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# VIRTUAL REALITY (VR) AS AN EDUCATIONAL MEDIA TO PREVENT EARLY MARRIAGE AMONG ADOLESCENTS

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**Abstract**

Early marriage remains a significant social issue affecting adolescent health, education, and well-being, particularly in Karangpring Village, Sukorambi District, Jember. This study aimed to develop and evaluate the effectiveness of *Virtual Reality* (VR) as an educational medium for preventing early marriage among adolescents. The research employed the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation). During the analysis phase, a survey involving 30 adolescents was conducted to identify educational needs. The VR media titled *"My Future in My Hands"* was developed using Unity 3D and validated by three experts, yielding a 89,75% feasibility score (very feasible). Field implementation further showed a statistically significant improvement in adolescents' knowledge scores after exposure to the VR simulation, underscoring its effectiveness as a learning tool. High user satisfaction ratings also reflected the acceptability and appeal of VR as a learning medium for digital-native youth. The findings demonstrate that VR is an effective and innovative educational tool to enhance adolescents' awareness of early marriage risks. This approach can be integrated into community-based reproductive health education programs for youth.

**Keywords:** ***Virtual Reality, early marriage, adolescents, health education, ADDIE model***

## INTRODUCTION

Medically, early marriage is associated with an increased risk of pregnancy complications, higher maternal and infant mortality rates, and various reproductive health problems. Many parents choose to hasten their children's marriage due to economic pressures, social norms, perceptions that education is not important for girls, and stigma related to remaining unmarried at an older age (Adedokun et al., 2016; Nirwan, 2023). This practice is often not accompanied by adequate knowledge of reproductive health and nutrition, resulting in early-age pregnancies with high-risk outcomes, infants born with poor nutritional status, impaired child growth and development, and other nutrition-related problems faced by both mother and child. The reproductive organs of adolescent mothers are physiologically immature, and factors such as low educational attainment, limited health knowledge, inadequate maternal care during pregnancy, and insufficient psychological readiness of young couples to assume household responsibilities contribute to adverse maternal and infant health outcomes (Irsadi, 2025; Jauhari et al., 2024; Wells et al., 2022). From a social perspective, early marriage frequently leads to school dropout, reduced quality of life, and the perpetuation of intergenerational poverty. Therefore, preventing early marriage requires educational strategies that are not only informative but also engaging and tailored to the characteristics of adolescents (UNFPA & UNICEF, 2022).

Previous studies have developed various educational methods, including lectures, counseling, and the use of printed or audiovisual materials. However, their effectiveness remains limited because these methods are generally one-directional and lack the ability to stimulate emotional engagement among adolescents (Fadhilah et al., 2022; Xi et al., 2025). Previous studies demonstrated that audiovisual-based education can improve adolescents' knowledge, yet information retention declines rapidly (Xi et al., 2025). Meanwhile, a study by Saputra and Lestari (2022) found that game-based learning approaches are more effective in improving attitudes toward preventing early marriage, although they still fail to provide realistic experiential components that adolescents can directly relate to adolescents (Andani et al., 2024; Taryzafitri et al., 2025). In this context, Virtual Reality (VR) technology emerges as an innovative alternative. VR enables immersive and interactive learning experiences, making information easier to understand and remember (Siahaya, 2024). Previous researches showed that VR is effective for experiential learning

and can enhance learner engagement and motivation. Nevertheless, the use of VR in addressing social issues, particularly the prevention of early marriage among adolescents, remains very limited (Safarati & Zuhra, 2024; Siahaya, 2024). This represents a research gap: the absence of VR implementation as an educational medium specifically addressing early marriage prevention in rural areas, particularly in Karangpring Village, Sukorambi, Jember. Based on these considerations, the urgency of this study lies in the need for more innovative educational media that align with technological advancements and the characteristics of today's youth, while also delivering both cognitive and affective impacts. The rationale for using VR is that adolescents, as a digital-native generation, tend to be more responsive to immersive technology-based media compared with conventional approaches. Therefore, this study aims to analyze the effectiveness of VR as an educational tool for preventing early marriage among adolescents in Karangpring Village, Sukorambi, Jember. The proposed problem-solving approach involves developing VR content that illustrates the negative consequences of early marriage from health, educational, social, and economic perspectives, and subsequently testing it among targeted adolescent groups. Through this approach, VR is expected to serve as a more effective educational medium for improving adolescents' knowledge, attitudes, and motivation to delay marriage and continue their education.

## LITERATURE REVIEW

Early marriage remains a significant public health and social issue, particularly in low- and middle-income countries, where limited access to comprehensive reproductive health education contributes to persistent rates of child marriage. Previous studies have explored various health-promotion strategies, including school-based interventions, digital learning modules, and community empowerment programs. Research on digital interventions indicates that interactive media can improve adolescents' knowledge and attitudes; however, many existing tools rely on two-dimensional platforms, which may limit immersion, engagement, and behavioral impact (Putri et al., 2025). Studies assessing virtual reality (VR) in health education show promising results, citing enhanced motivation, experiential learning, and emotional engagement as strengths . Nonetheless, most VR applications have focused on topics such as sexual health, mental health training, or anatomy education, with minimal attention to early marriage prevention specifically. This represents an important gap in the literature.

The development of VR-based educational media is often informed by behavioral change theories, including the Health Belief Model (HBM) and Social Cognitive Theory (SCT). These frameworks emphasize perceived susceptibility, self-efficacy, outcome expectations, and interactive learning, all components that align closely with VR's capacity to simulate real-life decision-making contexts. Additionally, constructivist learning theory supports the use of immersive environments that allow learners to actively construct meaning through experiential engagement. Applying such theoretical foundations enables VR interventions to be designed not only as informational tools but also as transformative learning experiences that can reshape attitudes and intentions related to early marriage (Kam & Lee, 2024; Kyaw et al., 2019).

Despite their potential, existing studies reveal several limitations. While VR has been shown to improve knowledge retention and engagement, its long-term influence on behavioral outcomes remains inconclusive(Conrad et al., 2024; Liao, 2025; Putri et al., 2025). Discrepancies also emerge regarding accessibility and acceptability in resource-limited settings, with some researchers arguing that VR technologies may introduce socioeconomic barriers (Hu & Li, 2017). Conversely, other studies highlight the increasing affordability of VR devices and the feasibility of integrating low-cost headsets into community-based programs. Debates also persist around the depth of content needed for sensitive topics such as reproductive health and early marriage, with some scholars cautioning that immersive simulations might evoke emotional discomfort if not carefully designed. These differing perspectives underscore the need for culturally contextualized and ethically grounded VR interventions (Kyaw et al., 2019; Liao, 2025; Parong & Mayer, 2018). In summary, although VR demonstrates substantial promise as an educational tool for adolescents, there is a clear gap in research specifically addressing its application to early marriage prevention. Existing studies are limited in scope, often lacking integration of robust theoretical frameworks and failing to assess VR's impact on both knowledge and behavioral intentions. This study aims to address these gaps by developing a theoretically informed VR learning media tailored to adolescents, thereby contributing new insights into the role of immersive technology in preventing early marriage and promoting reproductive health literacy.

## METHOD

This study employed the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation) as the primary methodological framework. The ADDIE model is widely used in the development of instructional media and educational interventions due to its systematic, structured, and flexible nature (Branch,

2009). The research was conducted from July to September 2025 in Karangpring Village, Sukorambi Subdistrict, Jember Regency, East Java.

The phases of ADDIE model consist of:

1. Analysis Phase
   The analysis phase was carried out in July 2025 in Karangpring Village, Sukorambi Subdistrict, Jember Regency. At this phase, a field survey was conducted to identify problems and needs among adolescents related to early marriage. The survey involved questionnaires and brief interviews with 30 senior high school/vocational school students and community leaders. The data collected included levels of knowledge, attitudes, and perceptions regarding the risks associated with early marriage.
2. Design Phase
   Based on the analysis results, learning objectives, achievement indicators, and the structure of the educational content were established. The selected material covered the impacts of early marriage on health, psychological well-being, education, social functioning, and economic outcomes. A storyboard was also developed for the Virtual Reality (VR) content, including the simulation flow and scenarios that users would experience.
3. Development Phase
   The educational media were developed using Unity 3D software integrated with 360° animated video. The VR content was designed to be interactive, immersive, and user-friendly. The devices used included smartphone-based VR headsets (Oculus Quest 2 and standard VR box units). Content validation was carried out by a media expert, a nutrition expert, and a reproductive health expert to ensure alignment between the material and educational objectives.
4. Implementation Phase
   The VR media were piloted with 12 adolescents who served as research respondents. Each participant underwent a ±10-minute educational session. Prior to the session, a pre-test was administered to measure baseline knowledge and attitudes regarding early marriage. Participants then individually engaged with the VR media under facilitator supervision.
5. Evaluation Phase
   Evaluation was conducted through a post-test using the same questionnaire as the pre-test. Pre-test and post-test results were compared to identify differences in knowledge and attitude scores. Formative evaluation was also performed to assess user experience with the VR media. Quantitative data were analyzed using a paired sample t-test with SPSS software.

## RESULTS AND DISCUSSION

This section presents the integrated results and discussion of the development and evaluation of Virtual Reality (VR) as an educational medium to prevent early marriage among adolescents in Karangpring Village, Sukorambi District, Jember. The ADDIE development model, namely Analysis, Design, Development, Implementation, and Evaluation, served as the guiding framework. The presentation of findings is combined with interpretive analysis to provide a comprehensive and cohesive understanding of the effectiveness and relevance of VR in adolescent reproductive health education.

### 1. Analysis Phase

The analysis phase was carried out in July 2025 in Karangpring Village, Sukorambi Subdistrict, Jember Regency. This phase aimed to identify the level of knowledge, perceptions, and needs of adolescents regarding the prevention of early marriage. The methods used included surveys and semi-structured interviews with 30 senior high school students, as well as in-depth interviews with village officials, teachers, and local midwives. The analysis revealed that 89.3% of respondents did not have a comprehensive understanding of the negative impacts of early marriage, particularly on reproductive health and education. Most adolescents perceived early marriage as something “normal” in their environment, considering it a solution to avoid promiscuity or uncertainty about the future. Furthermore, the majority of respondents (70%) had never received information regarding marriage and reproductive health from reliable educational sources. Information they encountered on social media platforms, especially TikTok and Instagram, was often inaccurate. Only 10% of adolescents had ever participated in official counseling sessions conducted by community health centers or schools. These findings indicate a significant information gap between adolescents' educational needs and the relevance of existing communication media. In addition, interviews conducted with village leaders, teachers, and local midwives showed that conventional approaches such as lectures or leaflets were not appealing to adolescents, as they were perceived as monotonous. Based on these findings, the researchers

concluded that an innovative, visually rich, and interactive educational medium is needed to foster adolescents' empathy and awareness of the consequences of early marriage. These findings reflect a substantial *information gap* between adolescents' educational needs and the learning resources available to them. The lack of credible, engaging, and developmentally appropriate educational media contributes to persistent misconceptions regarding early marriage. This aligns with existing literature stating that traditional health education approaches often fail to attract the attention of digital-native adolescents, resulting in low information retention and weak attitude formation (Jelovac, 2025). According to Ausubel's theory of meaningful learning, instruction must be relevant and personally engaging for learners to internalize new knowledge effectively (Bryce & Blown, 2023). The results strongly support the need for an innovative and interactive medium, one that aligns with adolescents' preferences and learning styles, to address misconceptions regarding early marriage and promote informed decision-making.

**2. Design and Development Phase**

Based on the results of the needs analysis, a Virtual Reality (VR)–based educational medium was developed using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). During the design phase, the researchers prepared a storyboard titled *"Adolescent Reproductive Organs and the Risks of Early Marriage"*, which illustrated scenarios related to adolescent physiological development, simulations of risks associated with early pregnancy, and the consequences of nutritional problems. The development phase involved producing an interactive 360° VR video using Unity software. The educational content included simulations of the consequences of early marriage, explanatory narration, and motivational messages encouraging adolescents to delay marriage. The VR-based educational media underwent a validity assessment using the Delphi technique with three expert panelists comprising a media expert, a nutrition expert, and a reproductive health expert. The VR media presents realistic life simulations in a 10-minutes 3D 360° format developed with Unity 3D, complemented by voice-over narration and background music to enhance emotional engagement.

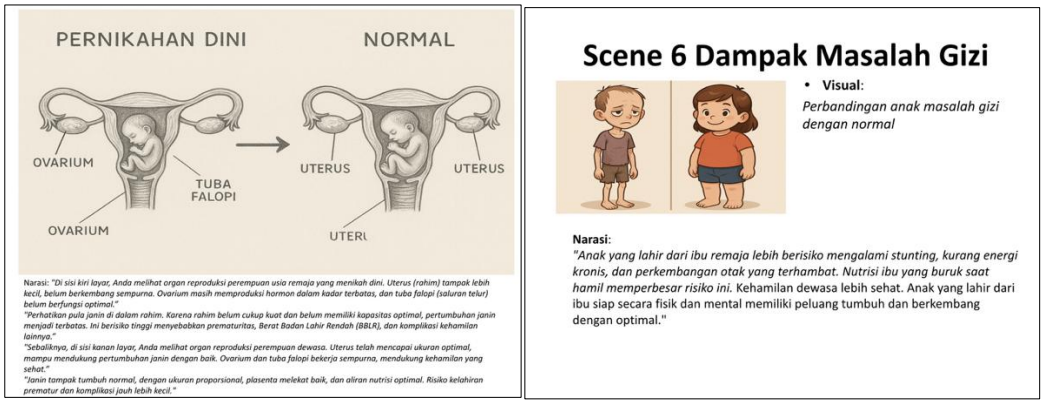
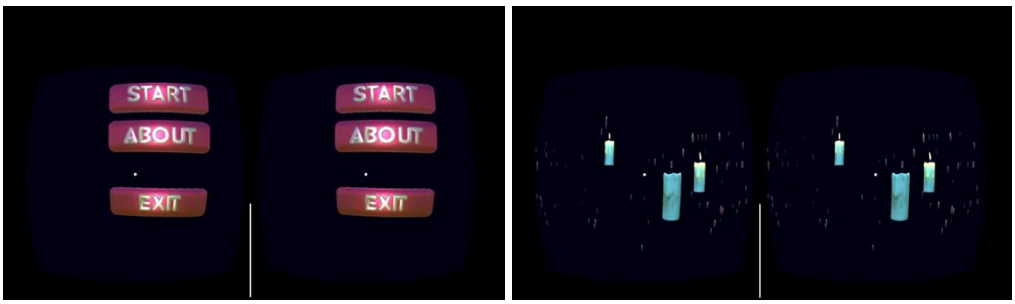



**Image 1.** *Virtual Reality Media Storyboard*

At the beginning of the VR module, participants are instructed to direct a pointer (dot) toward the "Start" menu and then ignite a virtual candle by focusing the pointer on it until it lights up. Following this interaction, the VR video begins to play.



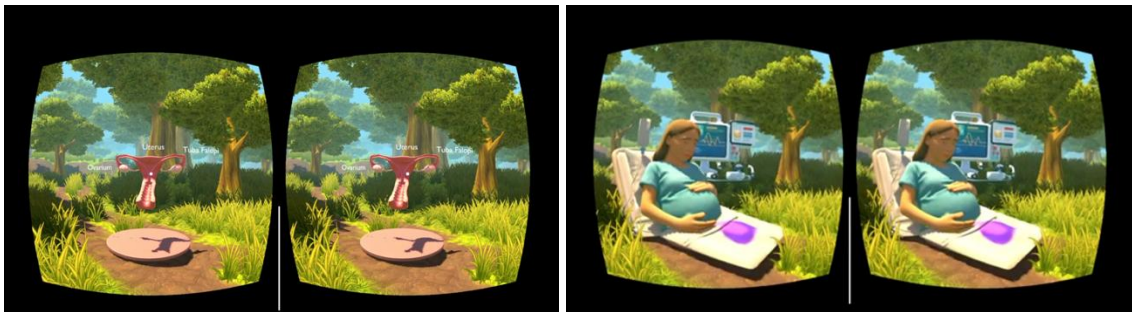


**Image 2.** Initial Interface of *Virtual Reality Media*

The validation test for the VR video was conducted using the Delphi Technique with three experts—a media specialist, a nutrition specialist, and a reproductive health specialist. The validated aspects included content relevance, clarity of material, visual and audio presentation, and educational effectiveness, with the results presented in Table 1. The validation yielded an average feasibility score of 89.75%, indicating that the VR video is categorized as highly feasible for use. The media fulfilled the required standards for content suitability, ease of use, visual and audio quality, and educational effectiveness, demonstrating its readiness to be utilized as an educational tool for adolescents in preventing early marriage as well as risks related to malnutrition and reproductive health.

**Table 1.** Validation Assessment of the Virtual Reality Video Media

| Indicator | Description | Average Score | Agreement Percentage (%) |
|---|---|---|---|
| Content Relevance | Highly Feasible | 4.6 | 88 |
| Ease of Use | Highly Feasible | 4.6 | 90 |
| Visual and Audio Quality | Highly Feasible | 4.5 | 90 |
| Educational Effectiveness | Highly Feasible | 4.8 | 91 |
| | | **Average** | **89.75** |

The high feasibility score confirms that the VR media meets pedagogical, technological, and aesthetic standards expected of modern learning tools. VR provides an immersive and emotionally engaging environment that enhances motivation and attention compared to traditional educational media (Analyti Patras et al., 2024; Siahaya, 2024). Moreover, the careful alignment of content with learning objectives is consistent with the principles of the ADDIE model, which emphasizes coherence between learner needs, instructional strategies, and technology integration (Nasution & Taufik, 2025). The incorporation of simulated real-life consequences of early marriage aligns with Kolb's experiential learning theory, asserting that meaningful reflection and understanding develop when learners experience events directly rather than merely being told about them (Akella, 2010). VR thus serves as a bridge between abstract information and concrete emotional understanding, a critical factor in shaping adolescent attitudes and behaviors.

### 3. Implementation Phase

The implementation phase was carried out in June 2025 at a vocational high school located in Karangpring Village, Jember Regency. A total of 12 adolescents participated in this phase. The activity began with the administration of a pre-test to assess baseline knowledge and attitudes prior to the intervention. Participants then engaged in the VR simulation individually using VR headsets in rotation, followed by a post-test and a brief interview. The paired t-test statistical analysis showed a p-value of 0.0115 (< 0.05), indicating a significant difference between the pre-test score (81.67) and the post-test score (92.50). These findings demonstrate that the VR media was effective in improving adolescents' knowledge and understanding of issues related to early marriage.

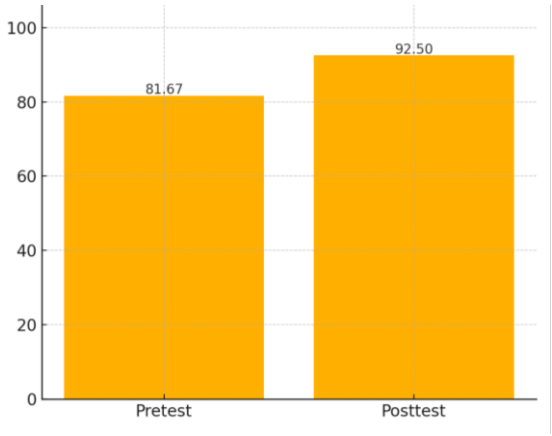



**Image 3.** Pre and Post Test Score

The significant improvement in test scores demonstrates the educational effectiveness of VR as a learning tool. VR's multisensory nature, combining visual, auditory, and narrative elements, enhances comprehension and memory retention, supporting Mayer's cognitive theory of multimedia learning (Analyti Patras et al., 2024; Liao, 2025; Mayer, 2009). Adolescents can visualize abstract concepts, observe realistic scenarios, and internalize information more effectively when presented in an immersive, interactive format. The immersive experience also encourages deeper cognitive and emotional engagement. Learners not only gain conceptual understanding of the risks associated with early marriage but also develop empathy toward individuals experiencing negative consequences, increasing their motivation to delay marriage and prioritize education (Analyti Patras et al., 2024; Conrad et al., 2024; Siahaya, 2024).

### 4. Evaluation Phase

The evaluation phase incorporated both learning outcomes and user satisfaction, as presented in Table 2. Post-test results reinforced the effectiveness of the VR intervention, and user satisfaction scores ranged from 3.4 to 4.6, categorized as "Satisfied" to "Very Satisfied." The highest-scoring item was "Learning with VR feels engaging" (4.58), while the lowest-scoring item was "The audio/narration is unclear" (3.42). Participants also reported increased understanding of reproductive health, early marriage risks, and the importance of nutrition for adolescents. Multiple respondents stated that the VR simulation of post-marriage life, depicting financial struggles, emotional stress, and limited educational opportunities, left a strong impression. Others expressed renewed motivation to pursue higher education after observing contrasting life paths shown in the simulation.

**Table 2.** Evaluation Result of the Virtual Reality Video Media

| Statement | Average Score | Category |
|---|---|---|
| The visuals and animations in the VR are clear and easy to understand. | 4.50 | Very satisfied |
| The audio/narration in the VR is unclear | 3.42 | Moderately satisfied |
| Learning with VR feels interesting | 4.58 | Very satisfied |
| **Content Quality** | | |
| The VR helps me better understand adolescent reproductive organs | 4.50 | Very satisfied |
| The material on early marriage risks is confusing. | 2.33 | Not satisfied |
| The information in the VR is appropriate for adolescents like me | 4.25 | Satisfied |
| **Virtual Reality** | | |
| The VR helps me understand adolescent health, especially reproductive health | 4.83 | Very satisfied |
| The VR does not make me think about the impact of early marriage | 2.67 | Moderately satisfied |
| The VR encourages me to pursue a healthier future | 4.83 | Very satisfied |
| **Satisfaction and Attitudes** | | |
| I am satisfied with the VR module I tried | 4.58 | Very satisfied |
| The VR module is too boring to use | 1.83 | Not satisfied |
| The VR learning duration is appropriate (not too long or too short). | 4.17 | Satisfied |
| I would like VR like this to be used again in schools/communities | 4.42 | Satisfied |
| Learning with VR is more enjoyable than learning only from books | 4.17 | Satisfied |
| After using VR, I feel that early marriage should be postponed. | 4.92 | Very satisfied |
| After using VR, I believe adolescent nutrition is important | 4.92 | Very satisfied |

The findings underscore the role of VR as a powerful educational medium capable of influencing both knowledge and attitudes. By allowing adolescents to "experience" potential consequences in a safe virtual environment, VR circumvents cultural taboos surrounding discussions on early marriage, making it an appropriate tool for sensitive reproductive health topics. This aligns with research suggesting that VR can facilitate empathy-building and perspective-taking, essential components in shaping health-related behaviors (Liao, 2025). Despite these strengths, several challenges emerged, such as the need for technical assistance for participants unfamiliar with VR devices and the risk of visual discomfort during prolonged use (Yuliana, 2021). These limitations are consistent with previous research (Yuliana, 2021) and highlight the need for structured facilitation and appropriate session duration in future VR-based educational programs.

## CONCLUSION

This study demonstrates that Virtual Reality (VR) is an effective, innovative, and contextually relevant medium for delivering reproductive health education aimed at preventing early marriage among adolescents. Through the systematic application of the ADDIE development model, the resulting VR module successfully addressed the documented gaps in adolescents' knowledge, engagement, and access to credible information. The expert validation process confirmed that the VR media met high standards of content accuracy, instructional clarity, usability, and audiovisual quality. Field implementation further showed a statistically significant improvement in adolescents' knowledge scores after exposure to the VR simulation, underscoring its effectiveness as a learning tool. Beyond cognitive gains, the VR experience fostered meaningful emotional engagement by illustrating realistic scenarios depicting the potential consequences of early marriage, including health risks, educational disruption, economic hardship, and psychosocial stress. This experiential component was essential for shaping adolescents' attitudes and motivations, allowing them to develop a deeper understanding of the long-term implications of early marriage. Additionally, high user satisfaction ratings reflected the acceptability and appeal of VR as a learning medium for digital-native youth.

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