Artificial intelligence as an educational media to improve adolescent reproductive health: Research and development studies

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Abstract

Background: Cognitive accessibility, psychosocial accessibility, and geographic accessibility are all barriers to adolescent sexual and reproductive health services. Cognitive accessibility, as an educational medium, provides access to comprehensive adolescent reproductive health information.
Purpose: This study aimed to turn a textbook into a learning module for adolescent reproductive health using artificial intelligence (AI).
Methods: The study used the Borg and Gall Research and Development design. Purposive sampling was used to select the trial sample of students, teachers, and media experts at Muhammadiyah Junior High School 4 Margahayu, Bandung Regency. Interviews, validation sheets, and questionnaires were used to collect data. The data analysis technique was carried out based on the validation analysis results of media and material experts, as well as the module's feasibility according to students.
Results: At the research and information gathering stages, the research results were obtained by incorporating material from the previous module on menstruation and sexually deviant behavior, particularly LGBT. The planning stage included application aspects, materials, and usage instructions. With the addition of revised trial results in practice questions and adapted religious materials, the development results show that the module is ready for use.
Conclusion: According to the results of the study, the adolescent reproductive health learning module using artificial intelligence was appropriate as an educational medium. It is suggested that the press be improved in terms of media display and comprehensive material.

Keywords: adolescent; artificial intelligence; educational media; reproductive health

Introduction

Adolescents account for approximately 16% of the total population (UNFPA, 2016), but their needs and rights to sexual and reproductive health are largely unmet. Discrimination and barriers to accessing sexual and reproductive health information, goods, and services contribute to this condition. Another barrier to accessing these services is the age limit, stigma, and social norms in society, particularly for young women seeking information about sexual and reproductive health. Biological and sexual maturity are typical in this period, forming a healthy character as an investment in the future. Individual profiles will be created that is also influenced by culture. Physical and sexual maturation can be the most difficult problem (Baker, 2017).

Adolescents must obtain the consent of their parents, guardians, or doctors to access sexual health and health information and services. Practically, there are barriers in the form of a lack of information for adolescents, which leads to a lack of understanding of their sexual and reproductive needs, which in turn leads to an inability to prevent unwanted pregnancies or sexually transmitted diseases. Because there is a lack of accurate and correct information about adolescent reproductive health, adolescents

are encouraged to explore on their own, whether through print, electronic media, or friendships, which can lead to risky behavior (Yusuf & Hamdi, 2021). Comprehensive sexuality education is essential for educating adolescents about reproductive health services, the right to access those services, and the right to make sexual and reproductive health decisions free of violence, pressure, or coercion. Access to reproductive health information is thought to reduce harmful reproductive health behavior (Susanto et al., 2016).

The results revealed that adolescents prioritized confidentiality and accessibility over medical accuracy, which are unlikely to exist in a clinical setting that frequently requires parental involvement. Other studies have found that adolescents prefer technological tools for sexual health education (Brayboy et al., 2018). Electronic devices in education, including information technology development technology, have become common due to the rapid development of information technology. The application of artificial intelligence in education/Artificial Intelligence for Education (AIEd) has advantages and disadvantages, with more opportunities than threats (Xie et al., 2022).

According to Ma et al.'s study, an intelligent guidance system is more effective than traditional learning tools. A learning environment using a web-based learning system positively influences academic achievement (Erdemir & Ingec, 2015), and artificial intelligence can help detect students' emotions. Teachers can adjust their teaching (Chung, So, Choi, Yan, & Wong, 2021). AIEd can change the way teachers and students communicate. Because of its ability to balance needs and address challenges associated with face-to-face communication strategies about adolescent sexual and reproductive health, digital technology has become a necessity for the twenty-first century (Guse, et al. 2012). Teachers and students have traditionally communicated face-to-face in a specific space and time. However, AIEd's emergence may limit opportunities for face-to-face communication. Furthermore, AIEd cannot function without the Internet and electronic devices. Youth are the most likely age group to use social media, with approximately 71% of those aged 15–24 online, compared to 48% of all people (United Nations Children's Fund (UNICEF, 2017)). This study aimed to develop an adolescent reproductive health education module using artificial intelligence (AI).

Wang et al. (2022) conducted a previous study on computers designed to simulate conversations with humans as users (chatbots) about adolescent reproductive health in India. They described how they used AI chatbots to educate adolescents about reproductive health. The objectives and methods of this study differed from those of the previous one, the purpose being to investigate the feasibility of Gibson's theory in assessing adolescent sexual and reproductive health in India and provide scientific guidance for AI chatbots to educate adolescents

and young adults, promote sexual and reproductive health, and advocate for girls and women's health. In addition, the previous study used mixed methods with an instrumental case study approach, whereas this study uses an engineering method approach with mixed methods as well. For this study, the research team is already at the stage of designing and developing the media, which is a novelty of the research.

Materials and Methods

Design
This research design used the Research and Development (R&D) method which, according to Borg and Gall (Hermawan & Zuhrie, 2019) is used to develop or validate products used in education and learning. The researchers completed five of the ten stages of R and D in connection with the resulting product, which is still a sample product. The stages are as follows: (1) research and information gathering; (2) planning; (3) initial product development; (4) initial field trials; and (5) test result revision. In stage one, the researchers followed up on a previous study about the effect of the reproductive health learning module on knowledge, attitudes, and behavior by conducting interviews with teachers about the material to be added to the module using artificial intelligence.

During the planning stage, the researcher created a design for the software or hardware aspect, searched for an appropriate name for the media, and made an appealing user interface and user experience for teenagers. The researcher was assisted by media experts from the second to the fifth stages.

Sample and Setting The trial sample consisted of students, teachers, and experts, and the sampling technique was quota sampling. The study was conducted at Muhammadiyah 4 Junior High School in the Bandung District.

Variable
The only dependent variable in this study is the development of adolescent reproductive health education media using artificial intelligence.

Research Instruments
Interview guidelines, validation sheets, and questionnaires are examples of research instruments. Interview guidelines were used to interview teachers, validation sheets were distributed to experts, and a questionnaire was distributed to students.

Data Collection
In order to collect data, the researcher conducted interviews, solicited validation experts, and distributed questionnaires to students.
Data Analysis: The data analysis technique was conducted based on the validation analysis results of media and material experts, as well as the module's

Table 1. Reproductive Health Module Validation Test Results using Artificial Intelligence

Validator	Validity Percentage	Validity Category
Media Expert	84.6%	Fairly Valid
Material Expert	90%	Highly Valid
Media and Material Expert	87.3%	Highly Valid

Table 2. Feasibility Test Results of Adolescent Reproductive Health Module Using Artificial Intelligence

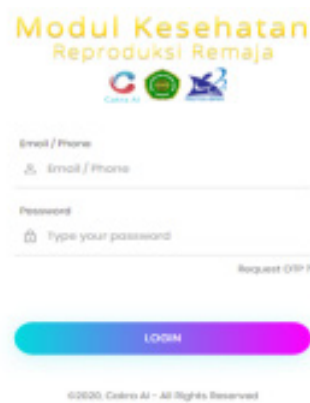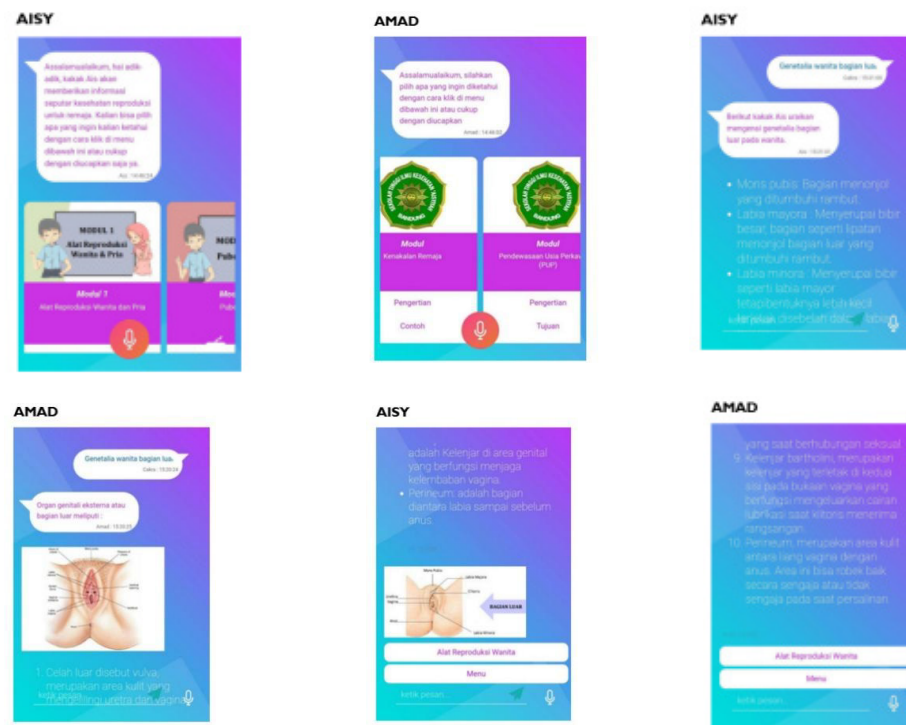| Group	Validity Percentage	Eligibility Category
Expertise	87.3%	Highly Eligible
Student	85.1%	Highly Eligible
Teacher	84.5%	Highly Eligible

Figure 1. Home Screen

Figure 2. Screen After Login

feasibility according to students.

Ethical Approval

The Health Research Ethics Committee of the University of Aisyiyah Bandung granted ethical approval for this study in number 78/KEP.02/STIKes-AB/VI/2020. Students were given the opportunity to provide informed consent both orally and in writing. The researcher asked that students resubmit research information that will be carried out with informed consent so that permission for student participation can be obtained from the students' parents.

Results

The results of the study describe each stage in the order specified in the research method. Researchers designed and developed an artificial intelligence-based reproductive health learning module that replaced a paper-based module. The study focused on the planning and development of a learning medium for adolescents up to the fifth of ten stages in Borg and Gall's theory regarding priority needs and resource availability.

Development of Adolescent Reproductive Health Module Using Artificial Intelligence

The results of each stage of doing adolescent reproductive health modules using artificial intelligence can be described as follows:

Research and Information Collecting Stage

This study is a follow-up of a previous study in which the researcher created a textbook-based adolescent reproductive health learning module. After the investigation was completed, the researcher found no conditions that matched expectations, indicating that the module was not being used appropriately; for example, students rarely read the module, and the teacher rarely used it. To become more developed and capable of addressing broader adolescent reproductive health issues, the researchers relocated the study from 'Aisyiyah Junior High School Rancaekek to Muhammadiyah Junior High School Margahayu in Bandung Regency.

Based on these conditions, the researchers conducted further research to develop educational media modules into innovative media to answer problems in the field. Researchers conducted a literature study on Information Communication and Education (IEC) services for adolescent reproductive health, including male and female reproductive organs, puberty, clean and healthy life behavior, juvenile delinquency, maturation of marriage age, violence against children, and deviant sexual behavior, in this follow-up study, research results, and information collection. They added material on menstruation and sexual behavior deviations such as lesbian, gay, bisexsual, and transgender (LGBT) to the results of interviews with teachers and school principals. There were guidelines for developing teaching materials for teenagers, both boys and girls.

Identifying media needs indicated the need for adolescent reproductive health learning media with appealing designs that are not only text-based but also include pictures and videos, and that can help students obtain information or study independently. Previous study has revealed a lack of teachers or notable people who can provide systematic and structured data on reproductive health, as well as a lack of sourcebooks, media, and evaluation forms that can reflect students with a healthy reproductive capacity in terms of knowledge, attitudes, and behavior.

Planning Stage

The second stage in this study was product planning. Product planning includes 1) the required equipment, which includes software, hardware, application users, and introduction and training; 2) a general description of the system, which includes a general description of the application and a general description of application requirements; 3) how to use, which includes menu structure and user instructions; and 4) materials for adolescent reproductive health education. All product information is presented in the form of an application user manual Artificial Intelligence (AI) Adolescent Reproductive Health Module (Aisy and Amad). The names Aisy and Amad are icons for the names of boys (Amad) and girls (Aisy) derived from the terms of the Muhammadiyah and 'Aisyiyah organizations, respectively.

Early Development Stage

The application's initial development is based on a prepared plan and refers to several development elements, including 1) the purpose of making the product; 2) the qualifications of the parties involved; 3) the form of participation of the parties involved; 4) work procedures; and 5) the feasibility test.

The purpose of making the product is to create a learning module for adolescent reproductive health using artificial intelligence technology. Media experts, material experts, and students as test subjects are involved, with experts providing input for adolescent reproductive health materials and assessing the preliminary results of module products designed with students. The module's operation is documented in the form of a manual for using the AI Aisy and Amad modules. The module validation test was performed on media and material experts. The validation test results are shown in Table 1.

The validation test from a combination of media experts and material experts shows the validity category was very valid, with 87.3%. Validation tests were also carried out on teachers through open discussions and received positive responses.

Initial Field Trial Stage

Initial field trials were conducted on junior high school students who had smartphones and were willing to

become research participants and teachers. There were 20 participants in the module feasibility test with the test results shown in Table 2 below.

Based on Table 2, it can be explained that the feasibility of the adolescent reproductive health module with artificial intelligence, according to experts, is very feasible (87.3%), and according to students, it is also very possible with a percentage of 85.1%, and according to teachers, 84.5%. The results of the module development in the form of applications can be seen in the following pictures.

Test Result Revision Stage
Discussions with experts helped researchers revise the trial's findings. There was additional material in the form of practice questions in the results of the debate in the initial field test which was useful for evaluating students' knowledge of all the material in the artificial intelligence module. Experts also suggested that religiously charged material, the emergence of Eastern culture, and image visualization be included.

Discussion

According to Borg and Gall (Hermawan & Zuhrie, 2019), research and development is defined as an activity that aims to develop and produce good research products through cyclical and iterative processes or steps such as field testing, product revision, and finally producing products that meet the stated goals (Rabiah, 2015). The Organization for Economic Cooperation and Development defines research and development as "creative and systematic work carried out sequentially to increase the supply of knowledge about humans, culture, and society and design new applications of available knowledge." The. The research discussion can be summarized as follows.

Research and Information Collecting Stage
The artificial intelligence module is created by gathering information in the form of needs analysis and competency analysis. It requires examination to identify potential issues (Kamal, 2020). The researchers conducted research in accordance with the theory. They gathered data on adolescent reproductive health data acquisition problems in schools through needs analysis, literature review, and field observations. These results of this stage included material requirements for adolescent reproductive health and media created with artificial intelligence technology.

Based on Government Regulation No. 61 of 2014 concerning Reproductive Health, the IEC material contained in the module has not been fulfilled, namely material on mental health, family planning services, and behavior that hurts adolescent reproductive health, while there is additional material on menstruation and deviant sexual behavior, especially LGBT. There is a need for various media that can be accessed quickly, have attractive designs, and facilitate student interaction with the media when collecting information about media. The steps of research and information collection were carried out by researchers in systematic stages.

Planning Stage
Planning stage included the abilities needed in conducting this study, the formulation of the objectives to be achieved in the study, design and research steps, and the possibility of testing in a limited scope (Sa'diyah, Alfiyah, Tamin, & Nasaruddin, 2020). During the planning stage, the researcher devised a strategy that included transforming the textbook module into a module that used AI technology design and testing on a micro-scale. An application user manual compiled the method for using modules, techniques, and devices that users must know. According to theory, the module testing plan was conducted by researchers in collaboration with teachers, students, and media experts.

Early Development Stage
In the initial product development stage, the supporting components were prepared, guidelines and manuals were designed, and the feasibility of the tool was evaluated (Haryati, 2012). Researchers used AI applications to develop products, such as adding reproductive health materials and changing modules. At this stage, validation testing was performed, an activation process to determine whether the product design, in this case, the new AI module, can be more effective than the textbook module. Validation was said to be rational because it is based on logical thinking rather than field facts (Purnama, 2013). The test results demonstrating the application's feasibility indicated a type of evaluation of the tools' feasibility. Valid statements from media experts serve as the foundation for individual and group testing of products.

In this study, the AI application is part of the Virtual Assistant (VA). According to Guzman (2019) and Perdana and Irwansyah (2019), VA is a set of programming languages based on NLP (Natural Language Program) that allows users to speak and receive responses from applications in the same way that other people do. This AI module was created using the chatbot application, a VA derivative and component of AI which can integrate text-based input, and the presence of audio making it easier for users to get information from the database and quickly inform users. A chatbot is a computer program that simulates human conversations through artificial intelligence to allow machines to interact with humans in a closed area through written text or voice interaction, with or without human assistance. The presentation of the results of this study strengthened the design of the adolescent reproductive health module designed by the researcher.

Trial Stage

The initial trial was carried out individually to test the feasibility of the module. The trial involving students and teachers was then revised to complete and perfect the AI module product. Teachers have suggested that material about religion and its relationship to adolescent reproductive health be included in this trial. The manual also guided data collection during the trial stage for using the module described at the start of the meeting. Trials were conducted in Kamal (2020) after the product received expert advice and field findings.

Test Result Revision Stage

Sustainable development continues, and changes in the nation's economy are reflected in investments in science, technology, and investment. Investment is defined as the ability of a state to generate, utilize, and wisely apply scientific knowledge and technology related to innovation (Sibiya, 2011). Currently, research and development results are obtained through the collaboration of universities and other organizations, and they are then applied in a variety of ways in the industrial sector. This is done because research and development help humans better understand themselves and find solutions to health problems in a more straightforward and guided manner (Sibiya, 2011). In addition, theoretical reinforcement is that in research and development, thus a revision of the trial results is needed to make the primary product draft ready to be tested more broadly through the improvement of the initial product, and this improvement can be carried out more than once based on the initial trial results (Silalahi, 2017).

The usefulness of AI for human life can be used to assess its success. As a result, AI must be well-designed so that people become acquainted with the AI system, become a part of it, and develop trust. Public policy should make it easier for people to use AI, extending benefits while reducing unavoidable errors and failures (Grosz et al., 2015).

The use of artificial intelligence as a learning medium has allowed students to grasp information more quickly. Research on the use of artificial intelligence technology as a learning medium for adolescent reproductive health has never been conducted in junior high or high schools, particularly in the educational environment of the Muhammadiyah organization, Indonesia's largest educational charity. This study is expected to be a reference for the development of digital technology science to support adolescent health. In addition, the media design can be used by adolescents and related institutions in practice. This study has limitations in that it has only been done until the fifth stage or revision of the initial product has been tested in a limited environment, and has not yet been widely used by students.

Conclusion

Based on the evidence obtained from research and development in the field, it can be concluded that each stage was carried out properly, starting from the research and information gathering stage, planning stage, development stage, trial stage, and revision stage of the test results. It is suggested that the study be continued until it is widely used by students and lecturers.

Declaration of Interest

There is no conflict in this research.

Data Availability Statement
none

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