

Development of E-Modules Assisted by Smart Apps Creator on Reproductive System Material to Improve Cognitive Abilities and Self-Awareness Attitudes towards Reproductive Health of Class XI SMA/MA Learners

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Abstract: This research was conducted using the ADDIE development model. The development design consists of 5 stages, namely, Analysis, Design, Development, Implementation, and Evaluation. The subjects for limited trial were 30 students of class XII IPA MAN 1 Yogyakarta, while for a wide-scale trial, they were of 58 students of class XI IPA MAN 1 Yogyakarta. Data collection techniques used in this study were observation, interviews, questionnaires, tests, and documentation. The data from this study were analyzed using by Manova test. The results of this study indicate that, 1) e-modules assisted by *smart apps creator* on reproductive system is declared feasible for use in the process of learning activities, 2) e-modules assisted by *smart apps creator* on reproductive system material are declared practical for use in the learning activity process, 3) e-modules assisted by *smart apps creator* effectively improve cognitive abilities and self awerness attitude towards reproductive health with an N-Gain value of 57.7 and 56.4, respectively (fair category). The Manova test indicates a Sig. 0.000 meaning there is a significant difference in cognitive abilities and self-awareness attitudes towards reproductive health of students who use and do not use e-modules assisted by *smart apps creator*.

Keywords: Cognitive Ability E-module; *Smart Apps Creator*; Self-awareness Attitude Toward Reproductive Health

Introduction

The World Health Organization (WHO, 2016) states that the adolescent group is 1.2 billion or 18% of the world's population, with an age range of 10-19 years, adolescents can already be categorized as entering the preconception period or women of childbearing age (Syamsuddin, 2023). and at this age the behavioral patterns that develop have an impact on future reproductive health status (Sidamo et al., 2023).

Globalization and technological development have had a tremendous impact on adolescent relationships. The ease of accessing and modeling unhealthy sexual behavior is one example of the negative impact of

technological development. This can be seen from the teenage dating style interspersed with sexual behavior that is not in accordance with religious norms, community norms, immoral norms and the developmental stage of adolescence (Aini, 2016).

Adolescent reproductive health is very important in national development because adolescents are assets and the next generation of the nation. Reproductive health is the success of carrying out functions, procreation, regulating and maintaining pregnancy towards a well born baby-well health mother and for family health (Erghezha, 2016). Maintaining reproductive health during puberty is very important because the sexual function of adolescents is already

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functioning in adolescence. According to SDKI 2012 KRR, the increase in adolescent knowledge about reproductive health is still lacking, with 73.46% of male adolescents and 75.6% of female adolescents aged 15-19 years in Indonesia not knowing adequate information about reproductive health (Ananda & Purba, 2023).

The problem of free sex is very vulnerable among adolescents. This can happen because adolescents are at an active sexual potential related to sexual urges that affect hormones. Most teenagers do not have enough information on their own sexual activities. Then teenagers themselves try to find out about sexual problems and various ways. From the results of a survey conducted by the Inovate Research Survey institute in 2017 conducted in four major cities namely Jakarta, Bandung, Surabaya, and Medan with respondents aged 15 to 24 years revealed that 65% of the information they got from friends and the remaining 35% from porn movies (Faswita & Suarni, 2017). Research from SKRRI (Indonesian Reproductive Health Survey) quoted in Mukminun (2022), stated that Indonesian teenagers first started dating when they were 12 years old, the percentage of unhealthy teenage dating behavior includes, 63% of teenagers when dating grope each other's intimate parts, teenagers who kiss with a percentage of 82%, and teenagers who hold hands with a percentage of 92%. This unhealthy dating behavior in adolescents can lead to free sexual behavior before marriage.

The freedom of teenagers in dating is something that must be considered, because the advancement of the times makes teenagers now easily trapped in promiscuity, where teenagers who are dating engage in deviant behavior such as hand holding, hugging, kissing, and even having intercourse with husband and wife (Haryati, 2020). In terms of health, the dangers of free sexual behavior can cause various disorders in adolescents themselves, such as the occurrence of unwanted pregnancies that lead to abortion, early marriage and the risk of spreading sexual diseases that are increasingly widespread with the increasing number of sex workers and early sex (teenage sex under 19 years old), can cause AIDS/HIV which is a sexually transmitted disease. This is a major conflict for adolescents (Rodiyatul et al., 2021). Centers for Disease Control (CDC) in 2022 stated that the most reported sexually transmitted diseases from various countries are syphilis (including congenital syphilis), gonorrhea, chlamydia, chancroid, and HIV (human immunodeficiency virus) (Niforatos & Rothman, 2021).

Various problems related to reproductive health, students need an effort to develop an adolescent reproductive health education program that can include the provision of accurate information. School-based

reproductive health education is one of the appropriate alternative strategies because it can cover all adolescent reproductive health issues (Wicaksana et al., 2020). Reproductive health education implemented in schools is one of the efforts to guide adolescents to overcome problems related to their reproductive organs (Uberty, 2022).

Reproductive health education is very important, the existence of reproductive education in schools can increase their knowledge about the impact and dangers of promiscuity (Yao, 2023). Learning about reproductive health is very important for students where this reproductive system material is one of the Biology materials, based on the Regulation of the Minister of Education and Culture No. 24 of 2016 concerning content standards for primary and secondary education, the competencies achieved in class XI human reproductive system material are understanding the scope of biology which includes the structure and function of reproductive organs in men and women, the process of sex cell formation, ovulation and menstruation, fertilization, gestation, and childbirth, to disorders or diseases associated with the human reproductive system.

Based on the results of the needs analysis through interviews with biology teachers, the teacher stated that students' understanding of reproductive system material is still low, and their knowledge related to terms that are considered taboo related to reproductive organs is still low, for example they do not know about the term oral sex, and its consequences. The needs analysis was also conducted on the students of class XI MAN 1 Yogyakarta using google form, getting the results that the material of the reproductive system & reproductive health is very important to learn early on with a percentage of 100%, and as many as 98% of students want to know the facts about their reproductive system, thus the material about reproductive health needs to be learned at school, then the need for guidance from the teacher, so that they are not confused about the terms and dangers of reproductive organs.

Students' self-awareness needs to be increased to avoid themselves from diseases that might attack the reproductive organs. Because adolescents' problems with their reproductive organs receive less attention. Because of their relatively young age, they are still in educational status, they seem to be free from the possibility of facing diseases related to their reproductive organs. It is evident that adolescents who are looking for self-identity have been very easy to receive world information related to the problem of the function of their reproductive organs so that they tend towards the implementation of increasingly free sexual relations (Rahma, 2018).

Based on the results of the researcher's interview with the biology teacher, students are very enthusiastic about learning about reproductive system health because learning about reproductive system health departs from their daily lives and experiences, which makes them happy, then from their experiences it is connected to the reproductive system material. However, there are some obstacles experienced by teachers in teaching reproductive system health, namely when students consider lessons about the reproductive system very difficult to understand because of the many terms they do not understand, and the limited teaching materials used by the teacher, so it makes students lazy to learn and results in a lack of student knowledge of reproductive system health material. This problem causes learning to be less effective and less enjoyable, for this reason a teaching material is needed with the aim of students being able to learn independently.

At school, teachers only use printed books that have been provided by the school, so the result is that the material they get is very limited. For example, in the reproductive system material, there are still many terms that students do not understand, while the learning time is limited. According to Puspitasari (2019) Time constraints, namely modules, because modules train students to learn independently, modules are also arranged according to the needs of students.

The development of technological knowledge can be utilized for the development of teaching materials needed so that researchers want to develop teaching materials that are in accordance with current developments, namely the Electronic Module (e-module). One of the advantages of e-modules is that in e-modules there are videos, animations, and audio to enrich the learning experience, and e-modules are practical and can be taken anywhere and everywhere, and can support students' learning independence. E-modules can be used as a tool or learning tool that contains material, methods, limitations and ways to evaluate which are systematically and interestingly designed to achieve the expected competencies according to the level of complexity electronically. To support the development of e-modules, researchers will develop android-based e-modules in the form of applications, the selection of this android system is based on a report in "Global Stashot in Q3 2017" which states data on android operating users reaching 72.9% (Antika et al., 2023).

This is reinforced by the results of the needs analysis which states that 76.9% of 52 respondents use the android system. The use of android-based e-modules is considered easier and more practical so that it provides convenience to students, including being able to be accessed anywhere and anytime when needed, not

easily damaged and provides a more attractive appearance such as images, moving animations, learning videos so that students are not easily bored.

Based on the explanation above, the researcher wants to develop e-modules assisted by smart apps creator with the aim of producing e-module products assisted by smart apps creator that can improve cognitive abilities and self-awareness attitudes towards students' reproductive health.

Method

This research is a type of development research or Research and Development (R&D), which aims to develop a new product or improve existing products. This research uses the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation), which is a development model whose final result is a product and is tested for the feasibility of the product developed (Subali, 2016). The following is a chart of the product development procedure:

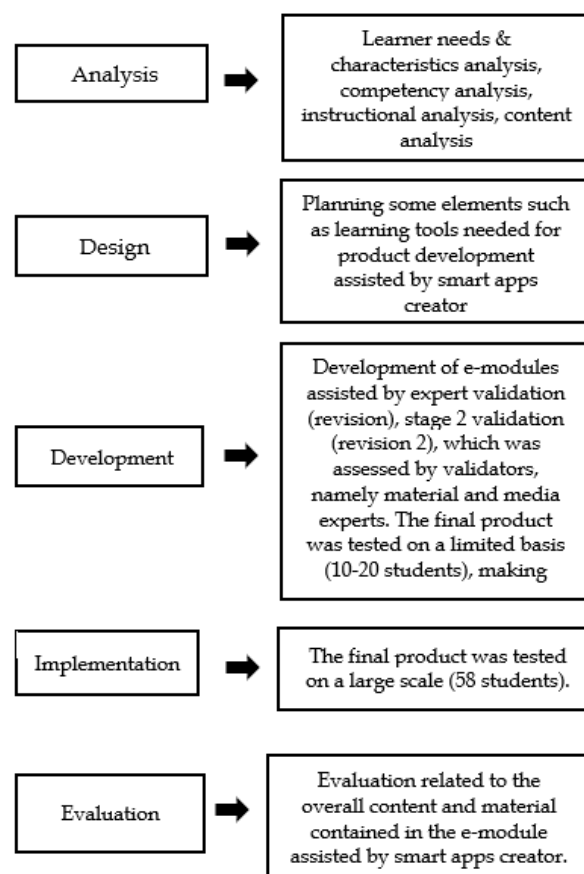


Figure 1. Product Development Procedure

The population in this study were students of class XI MAN 1 Yogyakarta. Sampling was done through random sampling with purposive sampling technique.

Data collection techniques used in this study include tests, questionnaires, and documentation. The test technique was used to measure the cognitive abilities of students totaling 20 multiple choice questions, while the questionnaire of self-awareness of reproductive health attitudes totaled 30 items modified from (Azwar, 2022). In addition to being tested, the instrument was validated by material experts and media experts. Data were analyzed using the Manova test.

Table 1. Nonequivalent Control Group Design

Class	Pretest	Treatment	Posttest
Experiment	O ₁	X ₁	O ₂
Control	O ₃	-	O ₄

(Sugiyono, 2016)

Description:

X₁ = Biology learning using smart apps creator-based module with Discovery Learning learning model

- = Biology learning using modules from the Ministry of Education and Culture that are commonly used in schools with the Discovery Learning learning model

O₁ = Pretest (initial test) in the experimental class

O₂ = Posttest (final test) in the experimental class

O₃ = Pretest (initial test) in the control class

O₄ = Posttest (final test) in the control class

In the implementation of the field trial, pretest and posttest were held before and after the learning process took place. This aims to obtain data and information related to cognitive abilities and self-awareness attitudes towards reproductive health. The data obtained is calculated on average and then converted into qualitative values on a scale of 4. The conversion of scores into values on a scale of 4 is as follows.

Table 2. Score Conversion

Range	Score	Criteria
$X > (\bar{X}_l + 1,8Sb_l)$	A	Very good
$(\bar{X}_l + 0,6Sb_l) < X \leq (\bar{X}_l + 1,8Sb_l)$	B	Good
$(\bar{X}_l - 0,6Sb_l) < X \leq (\bar{X}_l + 0,6Sb_l)$	C	Fair
$(\bar{X}_l - 1,8Sb_l) < X \leq (\bar{X}_l - 0,6Sb_l)$	D	Less
$X \leq (\bar{X}_l - 1,8Sb_l)$	E	Very less

(Widoyoko, 2017)

Description:

X = Empirical score

\bar{X}_l = Ideal mean ($\frac{1}{2}$ (Maximum score + minimum score))

Sb_l = Ideal standard deviation ($\frac{1}{6}$ (Maximum score - minimum score))

The minimum product feasibility value is good enough, so the product is feasible to be tested on students as media in learning activities. The effectiveness of using smart apps creator-based learning media in improving students' critical thinking and problem solving skills can be measured through hypothesis testing.

The Manova test was conducted to see the effectiveness of smart apps creator learning media in improving analytical thinking skills and problem solving skills. Before the Manova test, the data must go through a multivariate normality test by determining the Mahalanobis distance and then through the covariance variance matrix homogeneity test with Box's M test.

Result and Discussion

This product development produces an e-module product assisted by smart apps creator that is appropriate and effective for improving cognitive abilities and self-awareness attitudes towards reproductive health. The stages of product development are as follows:

Analysis Stage

The first stage in this research is the analysis stage. At this stage, the needs & characteristics of learners, competency analysis, instructional analysis, and content analysis are analyzed. At the stage of analyzing the needs & characteristics of students, researchers conducted interviews with biology teachers at MAN 1 Yogyakarta. Based on the results of interviews obtained from biology teachers stated that teachers have difficulty delivering material optimally due to limited time. The teacher stated that he had difficulty finding suitable media and teaching materials to use and based on the results of observations made by researchers, that the material of the human reproductive system is among the materials that are difficult for students to understand, because there are still many concepts that are difficult to understand, so this problem results in a decrease in student learning outcomes.

Based on the needs analysis, the teacher stated that students' understanding of the reproductive system material was still low, and their knowledge related to terms in the reproductive organs was still taboo, for example they did not know about the term oral sex and its consequences. The needs analysis was also conducted on students of class XI MA using google form, the material of reproductive system & reproductive health is very important to learn early on with a percentage of 100%, and as many as 98% of students want to know the facts about their reproductive system, thus the material

about reproductive health needs to be learned at school, then the need for guidance from the teacher, so that they are not confused about the terms and dangers about reproductive organs. Students' self-awareness needs to be increased to avoid themselves from diseases that might attack the reproductive organs.

Analysis of learner characteristics is used to determine the characteristics of learners who are the subject of research which is the basis for researchers in preparing and developing e-modules developed. The e-module developed is in accordance with the characteristics of students, namely grade XI SMA / MA students who are generally 16-17 years old. In learning activities, students follow learning activities quite well, but learning activities feel boring because they rarely use media, teaching materials and learning is monotonous, so students feel tired and sleepy. For this reason, teaching materials are needed that students can use offline wherever and whenever they learn.

Design Stage

The design stage consists of product design. This stage consists of several steps, as follows: Preparation of biology learning tools KD 3.12 and KD. 4.12 class XI MIPA which consists of a syllabus and Learning Implementation Plan (RPP). Designing the basic framework for making e-modules assisted by smart apps creator in the form of storyboards. Creating a design on the main menu consisting of a homepage, glossary, concept map, material, LKPD, crossword puzzles, bibliography, and author profile. Designing evaluation tools to evaluate e-module products assisted by smart apps creator that will be developed. Evaluation tools are consulted and validated by experts, biology teachers (practitioners), and students. Collecting various reference sources for materials, videos, interesting facts, and images relevant to the human reproductive system material. Designing assessment instruments that will be used to assess, validate, and evaluate the feasibility of e-module products assisted by smart apps creator.

The smart apps creator-assisted e-module product to be developed has several main menu pages that have different content. The description of the home page and main menu page on the smart apps creator-assisted e-module consists of, home page, menu page, namely instructions for use, introduction, material, crossword puzzles and LKPD, bibliography, and developer.

Development Stage

The activities at this stage are realizing the product design that has been made at the design stage and validating the product to media experts and material experts, as well as practitioners (teachers) and students.

Making this e-module is assisted by the canva application, with the final result in the form of an android application that is loaded into the smart apps creator application. Based on the design that has been prepared, the results of the e-module design assisted by smart apps creator are as follows:

Product Development

Home Page and Menu Page

The home page is the first page that will appear when opening the e-module assisted by smart apps creator. The home page will display the e-module identity. The menu page is the initial display after the main page of the e-module assisted by smart apps creator. The menu page presents instructions for use, introduction (consisting of a concept map, glossary, and e-module identity), material (consisting of learning activity 1, learning activity 2, and learning activity 3), crossword puzzles & LKPD, bibliography, and developer identity. The menu page can be seen in Figure 2.

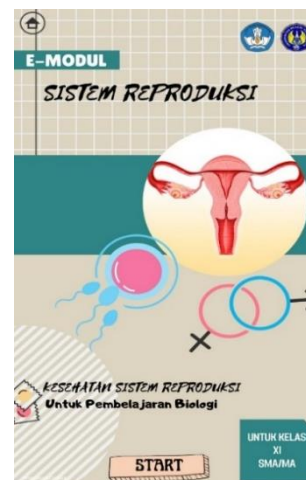


Figure 1. Home Page



Figure 2. Menu Page

Instruction Page and Introduction Page

The instructions menu contains an explanation of the instructions for using the e-module, and contains an explanation of the menu buttons used in the e-module. The introduction menu contains an explanation of the concept map, glossary, and e-module identity. The display of the introduction menu page can be seen in Figure 4.



Figure 3. Instructions Page



Figure 4. Introduction Menu Page

Material Menu Page

The material menu page contains learning activities that present materials that have been prepared for students to learn. The material menu is divided into three learning activities, namely learning activity 1 which contains material about the reproductive system in women, consisting of female reproductive organs, oogenesis, menstrual cycle, male reproductive organs, and spermatogenesis. Activity 2 contains material about puberty, fertilization, pregnancy, and childbirth. Learning activity 3, contains material about the dangers of free sex, sexually transmitted infections, and how to maintain reproductive health. The material menu display is presented in Figure 5.



Figure 5. Material Menu Page

Crossword and LKPD Page

The crossword menu contains questions about the reproductive system material. The crossword puzzle

consists of crossword puzzles 1 and 2. The appearance of the crossword menu page can be seen in Figure 6.

The LKPD menu contains learning activities on reproductive system material. LKPD consists of LKPD 1 which contains learning activities about human reproductive organs, in LKPD 1 and 2 interesting facts about the reproductive system are presented. LKPD 3 contains learning activities about the dangers of free sex, and infections in the reproductive system. The LKPD menu display can be seen in Figure 6.



Figure 6. Crossword Puzzle Page and LKPD

Bibliography

The bibliography menu contains a list of references or sources used as references for human reproductive system material. The references listed are mostly obtained from electronic books and relevant journals. The display of the bibliography menu is presented in Figure 7.



Figure 7. Bibliography Page

Developer

The developer menu presents the author's identity with the supervisor. The developer page can be seen in Figure 8.



Figure 8. Developer Page

Results of Product Feasibility and Practicality

Results of the feasibility of E-module Products Assisted by Smart Apps Creator by Experts

Product trials of e-modules assisted by smart apps creator were conducted on two study groups, namely experimental and control classes. The feasibility of e-modules assisted by smart apps creator was assessed by two experts, namely media experts and material experts. The assessment of the media aspect consists of four criteria, the following description of the assessment results by media experts is in table 3.

Table 3. Results of Feasibility Assessment by Media Experts

Assessment Aspect Number	Assessment Aspect	Average	Category
1-4	Display Quality Aspects	16	Very Good
5-8	Language Aspect	15	Very Good
9-12	Ease of Use Aspect	14	Very Good
13-16	Illustration Quality Aspect (Image & Video)	16	Very Good

Based on table 3, it can be seen that all aspects are classified as very good with the score of the display quality aspect scoring 16, in the language aspect getting

a score of 15 with a very good category, in the ease of use aspect scoring 16 with a very good category, and the illustration quality aspect scoring 16 with a very good category. This shows that the e-module assisted by smart apps creator is declared feasible to use in the biology learning process on the material of the human reproductive system.

Furthermore, the assessment on the material aspect was carried out by material experts. The results of the feasibility assessment on the material aspects are described in Table 4.

Table 4. Assessment Results by Material Experts

Assessment Aspect Number	Assessment Aspect	Average	Category
1-5	Aspects of Material Appropriateness and Material Accuracy	20	Very Good
6-12	Material Presentation Aspect	27	Very Good
13-15	Language Aspect	12	Very Good

Based on table 4, it can be seen that all aspects are classified as very good with aspects of material feasibility and material accuracy scoring 20 in the very good category, aspects of material presentation scoring 29 in the very good category, and language aspects scoring 12 in the very good category. It can be concluded that the e-module assisted by smart apps creator is feasible to use with some suggestions and input from the material expert.

Results of the practicality of E-module products assisted by Smart Apps Creator by Biology Teachers and Student Responses

The practicality of e-module products assisted by smart apps creator by practitioners was assessed by two biology teachers from MAN 1 Yogyakarta. The criteria assessed consisted of four including material/content, language, media, and learning. The results of product assessment by practitioners are presented in table 5.

Based on Table 5, it can be seen that the results of the feasibility assessment of e-modules assisted by smart apps creator by biology teachers in the aspect of material assessment with a score of 12 with very good criteria, in the language aspect getting a score of 11.5 with a very good category, the media aspect scored 20.5 with very good criteria, and the learning aspect scored 21 with a very good category. This shows that e-modules assisted by smart apps creator are practically used in the biology

learning process on the material of the human reproductive system.

Table 5. Results of Practicality Assessment by Biology Teacher

Assessment Aspect Number	Assessment Aspect	Average	Criteria
1-3	Material/Content	12	Very Good
4-6	Language	11.5	Very Good
7-12	Media	20.5	Very Good
13-18	Learning	21	Very Good

The practicality of this e-module product assisted by smart apps creator was assessed by students from class XII MIPA MAN 1 Yogyakarta with a total of 30 students. There are five criteria that are assessed, including the attractiveness of the material, language, ease of use, attractiveness of appearance, learning. Data on the results of product assessment by practitioners are presented in table 6.

Table 6. Results of Practicality Assessment by Students

Assessment Aspect Number	Assessment Aspect	Average	Criteria
1-3	Attractiveness of Material	8.8	Good
4-6	Language	9.1	Good
7-10	Ease of Use	12.2	Good
11-13	Attractiveness of Display	9.3	Good
14-16	Learning	9.8	Good

Based on Table 6, it can be seen that students gave a good response to the e-module assisted by smart apps creator. In the aspect of the attractiveness of the material getting a score of 8.8 with a good category, the language aspect gets a score of 9.1 with a good category, the ease of use aspect gets a score of 12.2 with a good category, the appearance aspect gets a score of 9.3 with a good category, and the learning aspect gets a score of 9.8 with a good category. This is based on the responses given by students, namely the delivery of material that is easy to understand, good, and very useful.

Empirical Validity and Reliability of Instruments

Validity and reliability are carried out to determine the validity of the items used to test the effectiveness of the teaching materials developed. Before the items are used for testing in large groups at the implementation stage, an empirical test is carried out first. The question items have also been assessed for quality through validation by material experts. The questions to be tested

are cognitive ability questions consisting of 20 items in the form of multiple choice. The subject of this empirical test is the same as the subject of the limited trial, namely 30 class XII students who have gone through the learning process on the material of the human reproductive system.

Implementation Stage

This implementation stage is the step of the product that has been tested and declared feasible by media experts, material experts, and practitioners. This stage aims to determine the effectiveness of the product in improving cognitive abilities and self-awareness attitudes towards reproductive health. The method used is a quasi experiment with a non-equivalent pretest-posttest control group design. Field trial subjects were 58 participants of MAN 1 Yogyakarta who were divided into experimental and control classes.

Descriptive Test Results

Effectiveness of SAC-assisted E-modules on Cognitive Skills

The cognitive ability of students is measured using multiple choice questions consisting of pretest and posttest. Data on the results of students' cognitive abilities can be seen in table 7.

Table 7. Results of Students' Cognitive Ability

Description	Experiment Class		Control Class	
	Pretest	Posttest	Pretest	Posttest
Minimum	30	70	20	50
Maksimum	65	90	45	75
Mean	48.57	75.54	32.50	60.89

Based on the results of the cognitive abilities of the experimental class and control class, it is known that the minimum and maximum scores (pretest-posttest) of the experimental class are higher than those of the control class. Meanwhile, the average score (pretest-posttest) of the experimental class was higher than the control class. The following is a mapping of the results of the average cognitive ability scores for the experimental class and control class in Figure 8.

In figure 8, it can be seen a significant difference in cognitive abilities between the control and experimental classes. This shows that e-modules assisted by smart apps creator are effective in improving students' cognitive abilities.

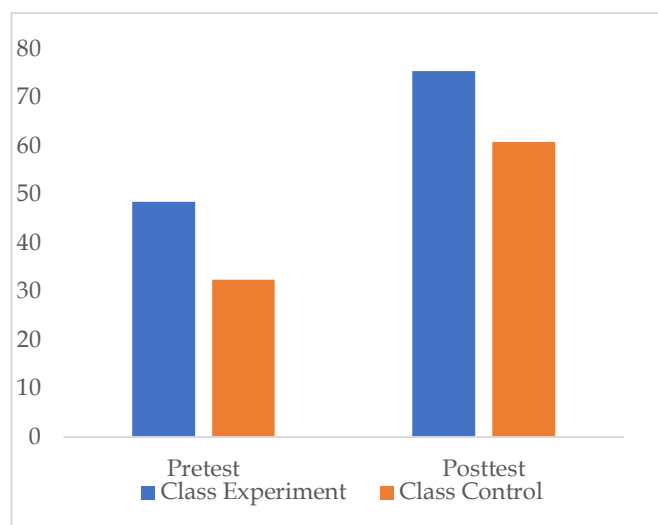


Figure 8. Mapping Graph of Average Cognitive Ability Score Results

Effectiveness of SAC-assisted E-modules on Self-Awareness Attitudes Toward Reproductive System Health

The attitude of self-awareness towards the health of the reproductive system of students is measured using a questionnaire consisting of pretest and posttest. Data on the results of the attitude of self-awareness towards the health of the reproductive system of students can be seen in Table 9.

Table 9. Results of Self-Awareness Attitudes Toward the Health of the Learner's Reproductive System

Description	Experiment Class		Control Class	
	Pretest	Posttest	Pretest	Posttest
Minimum	10	18	9	13
Maksimum	19	28	16	20
Mean	14.86	24.21	12.32	17.39

Based on the results of self-awareness attitudes towards reproductive system health of experimental and control classes, it is known that the minimum and maximum values (pretest-posttest) of the experimental class are higher than the control class. While the average value (pretest-posttest) of the experimental class is higher than the control class. The following is a mapping of the results of the average value of self-awareness towards the health of the reproductive system of the experimental class and control class in Figure 9.

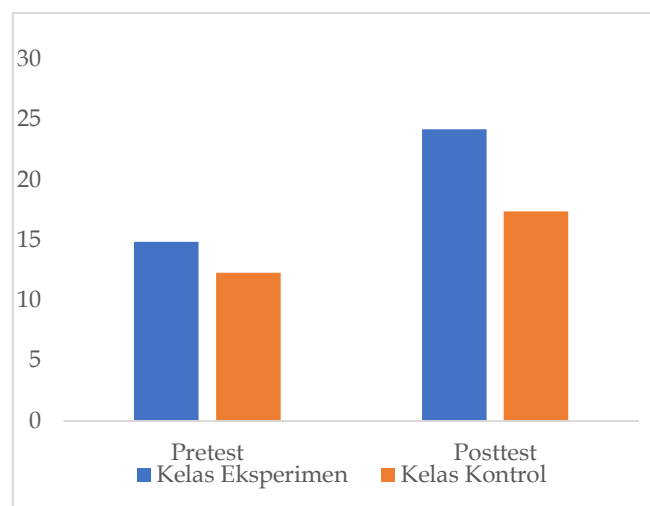


Figure 9. Mapping Graph of the Results of the Average Value of Self-Awareness Attitudes Toward Reproductive Health

In Figure 9, it can be seen a significant difference in cognitive ability between the control and experimental classes. This shows that the e-module assisted by smart apps creator is effective in improving students' self-awareness attitude towards reproductive system health.

The results of the effectiveness of e-modules assisted by smart apps creator are seen from 3 aspects of self-awareness attitudes towards reproductive health, namely, cognitive, affective, and conative aspects. The results of this questionnaire recapitulation are presented in table 10.

Table 10. Results of Recapitulation of Self-Awareness Questionnaire Attitudes Toward Reproductive System Health

Aspects	Score	Score Interval	Category
Cognitive	7.5	7.8 – 5.9	Good
Affective	3.8	5 – 2.9	Good
Conative	12.1	12-15	Very Good

Based on the results of the self-awareness questionnaire attitude towards the health of the reproductive system of students obtained in the cognitive aspect scored 7.5 with a good category, in the affective aspect scored 3.8 with a good category, and in the conative aspect scored 12.1 with a very good category.

N-gain Score Test of Cognitive Ability and Self-Awareness Attitude towards Reproductive Health

The N-gain Score test aims to determine how much improvement in cognitive abilities and self-awareness attitudes towards reproductive system health after learning. The N-gain Score test was obtained from the pretest and posttest scores of the experimental and

control classes. The results of the N-gain Score calculation are presented in table 11.

Table 11. N-gain Score Results of Cognitive Ability and Self-Awareness Attitudes Toward Reproductive System Health

Measured Ability	Class	Average Value	Category
Cognitive Ability	Experiment	57.74	Effective Enough
	Control	39.32	Ineffective
Self-Awareness Attitudes Toward Reproductive System Health	Experiment	56.41	Effective Enough
	Control	38.16	Ineffective

Based on the results of the N-gain test above, the cognitive ability of the experimental class has a higher value with an average of 57.74 compared to the control class, after being categorized as an average of 57.74 in the experimental class including the moderately effective category, while in the control class with an average value of 39.32 including the ineffective category, therefore, based on the results of the N-gain test of the two classes it can be concluded that the use of e-modules assisted by smart apps creator with the discovery learning learning model is quite effective in improving the cognitive abilities of class XI MAN students.

Then the results of the N-gain value on the attitude of self-awareness towards reproductive system health in the experimental class are also higher than the average value in the control class, namely $56.41 > 38.16$. After being categorized, the average value of 56.41 in the experimental class is included in the moderately effective category, then in the control class with an average value of 38.16 is included in the ineffective category. Based on these results, it can be concluded that the use of e-modules assisted by smart apps creator with a discovery learning learning model is quite effective in improving self-awareness of the health of the reproductive system of grade XI MAN students.

Manova Test Results

Multivariate Normality Test

The multivariate normality test aims to determine whether the data from each variable is normally distributed multivariate or not. The variables measured are cognitive abilities and self-awareness attitudes towards the health of the reproductive system of students. The results of the multivariate normality test are presented in Table 12.

Table 12. Recapitulation of Multivariate Normality Test Results

Class	Test Type	Sig.	Correlation
Experiment Class Preetest KK dan SKD		0.000	0.951
Control Class Preetest KK dan SKD	Mahalanobis Distance	0.000	0.989
Experiment Class Posttest KK dan SKD		0.000	0.995
Control Class Posttest KK dan SKD		0.000	0.986

Based on table 32, if the correlation coefficient $> r$ table or sig value. < 0.05 then there is a significant correlation. In the experimental class pretest, cognitive ability and self-awareness attitude towards the health of the reproductive system of students have a significance of 0.000 and the correlation coefficient value of 0.951 shows a very high correlation coefficient, meaning that the data comes from a multivariate normally distributed sample. In the control class pretest, cognitive ability and self-awareness attitude towards reproductive system health had a sig. 0.000 and a correlation value of 0.989 indicates a very high correlation coefficient, meaning that the data comes from a multivariate normally distributed sample.

In the posttest of the experimental class cognitive abilities and self-awareness attitudes towards reproductive system health get a sig value. 0.000 and the correlation coefficient value of 0.995 shows a very high correlation coefficient, meaning that the data comes from a multivariate normally distributed sample. In the control class posttest, cognitive ability and self-awareness attitude towards reproductive system health had a sig value. 0.000 and the correlation coefficient value with a value of 0.986 indicates a high correlation coefficient, meaning that the data comes from a multivariate normally distributed sample.

Multivariate Homogeneity Test

Homogeneity of the covariance variance matrix was performed with Box's M Test. Multivariate tests were conducted on pretest scores of cognitive abilities and self-awareness attitudes towards reproductive system health in experimental and control classes. In the posttest cognitive ability and self-awareness attitude towards reproductive system health. The results of the homogeneity test are presented in Table 13.

Table 13. Box's M Test Homogeneity Test Results

Class	Test Type	Sig.
<i>Preeetest</i>	Box's M	0.000
<i>Posttest</i>		0.000

Based on Table 25, it shows that both significance values are less than 0.05 or $0.000 < 0.05$ so it can be concluded that the covariance matrix of the dependent variable is not the same. However, according to Fauziyah & Suyoso (2018), even though it shows rejection of H_0 , the Manova test can still be done by looking at the Pillai's Trace value. Hypothesis testing can be done using the Manova test with Pillai's Trace.

Multivariate Hypothesis Test

Manova test was conducted after the prerequisite tests of multivariate normality and multivariate homogeneity were met. The Manova test results aim to see the effect simultaneously. The Manova test results are presented in Table 14.

Table 14. Manova Test Results

Test Type	Sig. Score
<i>Pillai's Trace</i>	0.000

Based on table 34, the Pillai's Trace test results have a sig value. $0,000 < 0,05$. This means that H_0 is rejected, which means that there is a significant difference in cognitive abilities and self-awareness attitudes towards the health of the reproductive system of class XI students who use and do not use e-modules assisted by smart apps creator. The existence of this significant difference concludes that the use of e-modules assisted by smart apps creator is effective in improving cognitive abilities and self-awareness attitudes towards the health of the reproductive system of grade XI SMA/MA students.

According to the opinion of Chen et al. (2020), the use of e-modules based on android applications is very effective so that it can help students understand learning and gain knowledge and can increase students' knowledge. According to research Ulya (2022), learning using android-based e-modules with the help of smart apps creator is very influential on improving cognitive abilities by looking at learning outcomes.

According to Erghiezha (2016), stated that the use of health e-modules is effective for increasing self-awareness of students' reproductive health. The increase in students' self-awareness occurs when students read the e-module. By increasing the attitude of self-awareness towards the health of the reproductive system, it is expected that students are able to try to be diligent and persevere in learning, with the amount of knowledge that students have about reproductive system health problems, it is expected that students can

maintain the hygiene and health of the reproductive system properly. Adolescent's knowledge about reproductive system health greatly influences the attitude and behavior of students to live a healthy life, especially related to reproductive system health (Mona, 2019).

Conclusion

The e-module assisted by smart apps creator that has been developed meets the feasibility based on the assessment of media experts and material experts. The e-module with smart apps creator is considered very practical by the assessment of biology teachers and students. The application of e-modules assisted by smart apps creator in improving cognitive abilities and attitudes of self-awareness towards the health of the reproductive system of students seen from the results of the Manova test gets a sig. (2-tailed) of $0.000 < 0.05$ with a gain score category effective enough to improve the measured ability. With the conclusion that there are differences in cognitive abilities and self-awareness attitudes towards reproductive health that follow learning using e-modules assisted by smart apps creator and e-modules from the Ministry of Education and Culture.

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This research contributes to learning, in the form of an android-based e-module that can be used by teachers in secondary schools. That can be used by teachers in secondary schools. The author was involved in the whole making of this article.

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Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

References

- Aini, N. (2016). Faktor rendahnya kesadaran remaja tentang kesehatan reproduksi. *Jurnal Keperawatan*, 10(1), 898-909. Retrieved from <https://www.stikeshangtuah-sby.ac.id/wp-content/uploads/2017/08/Jurnal-Ilmiah-Keperawatan-Edisi-Maret-2016-final.pdf#page=43>
- Ananda, L., & Purba, C. B. (2023). Pentingnya edukasi kesehatan reproduksi terhadap remaja. *Jurnal*

- Mahasiswa Kesehatan Masyarakat*, 6(1). Retrieved from <https://ejournal2.uika-bogor.ac.id/index.php/PROMOTOR/article/view/96>
- Antika, A. R., Susila, A. B., & Budi, A. S. (2023). Pengembangan aplikasi e-modul magnitis berbasis android berbantuan software SAC. *Jurnal Prosiding Seminar Nasional Fisika*, 11, 47-54. <https://doi.org/doi.org/10.21009/03.1102.PF07>
- Azwar, S. (2022). *Sikap manusia: Teori dan pengukurannya*. Pustaka Pelajar.
- Chen, M., Wang, S., Chen, Y., Chen, X., & Lin, Y. (2020). Education sciences a preliminary study of the influence of game types on the learning interests of Primary School students in digital games. *Jurnal Edocation Sciences*, 10. <https://doi.org/10.3390/educsci10040096>
- Erghezha, C. (2016). Efektifitas modul peningkatan kesehatan reproduksi terhadap kesadaran diri siswa SMPN se-Kota Malang. *Konsling Indonesia*, 3(1), 16-21. <https://doi.org/10.21067 by>
- Faswita, W., & Suarni, L. (2017). Hubungan pemberian pendidikan seks di sekolah dengan perilaku seksual remaja di SMA Negeri 4 Kota Binjai 2017. *Jurnal Jumanik*, 5(49), 1-16. <https://doi.org/10.30829/jumantik.v3i2.1864>
- Mona, S. (2019). Hubungan pengetahuan dan sikap remaja tentang kesehatan reproduksi dengan perilaku seksual pranikah siswa. *Jurnal Penelitian Kesmasy*, 1(2), 58-65. <https://doi.org/10.36656/jpksy.v1i2.167>
- Mukminun, A. (2022). Pengaruh perilaku berpacaran terhadap perilaku seksual pranikah pada remaja perempuan Indonesia. *Jurnal Kesehatan Masyarakat*, 13, 36-46. <https://doi.org/10.22487/preventif.23>
- Puspitasari, A. D. (2019). Penerapan media pembelajaran fisika menggunakan modul cetak dan modul elektronik pada siswa SMA. *Jurnal Pendidikan Fisika*, 7(1), 17-25. <https://doi.org/10.24252/jpf.v7i1.7155>
- Rahma, M. (2018). Hubungan antara pengetahuan seksualitas dengan perilaku seksual remaja di SMA Negeri 1 Subang. *Jurnal Bidan "Midwife Journal"*, 5(01), 17-25. Retrieved from <https://media.neliti.com/media/publications/234021-hubungan-antara-pengetahuan-seksualitas-25dfe91b.pdf>
- Rodiyatul, A., Muhibbah, S., Alfiandy, & Handoyo, W. (2021). Perilaku seks pranikah pada kalangan remaja di Kota Serang. *Jurnal Al-Shifa*, 2(1), 12-21. <https://doi.org/10.32678/alshifa.v3i1>
- Sidamo, N. B., Kerbo, A. A., Gidebo, K. D., & Wado, Y. D. (2023). Socio-Ecological Analysis of Barriers to Access and Utilization of Adolescent Sexual and Reproductive Health Services in Sub-Saharan Africa: A Qualitative Systematic Review Socio-Ecological Analysis of Barriers to Access and Utilization of Adolescent Sex. *Jurnal of Contraception*, 4. <https://doi.org/10.2147/OAJC.S411924>
- Subali, B. (2016). *Metodologi penelitian pendidikan biologi dan pendidikan sains pada umumnya*. UNY Press.
- Sugiyono. (2016). *Metode penelitian kuantitatif, kualitatif dan R&D*. PT Alfabet.
- Syamsuddin, S. D. (2023). Pengaruh edukasi kesehatan reproduksi terhadap pengetahuan pada remaja pubertas di SMPN 1 Kepala Pitu Tahun 2022. *Midwifery*, 5(1). <https://doi.org/10.24252/jmw.v5i1.35187>
- Uberty, A. (2022). Pendidikan kesehatan reproduksi di sekolah. *Jurnal Abdimas ADPI Sains Dan Teknologi*, 3(3), 12-16. <https://doi.org/10.47841/saintek.v3i3.222>
- Ulya, S. M. (2022). Pengaruh media pembelajaran berbasis android terhadap hasil belajar ranah kognitif dan afektif siswa kelas IV. *Jurnal Ilmiah Wahana Pendidikan*, 8(September), 568-577. <https://doi.org/doi.org/10.5281/zenodo.7068096>
- Wicaksana, E. J., Atmadja, P., & Asmira, Y. (2020). Pengembangan poster kesehatan reproduksi berbasis pendidikan karakter menggunakan canva pada usia remaja sekolah di SMA. *Jurnal Penelitian Dan Pengkajian Ilmu Pendidikan: E-Saintika*, 4(2), 160. <https://doi.org/10.36312/e-saintika.v4i2.215>
- Widoyoko, E. P. (2017). *Teknik penyusunan instrumen penelitian*. Salemba Medika.
- Yao, S. (2023). The impact of chinese sex education on the younger generation: Gender relations , self-awareness , and awareness of sexual protection. *Jurnal of Education, Humanities and Social Sciences*, 8, 1246-1252. <https://doi.org/https://doi.org/10.54097/ehss.v8i.4458>