

Science-Integrated Munakahat Learning as Sex Education for High School Students

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Abstract

This study examines the integration of science into munakahat learning as a strategy to enhance sex education among adolescents in Indonesia. Using a mixed-method approach with an Embedded Concurrent Mixed Method design, data were collected from students in Grade XI and XII at MAN 3 Pekanbaru and SMAN 12 Pekanbaru through questionnaires, tests, and semi-structured interviews. The findings reveal that students in the experimental class, exposed to science-integrated munakahat learning, demonstrated significantly higher understanding of sex education (81%) compared to the control class (79%). Additionally, the experimental class achieved better learning outcomes (average score of 60 vs. 52). Despite challenges such as network issues and limited interaction during online learning, the integration of science and religious teachings proved effective in fostering moral values and preventing risky behaviors. The study concludes that science-integrated munakahat learning provides a comprehensive approach to sex education, equipping students with knowledge about reproductive health, sexual behavior, and human development while strengthening their faith. Recommendations include adopting hybrid learning methods and involving government institutions to promote broader societal acceptance of sex education.

Keywords: Integration, munakahat learning, science learning, sex education, learning outcomes

INTRODUCTION

Sexuality education is an important element in the formation of the character of the younger generation, encompassing biological aspects, moral values, religion, and reproductive health (Levand & Ross, 2021; Przygoda et al., 2023). This education aims to prevent sexual deviations, harassment, and risky behaviors in children and adolescents (Michielsen & Brockschmidt, 2021; Millanzi et al., 2022; Navarro-Prado et al., 2023). Ideally, sexuality education is delivered structurally through a formal curriculum in schools, such as in biology classes, and is heavily supported by informal teaching within the family environment (Heyes & Billingsley, 2024). However, evidence indicates that most teenagers do not receive adequate information from their parents, driving them to seek information from alternative sources such as peers, literature, mass media, or the internet (Dedkova et al., 2022). Consequently, providing comprehensive, accurate, and well-guided sexuality education to children and adolescents has become increasingly urgent.

Research indicates that premarital sexual behavior among Indonesian adolescents is a growing concern. A 2017 survey found an increase in such behavior among 15-19 year olds, with males more likely to engage in it (Ma et al., 2021). Factors contributing to this trend include peer influence, risky dating behaviors, and internet access (Henneberger et al., 2021). The issue is exacerbated by limited sexuality education, often considered taboo in Indonesia (Fuadi & Irdalisa, 2024). Studies show that dating status, media exposure, peer influence, and parental roles significantly impact premarital sexual behavior among male adolescents (Chigbu et al., 2021; Malihah et al., 2022). To address this, experts recommend comprehensive sexuality education that is culturally appropriate and involves parents, schools, and the community (Chavula et al., 2022; Rocha et al., 2022). Such education could help prevent sexual violence against children and reduce risky sexual behaviors

among adolescents (Hu et al., 2023; Rivera et al., 2021). This phenomenon is exacerbated by the low level of sexual literacy among students, which may increase their vulnerability to various forms of risky and inappropriate sexual behavior. Previous studies have demonstrated that inadequate knowledge of sexual and reproductive health is significantly associated with risky sexual behavior among adolescents, including early sexual initiation and other unsafe practices (Aprilia et al., 2023). Moreover, limited access to comprehensive sexuality education often leads adolescents to seek information from unreliable sources, thereby increasing their susceptibility to misinformation and harmful behaviors (Fraser et al., 2019). Reports from official institutions in Indonesia, including the Indonesian Ministry of Women's Empowerment and Child Protection and UNICEF, further indicate that sexual violence and online sexual exploitation involving children remain a significant concern, with many cases remaining undisclosed and unreported (UNICEF, 2022). These findings underscore the urgent need for comprehensive sexuality education to strengthen students' sexual literacy and promote healthy and responsible behavior. Society tends to avoid discussion of this topic because it is considered sensitive, even though the lack of education actually worsens the situation.

Islamic Religious Education in schools aims to foster students to understand and practice the teachings of Islam holistically (Masturin, 2024; Tsani et al., 2024). However, its implementation faces various internal and external problems (El Widdah, 2022; Ridlwan & Asrori, 2022). The solutions offered include a partial approach, optimization of affective domains, and the creation of religious climate in the educational environment (Bachmann et al., 2022). The integration of sexuality education into the PAI curriculum is also proposed as a preventive step against juvenile delinquency (Moulin-Stozek, 2021). Islamic Education is considered particularly appropriate because its primary objective is not only the transmission of knowledge but also the formation of students' moral character, religious values, and ethical behavior. In the Indonesian educational context, PAI addresses topics related to personal morality (*akhlaq*), family life, social relations, and Islamic legal principles concerning human sexuality, making it a relevant platform for delivering sexuality education from a values-based perspective. While subjects such as Guidance and Counseling and Social Studies also contribute to students' personal and social development, PAI provides a distinctive framework that integrates cognitive, affective, and spiritual dimensions, thereby enabling students to develop responsible sexual attitudes grounded in religious and moral principles. This approach includes aspects of sharia, muamalah, morals, and reproductive health based on the Qur'an and Hadith (Mohidem & Hashim, 2023; Mundzir & Muthmainnah, 2022). Learning characteristics include preventive-Curative material, cognitive-affective-psychomotor competencies, critical-creative-reflective strategies, and holistic evaluations (Kuo et al., 2024). Synergy between schools, family, and community is needed to create a generation that is aware of moral and social responsibilities (Casmana et al., 2023). Through synergy between schools and family, this education can create a generation that is more aware of moral and social responsibilities.

Previous studies have consistently demonstrated that sexuality education plays an important role in promoting healthy adolescent development and reducing engagement in risky sexual behaviors. International evidence indicates that comprehensive sexuality education contributes to improved sexual literacy, delayed sexual initiation, and increased self-protective behaviors among adolescents (Lameiras-Fernández et al., 2021; Li, 2024; Seiler-Ramadas et al., 2021). Effective sexuality education is not solely determined by school-based instruction; rather, it requires collaboration among families, schools, and the wider community. Parents serve as primary educators by providing age-appropriate guidance grounded in moral, religious, and social values (Bweyale & Sekaye, 2023; Mokaya, 2021), while schools function as formal institutions that systematically develop students' knowledge, attitudes, and life skills related to sexuality (Badriah et al., 2023; Okah et al., 2023).

However, the implementation of sexuality education remains challenging in many cultural contexts, including Indonesia, where discussions concerning sexuality are often considered sensitive or taboo (Horanieh et al., 2022). Consequently, adolescents frequently obtain information from informal and potentially unreliable

sources, such as peers and social media, which may increase their vulnerability to misinformation and risky behavior (Tabaac et al., 2021). Official reports from Indonesian child protection institutions and recent national studies have also highlighted continuing concerns regarding sexual violence and online sexual exploitation involving children and adolescents, underscoring the urgency of strengthening preventive educational efforts. In the Indonesian context, several studies have shown that Islamic Religious Education (PAI) has considerable potential to strengthen students' moral character, self-control, and ethical decision-making. Existing studies generally emphasize character education, moral values, and the prevention of juvenile delinquency through PAI. Nevertheless, these studies predominantly focus on general moral instruction and have not systematically explored how sexuality education can be integrated into PAI curriculum content in a pedagogically and theologically coherent manner. Most previous research has discussed sexuality education and Islamic education as separate domains, with limited attention given to curriculum integration based on Qur'anic and Hadith perspectives.

This limitation reveals a significant research gap. To date, there is still a lack of studies that specifically formulate a curriculum integration framework for sexuality education within Islamic Religious Education materials that is contextually relevant to contemporary adolescents while remaining consistent with Islamic teachings. Therefore, the novelty of this study lies in the development of a conceptual framework for integrating sexuality education into PAI materials through the systematic incorporation of Qur'anic and Hadith values, thereby providing a culturally and religiously appropriate approach to sexuality education in Indonesian schools and madrasas.

Accordingly, this study aims to analyze and formulate a framework for integrating sexuality education into Islamic Religious Education (PAI) materials as a preventive educational strategy for promoting responsible sexual behavior among students. Specifically, the study seeks to identify relevant Qur'anic and Hadith concepts related to sexuality education, examine opportunities and challenges in integrating these concepts into PAI materials, and formulate recommendations for developing a more adaptive and context-responsive PAI curriculum. These objectives are consistent with the qualitative and conceptual nature of the research design employed in this study.

METHOD

This research employs a mixed-method approach with an Embedded Concurrent Mixed Method design to evaluate the implementation of science-integrated munakahat learning. Data collection techniques include questionnaires, tests, and semi-structured interviews. Questionnaires, using a Likert scale based on comprehensive sexuality education frameworks, measure students' understanding of sex education. Tests assess learning outcomes by focusing on munakahat material integrated with science/biology concepts, while interviews explore students' experiences during the integration process. The data sources consist of Grade XI and XII students from MAN 3 and SMAN 12 in Pekanbaru City, selected through cluster sampling. Data analysis involves descriptive statistics for questionnaire scores, quantitative analysis using SPSS 22.0 (including normality, homogeneity, and mean difference tests), and qualitative analysis following Miles and Huberman's interactive model. By combining quantitative and qualitative data, the study produces holistic findings and conclusions.

The research was conducted in systematic stages to ensure accuracy and validity. The preparation stage involved analyzing syllabi for munakahat and science/biology materials to align them with research objectives, developing research instruments such as questionnaires, interview guides, and test questions, and validating these instruments through expert reviews and limited trials with students. Adjustments were made based on validity and reliability test results using SPSS 22.0. In the implementation stage, coordination with subject teachers ensured clarity on integrating munakahat with science, followed by Focus Group Discussions (FGDs) to refine strategies. Learning was conducted online via Zoom and WhatsApp, with separate control

(non-integrated) and experimental (integrated) classes. Data were collected through questionnaires, tests, and semi-structured interviews to capture students' understanding, learning outcomes, and experiences during the integration process.

Data analysis included both quantitative and qualitative approaches. Quantitative data were analyzed using SPSS 22.0, involving normality (Kolmogorov-Smirnov/Shapiro-Wilk), homogeneity (Levene), and mean difference tests (t-test or Mann-Whitney). Qualitative data were analyzed using Miles and Huberman's interactive model, which involves data collection, reduction, presentation, and conclusion drawing, with findings presented in narratives, tables, or schemes. The final step involved integrating quantitative and qualitative results to produce comprehensive insights into students' understanding, learning outcomes, and experiences. The research concludes with a detailed report highlighting the effectiveness of integrating munakahat with science, aiming to contribute to the development of adaptive and relevant integrative learning models for today's youth.

RESULTS AND DISCUSSION

Results

Differences in Students' Understanding of Sex Education

The study revealed significant differences in students' understanding of sex education between the experimental and control classes. Students in the experimental class, who participated in science-integrated munakahat learning, obtained a higher average score (81%) than those in the control class (79%). At MAN 3 Pekanbaru, the experimental class achieved an average score of 84%, while the control class scored 82%. Similarly, at SMA 12 Pekanbaru, students in the experimental class obtained an average score of 77%, compared to 76% in the control class. The normality test indicated that the data were not normally distributed ($p < 0.05$). Therefore, the Mann-Whitney test was employed to test the hypothesis. The results showed a statistically significant difference between the experimental and control groups in students' understanding of sex education ($p = 0.004$). In addition, student learning outcomes also differed significantly between groups ($p = 0.013$), with the experimental class outperforming the control class.

This finding lends empirical support to constructivist principles of active, learner-centered instruction, which hold that students construct more durable and meaningful understanding when new material is deliberately connected to familiar knowledge structures rather than delivered as isolated facts (Kivunja, 2021). By integrating *munakahat* (Islamic marriage jurisprudence) content with scientific explanations of reproductive health, the experimental treatment created a form of contextual scaffolding: students were not merely asked to absorb biological facts about sex education but were guided to relate them to an already-familiar religious framework an approach shown to strengthen conceptual understanding in science classrooms more broadly (Fitria, Jamaris, & Sufyarma, 2021).

The modest but statistically significant gap between groups also resonates with recent literature on culturally and religiously responsive sexuality education, which argues that sex education is most effective when it is sensitively adapted to students' religious and cultural context rather than presented as a purely biomedical topic (Sell & Reiss, 2022; Mulholland, 2023). The science–munakahat integration model used in this study can therefore be read as a localized, faith-sensitive adaptation of this broader shift toward culturally embedded sexuality education, which recent reviews suggest is central to overcoming resistance and improving comprehension in religiously conservative educational settings (Achen et al., 2023).

The modest but statistically significant gap between groups also resonates with recent literature on culturally and religiously responsive sexuality education, which argues that sex education is most effective when it is sensitively adapted to students' religious and cultural context rather than presented as a purely biomedical topic (Sell & Reiss, 2022; Mulholland, 2023). The science–munakahat integration model used in this study can therefore be read as a localized, faith-sensitive adaptation of this broader shift toward culturally

embedded sexuality education, which recent reviews suggest is central to overcoming resistance and improving comprehension in religiously conservative educational settings (Achen et al., 2023).

Students' Learning Outcomes

Overall, students in the experimental class achieved better learning outcomes than those in the control class. The average score in the experimental class was 60, whereas the control class obtained an average score of 52. At MAN 3 Pekanbaru, the experimental class scored an average of 64, compared with 55 in the control class. Likewise, at SMA 12 Pekanbaru, students in the experimental class achieved an average score of 55, while those in the control class scored 49. These outcomes can be interpreted through the continued relevance of Bloom's revised taxonomy of cognitive processes, which distinguishes lower-order skills (remembering, understanding) from higher-order skills (applying, analyzing, evaluating) as an analytical lens for learning outcomes (Salzmann-Erikson et al., 2025). The integrated instructional design used in the experimental class plausibly pushed students beyond rote recall of reproductive biology toward application and evaluation of that knowledge within an ethical-religious framework a cognitively demanding shift that recent reviews identify as a key driver of stronger learning outcomes when it is explicitly built into instructional modules (Hamzah, Hamzah, & Zulkifli, 2022). The consistency of this advantage across two schools with differing institutional characteristics (a madrasah and a general senior high school) further suggests that the effect reflects a genuine instructional mechanism the cognitive benefit of contextualized, values-integrated science learning rather than being an artifact of a single school's culture.

Students' Level of Concept Mastery

Analysis of the percentage of correct answers showed that most students in the experimental class were categorized in the medium, high, and very high levels of understanding. At SMA 12 Pekanbaru, 30% of the items were classified as "low", while 70% fell into the medium to very high categories. Similarly, at MAN 3 Pekanbaru, 31% of the items were categorized as "low". Students demonstrated stronger understanding, particularly on topics related to reproductive health and sexual behavior. This distribution can be understood through the continuing relevance of Bandura's social cognitive perspective, which holds that learning is most effectively internalized when it is linked to self-relevant, observable behavioral outcomes (de la Fuente, Kauffman, & Boruchovitch, 2023). Reproductive health and sexual behavior are topics with direct personal relevance to adolescents, which may explain the comparatively stronger mastery observed in these areas: students were more cognitively and motivationally engaged with content they perceived as directly applicable to their own lives. This is consistent with recent reviews of comprehensive sexuality education research, which report that personally relevant, health-behavior-linked content is retained and understood more effectively than abstract or purely procedural material (Achen et al., 2023).

Challenges in the Implementation of Online Learning

The study also identified several challenges during online learning implementation. Students reported difficulties related to internet connectivity and limited interaction with teachers. One student stated, "Sometimes I have network problems, and I cannot follow the online class completely." Another student commented, "Learning would be more understandable if it were conducted offline because students can communicate directly with teachers." Despite the positive learning gains, the study also surfaced implementation challenges, particularly around internet connectivity and reduced teacher-student interaction. As one student explained, *"Sometimes I have network problems, and I cannot follow the online class completely,"* while another noted, *"Learning would be more understandable if it were conducted offline because students can communicate directly with teachers."*

These challenges echo the Community of Inquiry (CoI) framework, which conceptualizes effective online learning as depending on three interdependent presences: cognitive, social, and teaching presence (Junus, Santoso, & Ahmad, 2021). Both student comments point specifically to a breakdown in social and teaching presence the reduced capacity for real-time dialogue and relational connection with instructors rather than to deficiencies in the instructional content itself. Recent Indonesian studies applying the CoI framework similarly find that teaching presence is the strongest predictor of cognitive engagement in online settings, and that its disruption (through poor connectivity or asynchronous-only interaction) constrains the full pedagogical potential of an otherwise well-designed intervention (Purwandari, Junus, & Santoso, 2022). This is also consistent with findings from Indonesian secondary schools during pandemic-era online learning, which identified unstable internet connectivity as the most frequently reported barrier to effective teacher-student interaction, particularly outside major urban centers (Ramdhani & Kholidi, 2021).

Discussion

Differences in Students' Understanding of Sex Education

The findings demonstrated that students who participated in science-integrated munakahat learning exhibited significantly better understanding of sex education than those in the control group. The integration of biological concepts into Islamic teachings enabled students to connect religious norms with scientific explanations, making learning more meaningful and contextual. According to Sahin (2021), integrating science and Islamic education fosters deeper understanding by linking fundamental values with universal and humanistic principles. Recent studies have further confirmed that integrating Islamic values into science education enhances students' spiritual development, critical thinking skills, and understanding of Islamic principles (Nugraha et al., 2024). Similarly, the Re-STEAM interdisciplinary approach, which combines religion, science, and technology, has been shown to improve students' learning motivation and application of Islamic values in everyday life (Adiyono & Anshor, 2024). Moreover, the integration of Islamic content into science learning contributes to the development of morally upright students and prevents the secularization of knowledge (Sasmitha et al., 2024). A meta-analysis also reported that incorporating Islamic values in biology learning has a significant positive effect, particularly at the senior high school level, especially in reproductive system materials (Amin et al., n.d.). These findings suggest that harmonizing Islamic teachings with science education creates a holistic learning environment that balances intellectual, emotional, and spiritual intelligence.

Students' Learning Outcomes

The higher learning outcomes achieved by students in the experimental class indicate that science-integrated munakahat learning effectively improves students' academic performance. The implementation of team teaching involving PAI/Fiqh and Biology teachers facilitated students' comprehensive understanding of both Islamic legal concepts and scientific principles. For example, students were able to understand the biological basis underlying the prohibition of marriage among close relatives due to the potential risk of genetic abnormalities. This finding is in line with Sudana et al., who argued that higher educational attainment and legal awareness contribute to better understanding of marriage-related rights and responsibilities. The integration of scientific and religious perspectives therefore not only strengthens conceptual understanding but also promotes meaningful learning experiences.

Students' Level of Concept Mastery

The findings revealed that most students in the experimental group demonstrated medium to very high levels of concept mastery, particularly regarding reproductive health and sexual behavior. The study addressed five major domains of sexuality education, namely personal skills, social-cultural influences, sexual

health, sexual behavior, and human development. These domains were adapted from the Sexuality Information and Education Council of the United States guidelines for comprehensive sexuality education. Personal skills emphasized self-awareness and decision-making, whereas social-cultural dimensions highlighted social norms and values. Sexual health focused on reproductive health and disease prevention, while human development addressed puberty and hormonal changes during adolescence.

Previous studies consistently report strong parental support for comprehensive sexuality education in schools. Approximately 90% of parents support school-based sexuality education (Astle et al., 2022; Noorman et al., 2023; Rouhparvar et al., 2022). This support extends across different political and demographic backgrounds, including support for discussions on puberty, relationships, sexually transmitted diseases, and birth control (Payne et al., 2024). Parents also support the inclusion of gender and sexuality diversity issues within the curriculum (Ullman et al., 2021). These findings challenge assumptions regarding parental resistance to sexuality education and emphasize the importance of evidence-based educational approaches in strengthening adolescents' personal and social development (van der Gaag et al., 2024). The integration of these sexuality domains through both scientific and religious perspectives enabled students to develop a more comprehensive understanding of sexuality.

Challenges in the Implementation of Online Learning

Despite its effectiveness, the implementation of science-integrated munakahat learning encountered several challenges, particularly those related to online learning. Adolescents currently face substantial challenges associated with hormonal changes, increased sexual curiosity, and exposure to sexual content through social media, all of which may increase their vulnerability to risky sexual behaviors. Previous studies indicate that premarital sexual behavior among adolescents is influenced by multiple factors, including cultural and religious norms (Munea et al., 2022). Muslim adolescents often hold conservative attitudes toward sexuality, and discussions concerning sex outside marriage remain highly sensitive (Khanpour & Mendenhall, 2024). In many Islamic contexts, adolescent sexuality is frequently viewed as an adult matter, leading to resistance toward sexuality education programs (Kosar Altinyelken et al., 2022; Erlich, 2023).

Nevertheless, comprehensive sexuality education remains essential for promoting healthy decision-making and preventing negative consequences among adolescents (Kågesten & van Reeuwijk, 2021). Islamic teachings emphasize that sexuality education should be integrated with monotheism, worship, and morality from an early age to prevent deviant behaviors during adolescence (Jordan, 2021). In addition, religiosity has been identified as an important protective factor against risky sexual behavior (Panting & Yong, 2020). Educational interventions that combine sexual health education with religious values significantly improve students' understanding of reproductive health and sexual behavior (Millanzi et al., 2022). In Aceh, for example, a multifaceted approach combining religious, cultural, and comprehensive sexuality education has been recommended to prevent extramarital sexual behavior and promote adolescent well-being (Fuadi & Irdalisa, 2024). These findings underscore the importance of culturally sensitive and religiously grounded sexuality education, particularly within Islamic educational settings.

Limitations and Recommendations

Despite its effectiveness, the study identified several limitations, particularly related to online learning. Network instability and limited interaction reduced students' engagement and learning performance. One student stated, "Sometimes I have network problems, and I can't follow the online class completely." These findings support constructivist learning theory, which emphasizes that meaningful learning occurs through active interaction between students, teachers, and learning materials. Reduced interaction in online settings may therefore hinder students' opportunities to construct knowledge effectively.

The present findings are consistent with previous studies reporting that technological barriers and limited social interaction remain major challenges in online education (Dawadi et al., 2021; Gilad, 2021). Similarly, Almalki (2016) argued that although mixed and technology-supported learning environments offer broader educational opportunities, their effectiveness depends largely on the quality of interaction and accessibility of learning resources. Thus, the difficulties experienced by students in this study corroborate earlier research demonstrating that inadequate technological infrastructure negatively affects students' participation and academic achievement.

Nevertheless, the findings also indicate that science-integrated munakahat learning remained effective despite these constraints, suggesting that the integration of religious and scientific perspectives can maintain students' motivation and understanding even in less-than-ideal learning conditions. This finding supports previous research showing that comprehensive sex education contributes positively to students' reproductive health knowledge and behavior (Chavula et al., 2022; Mbizvo et al., 2023; Sovianti et al., 2024). Furthermore, the results are in line with studies emphasizing the importance of adaptive instructional strategies, such as differentiated instruction and technology-assisted learning, in addressing diverse student needs and promoting inclusive education (Kaczorowski et al., 2023).

Overall, the present study supports existing theories and empirical evidence suggesting that effective sexuality education requires not only relevant instructional content but also interactive pedagogical approaches and adequate technological support. Therefore, future implementation should incorporate more interactive and hybrid learning models to maximize student engagement and learning outcomes.

CONCLUSION

The study concludes that integrating science into munakahat learning significantly enhances students' understanding of sex education. Students in the experimental class, exposed to science-integrated learning, demonstrated higher scores in both their comprehension of sex education and overall academic performance compared to the control class. This approach allowed students to connect religious teachings with scientific reasoning, making the material more meaningful and relatable. For instance, students were able to understand the biological basis for Islamic prohibitions, such as avoiding marriages among blood relatives due to genetic risks. Despite these positive outcomes, challenges related to online learning, such as network issues and limited interaction, affected student engagement and highlighted the need for improved teaching methods and infrastructure. The integration of personal skills, social-cultural influences, sexual health, sexual behavior, and human development domains ensured a holistic approach to sex education, fostering moral values and reducing risky behaviors among adolescents.

To address the identified limitations and further enhance the effectiveness of this integrative model, future implementations should adopt more interactive and hybrid learning methods. Incorporating tools that facilitate greater student-teacher interaction, even in online settings, could mitigate the challenges posed by connectivity issues and lack of direct communication. Additionally, government institutions like the Office of Religious Affairs (KUA) and notaries should play an active role in promoting sex education and marriage agreements, aligning with recommendations from Afrianto & Fahmi. Educators are encouraged to use mixed-method approaches, combining qualitative and quantitative data, to gain broader insights into student experiences and learning outcomes. By refining the curriculum and addressing infrastructural challenges, this model can be further developed into an adaptive and inclusive framework that equips adolescents with the knowledge and values needed to navigate modern societal challenges effectively.

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