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The Effectiveness of the Android-Based Interactive Multimedia Integrated Guided Discovery Learning Model on Cognitive Learning Outcomes on Reproductive System Material at SMA N 1 Mayong

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Abstract

Cognitive learning outcomes are one measure of the success of the learning process in the classroom. Knowledge of the reproductive system is important for high school students because it includes knowledge about the reproductive system, the importance of maintaining reproductive health and prevention of sexually transmitted infections. This research aims to examine the effectiveness of an Android-based interactive multimedia integrated guided discovery learning model on cognitive learning outcomes regarding reproductive system material at SMA N 1 Mayong. This research is experimental research using a quasi-experimental design with the type two group pretest-posttest with control design. The population of this study were students of class XI MIPA SMA N 1 Mayong with samples of class XI MIPA 1 (experimental class) and MIPA 2 (control class). The independent variable of this research is an Android-based interactive multimedia integrated guided discovery learning model, the dependent variable is students' cognitive learning outcomes. The results showed that the cognitive learning outcomes of the experimental class were higher than those of the control class. As many as 88.24% of students exceeded the KKM for SMA N 1 Mayong, namely 68, while the control class was 79.41%. The increase in learning outcomes for the experimental and control classes showed moderate results. These results were strengthened by the student response questionnaire who gave positive responses to learning using the Android-based interactive multimedia integrated guided discovery learning model. Based on the research results, it was concluded that the Android-based interactive multimedia integrated guided discovery learning model was effective in improving cognitive learning outcomes regarding reproductive system material at SMA N 1 Mayong.

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INTRODUCTION

Cognitive learning outcomes are the result of acquiring knowledge obtained by students during learning through cognitive activities (Hidayah, 2016). Evaluation of cognitive learning outcomes is an important activity in learning because it aims to find out how much knowledge can be absorbed by students during learning.

The reproductive system is material that is always studied at every level of education. Knowledge about the reproductive system is very important for high school students because it includes knowledge about the reproductive system itself, sexually transmitted infections, and reproductive technology. The knowledge that students already have can provide useful life provisions for them, such as knowing the importance of maintaining the health of reproductive organs, and being able to avoid promiscuity and sexually transmitted infections. For this reason, teachers need to facilitate their students to have good learning outcomes in studying the reproductive system.

Based on the results of interviews with biology teachers at SMAN 1 Mayong, it turns out that there are still many students who have daily test scores below the KKM on reproductive system material. Around 40% of students have not completed their formative evaluation. Based on the opinions of teachers and students, reproductive system material is difficult for students to understand because it is difficult to visualize systems and processes that are easy for students to understand. So students have difficulty understanding concepts and tend to memorize lesson material.

Low cognitive learning outcomes can occur due to several factors. According to Mulyono et al (2017), low cognitive learning outcomes are caused by: (1) students' lack of enthusiasm, (2) students' lack of prior knowledge, (3) students' lack of concentration during learning, (4) learning is ineffective or still uses conventional techniques and (5) Selection of inappropriate learning methods (Asih, 2018). So student readiness and the learning methods used are determining factors for the success of learning in class.

The guided discovery learning (GDL) learning model offers learning that can enable students to understand concepts with high and long-lasting thinking abilities because students are involved in discovering the concept (Asri, 2015). GDL is a discovery learning model that centers on students' mental processes of learning new concepts by connecting and developing students' previous concepts under teacher guidance (Wibowo, 2019). GDL can produce meaningful learning for students because students build their knowledge by discovering new concepts based on information that students already have in their memory. There are 5 learning steps in GDL, namely orientation, hypothesis generation, hypothesis testing, conclusion, and regulation (Veerman, 2013).

According to Purwanto (2021) the GDL model requires appropriate learning resources in carrying out exploration to find concepts. Teachers need to facilitate their students with learning resources that they can use independently and are rich in information.

According to Munir (2013), interactive multimedia offers the advantage of being a communicative and interactive learning resource. Interactive multimedia is communicative, because it contains more than 1 type of media. Users can obtain information in visual form; audio; text; etc., so that users can more easily understand what information is contained in interactive multimedia. Apart from that, this media is interactive, because it has a control system that allows users to access the elements in it according to their wishes. Users can access which parts of the multimedia will be displayed on their monitor (Rukimin & Koderi, 2015). So according to Sujono (2017) students can access it according to their learning speed and it is easier to choose which material they want to study.

According to Amirullah (2017), in the era of ICT development, mobile devices can be an alternative for use as learning media. Media with mobile devices has the advantage of being very flexible because it can be accessed whenever and wherever the user is.

Interactive multimedia can be flexibly used on various specific digital devices such as the Android operating system. Making interactive multimedia must adapt to the format of the digital device used. Arliza et al (2019) stated that Android-based interactive multimedia has several advantages, including: (1) flexible to use wherever and whenever students want. (2) the price of an Android smartphone is relatively affordable for students, so most students already have one.

RESEARCH METHOD

This research uses quantitative analysis with a quasi experimental design with the type two group pretest-posttest with control design. The experimental class was given treatment in the form of learning using the guided discovery learning (GDL) model which was integrated with Android-based interactive multimedia, while the control class used the guided discovery learning model with power point and video media.

The research was carried out at SMA Negeri 1 Mayong with the address Jalan Raya Jepara-Kudus KM. 20. Sengonbugel Village, Mayong District, Jepara Regency. The research was conducted in April 2023 - May 2023 in the even semester of the 2022/2023 academic year using the 2013 curriculum.

The population of this study were all class XI students majoring in Mathematics and Natural Sciences at SMAN 1 Mayong. Sample selection was carried out using a purposive random sampling technique with the results being class XI MIPA 1 students as control subjects and class XI MIPA 2 students as experimental subjects.

This research uses 2 instruments, namely a test instrument and a non-test instrument. The test instrument used is 20 multiple choice questions to measure students' cognitive learning outcomes. Meanwhile, the non-test instrument is in the form of a student response questionnaire to determine student responses during learning. The questionnaire uses a Likert scale containing 4 questions with 4 answer choices, namely (1) strongly agree, (2) agree, (3) disagree, (4) strongly disagree.

Analysis of students' cognitive learning outcomes was carried out by calculating classical completeness and the N-gain test. The experiment is said to be effective if the classical class completeness reaches 80% with a KKM of 68 and the N-gain results reach the medium category. Meanwhile, analyzing student questionnaire responses was carried out by measuring the percentage of each question on the questionnaire.

RESULTS AND DISCUSSION

Data on students' cognitive learning outcomes were obtained from pretest and posttest scores with multiple choice questions on reproductive system material totaling 20 questions. The results of the classical completeness analysis of students' cognitive learning outcomes data can be seen in Table 1.

	N	Min	Max	Mean	Completeness
Pretest Experiment	34	25	65	41.76	-
Experiment Posttest	34	60	100	80.29	88.24%
Control Pretest	34	20	65	41.17	-
Control Posttest	34	60	95	76.32	79.41%

Table 1 Results of classical completeness analysis

To determine the increase in students' cognitive learning outcomes, the N-gain test was carried out using the average data from the posttest results. The N-Gain test results can be seen in Table 2.

	N-Gain Score	N-Gain Category
Experimental Group	0.67	Medium
Control Group	0.60	Medium

Table 2 N-Gain test results data on student cognitive learning outcomes

The N-gain test results showed a score of 0.67 in the experimental class and 0.60 in the control class. After being assessed using the N-Gain level criteria, the experimental and control groups have the same category, namely medium.

Student response data was obtained from a questionnaire containing 4 questions with 4 answer choices, namely strongly agree, agree, disagree and strongly disagree. The results of data analysis of student responses can be seen in Table 3.

No	Question	Results
1	I find it easy to master the concept of the reproductive system with the guided discovery learning model integrated with Android-based interactive multimedia.	78.68%
2	I find it easy to understand information in Android-based interactive multimedia.	79.41%
3	I find it easy to find information in Android-based interactive multimedia.	77.94%
4	I feel that Android-based interactive multimedia is flexible to use anytime and anywhere.	80.88%

Table 3 Results of data analysis of student responses

This research examines the effectiveness of the Android-based interactive multimedia integrated guided discovery learning (GDL) model on the cognitive learning outcomes of students at SMAN 1 Mayong.GDL is a discovery learning model that centers on students' mental processes of learning new concepts by connecting and developing students' previous concepts under teacher guidance (Wibowo, 2019). The GDL model requires learning resources for student exploration in discovering concepts. According to Munir (2013), interactive multimedia offers the advantage of being a communicative and interactive learning resource for students.

Based on the research results, it can be seen that learning using the Android-based interactive multimedia integrated GDL model can improve students' cognitive learning outcomes, because the classical completeness of the experimental class reached more than 80%, namely 88.24% and the N-gain test results

reached the medium category with N-gain score of 0.67. The results show that there is a difference in the average posttest results and a better difference in completeness compared to the control class.

The GDL learning model can make it easier for students to understand concepts in the reproductive system. Based on the results of student responses, on average students found it easy to master the concept of the reproductive system using the Android-based interactive multimedia integrated GDL learning model with a response percentage of 78.68%. In the GDL model, there is a concept discovery process withconnecting and developing students' previous concepts (Wibowo, 2019). This kind of learning is a characteristic of meaningful learning. In this type of meaningful discovery learning, students build their knowledge by discovering new concepts based on information that students already have in their memory (Rahmah, 2013).

Students discover concepts under the guidance of the teacher. In the learning process, the teacher guides students by asking questions or statements to build their knowledge step by step until students obtain complete knowledge (Yerimadesi & Kristalia, 2021). Giving questions and statements is the orientation stage in GDL. The teacher also plays a role during the conclusion stage. At this stage the teacher and students provide conclusions about the new concepts that students have discovered. Apart from that, the teacher also discussed several students' hypotheses that were not quite right. Based on Vygotsky's zone of proximal development (ZPD) concept, learning is more effective if students work on a task with a challenge that is slightly above their ability, but can still be completed with the teacher's guidance (Schunk, 2012).

The questions and statements given by teachers to students at the orientation stage aim to ensure that the process of assimilation and accommodation occurs in students. According to Piaget, cognitive development occurs through a process of balance (Equilibration) between existing schemata and new information (Hergenhann et al, 2008). When there is a mismatch between schemata and new information, individuals seek balance through accommodation and assimilation. If at the hypothesis generation and hypothesis testing stages students can provide the correct hypothesis, then the assimilation process occurs. If at this stage students make a wrong hypothesis, an accommodation process will occur.

Questions and statements given by teachers to students can also be intentional to give rise to cognitive conflicts in students. According to Piaget, cognitive conflict that occurs as a result of disequilibrium plays an important role in encouraging students' cognitive development (Schunk, 2012). Disequilibrium can trigger cognitive conflicts that encourage students to seek ways to resolve discrepancies in their understanding. Resolving cognitive conflicts that arise is carried out under the guidance of the teacher at the conclusion stage where the teacher discusses the student's incorrect hypothesis at the hypothesis generation stage.

According to Purwanto (2021), the GDL model requires appropriate learning resources to make it easier for students to explore to discover new concepts. This research uses Android-based interactive multimedia as a student learning resource. According to Surjono (2017), interactive multimedia is a combination of more than one media, namely in the form of text, video, images, etc. which have integration and synergy between the media which can be accessed via digital devices as a conveyor of certain messages or purposes and has interactivity with its users. Multimedia can be used in constructivist learning because it can provide independent learning, collaboration and active participation (Neo et al, 2009; Malik & Agrawal, 2012).

Rasmani et al (2023) stated that interactive multimedia can make it easier for students to understand the information conveyed in learning media. This is in line with student responses, namely that on average students find it easy to understand information when using Android-based multimedia with a response percentage of 79.41%. According to Munir (2013) and Surjono (2017), interactive multimedia has the advantage of being communicative because it is composed of a combination of more than one type of

media that is integrated and synergistic. Users can obtain information in visual form; audio; text; etc., so that users can more easily understand what information is contained in interactive multimedia (Handaru et al, 2020).

According to Pangesti et al (2022), interactive multimedia is easy to operate because there are control or navigation buttons. According to Rukimin & Koderi (2015), with navigation, interactive multimedia can be controlled freely by the user. Users can access which interactive multimedia parts will be displayed on their monitor. Based on student responses, on average students find it easy to find information when using Android-based interactive multimedia with a response percentage of 77.94%. According to Sujono (2017), interactive multimedia can be used according to students' learning speed and it is easier to choose which material students want to learn.

Arliza et al (2019) stated that Android-based learning media has the advantage of being flexible to use wherever and whenever the user wants. This is in line with student responses, namely that on average students feel that Android-based interactive multimedia can be used flexibly whenever and wherever they want with a response percentage of 80.88%.

In the experimental class there are still 4 students who have not finished. If we look at the student response data, the four students agree with the statements about learning in this research, with an average response percentage of 75% in the good category. So it can be interpreted that the four students did not have problems with the learning model in this research. Low learning outcomes are not only caused by learning models that do not match student characteristics. According to Dalyono (2015), low learning outcomes can be caused by 2 factors, namely: (1) internal factors, and (2) external factors. Internal factors include intelligence, talent, interests, motivation, mental health factors and special types of students. Meanwhile, external factors include family factors, teachers, facilities and infrastructure, and the social environment.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the guided discovery learning (GDL) model integrated with Android-based interactive multimedia is effective in improving students' cognitive learning outcomes at SMAN 1 Mayong. Effectiveness can be seen from the results of classical completion which reached more than 80%, namely,88.24% and the N-gain test results reached the medium category with an N-gain score of 0.67.

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