICS13020018.
- 8) R. O. Lutkenhaus, J. Jansz, and M. P. A. Bouman, “Toward spreadable entertainment-education: leveraging social influence in online networks,” *Health Promot. Int.*, vol. 35, no. 5, p. 1241, Oct. 2019, doi: 10.1093/HEAPRO/DAZ104.
- 9) M. Mashora, M. Taylor, and S. Dlamini, “Health education programs and cervical cancer control in resource limited settings: a narrative review,” *Discover Public Health 2025 22:1*, vol. 22, no. 1, pp. 698–, Nov. 2025, doi: 10.1186/S12982-025-01130-3.
- 10) A. L. Adebayo, R. D. Mhonde, N. Denicola, and E. Maibach, “The Effectiveness of Narrative Versus Didactic Information Formats on Pregnant Women’s Knowledge, Risk Perception, Self-Efficacy, and Information Seeking Related to Climate Change Health Risks,” *Int. J. Environ. Res. Public Health*, vol. 17, no. 19, p. 6969, Oct. 2020, doi: 10.3390/IJERPH17196969.
- 11) J. Paul, “Digital Games in Education for Sustainable Development,” *Sustainability 2026*, Vol. 18, vol. 18, no. 12, Jun. 2026, doi: 10.3390/SU18125930.
- 12) G. Kim and C. Noriega, “The Value of Media Studies Approaches for the Evaluation of Entertainment Education: A Case Study of East Los High,” *Health Educ. Behav.*, vol. 47, no. 1, pp. 24–28, Feb. 2020, doi: 10.1177/1090198119865007.
- 13) S. Febres-Cordero *et al.*, “A Scoping Review of Graphic Medicine Interventions to Promote Changes in Health Behavior, Health Service Engagement, and Health Outcomes,” *International Journal of Environmental Research and Public Health 2025*, Vol. 22, vol. 22, no. 5, Apr. 2025, doi: 10.3390/IJERPH22050657.
- 14) W. Abu-Ras, L. B. Idris, and B. H. Aboul-Enein, “Effectiveness of Cartoons, Comics, and Animation-Based Sexual Health Promotion and Education Interventions: A Scoping Review,” *International Journal of Sexual Health*, vol. 37, no. 2, p. 221, 2024, doi: 10.1080/19317611.2024.2421882.
- 15) N. Suwanphan, D. Mettarikanon, S. Kacophanuek, C. Eden, and W. Tawanwongsri, “Digital Motion Graphics and Animated Media in Health Communication: A Systematic Review of Strategies for Sexual Health Messaging,” *Healthcare (Switzerland)*, vol. 13, no. 22, p. 2895, Nov. 2025, doi: 10.3390/HEALTHCARE13222895/S1.
- 16) S. Febres-Cordero *et al.*, “A Scoping Review of Graphic Medicine Interventions to Promote Changes in Health Behavior, Health Service Engagement, and Health Outcomes,” *International Journal of Environmental Research and Public Health 2025*, Vol. 22, vol. 22, no. 5, Apr. 2025, doi: 10.3390/IJERPH22050657.
- 17) T. Róg, “Task-based Language Teaching and Beyond: L2 Pragmatics Instruction for Young Learners,” 2025, doi: 10.1007/978-3-031-86566-4.
- 18) B. R. Belland, C. M. Kim, and M. J. Hannafin, “A Framework for Designing Scaffolds That Improve Motivation and Cognition,” *Educ. Psychol.*, vol. 48, no. 4, p. 243, Oct. 2013, doi: 10.1080/00461520.2013.838920.
- 19) W. Abu-Ras, L. B. Idris, and B. H. Aboul-Enein, “Effectiveness of Cartoons, Comics, and Animation-Based Sexual Health Promotion and Education Interventions: A Scoping Review,” *International Journal of Sexual Health*, vol. 37, no. 2, pp. 221–239, 2025, doi: 10.1080/19317611.2024.2421882.
- 20) W. Abu-Ras, L. B. Idris, and B. H. Aboul-Enein, “Effectiveness of Cartoons, Comics, and Animation-Based Sexual Health Promotion and Education Interventions: A Scoping Review,” *International Journal of Sexual Health*, vol. 37, no. 2, p. 221, 2024, doi: 10.1080/19317611.2024.2421882.
- 21) R. Aman and L. Wallner, “Introduction: Teaching with Comics: Empirical, Analytical, and Professional Experiences,” *Teaching with Comics: Empirical, Analytical, and Professional Experiences*, pp. 1–13, Jan. 2022, doi: 10.1007/978-3-031-05194-4_1.
- 22) D. Lewkowich, “The Figure of the Teacher in Comics: A Psychoanalytic Study of Immaterial and Fragmented Education,” *The Figure of the Teacher in Comics: A Psychoanalytic Study of Immaterial and Fragmented Education*, pp. 1–335, Jan. 2024, doi: 10.1007/978-3-031-67043-5/SAVE-RESEARCH.
- 23) M. S. Kogan, A. V. Gavrilova, N. E. Anosova, and E. D. Petrikova, “Comics-Based Online Course as a Learning Resource for Encouraging Students’ Speaking Activity Through Intensive Independent Learning,” *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, vol. 14060 LNCS, pp. 139–153, 2023, doi: 10.1007/978-3-031-48060-7_11.