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Development of Problem-Based Health Education Media to Improve Students' Reasoning and Physics Concepts Mastery

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Abstract: Health education is the main focus in fostering students. This is a fundamental part of starting a healthy life in an educational environment. This study aims to develop a valid and effective problem-based health physics learning tool. The object of the research was FIK students who took the Health Education course as many as 49 students of Class A as the experimental class and 39 students of Class B as the control class. The method used is Research and Development with a pretest-posttest control group design. The results showed that the problem-based health physics learning device that had been tested by three experts was feasible to be applied in classroom learning. The N-gain of the experimental class students' reasoning was 0.6 and the control class was 0.3, while the N-gain of the experimental class students' conceptual mastery was 0.55 and the control class was 0.43. Furthermore, it can be concluded that the use of problem-based health physics learning tools is effective for improving students' reasoning and mastery of concepts

Keywords: health education, reasoning physics concept, concept mastery.

Abstrak: *Pendidikan kesehatan menjadi fokus utama dalam membina peserta didiknya. Hal tersebut menjadi bagian fundamental untuk memulai hidup sehat dilingkungan pendidikan. Penelitian ini bertujuan untuk mengembangkan perangkat pembelajaran fisika kesehatan berbasis masalah yang valid dan efektif. Objek penelitian dilakukan pada mahasiswa FIK yang mengambil mata kuliah Pendidikan Kesehatan sebanyak 49 mahasiswa Kelas A sebagai kelas eksperimen dan 39 mahasiswa Kelas B sebagai kelas kontrol. Metode yang digunakan yaitu Research and Development dengan desain pretest-posttest control group design. Hasil penelitian menunjukkan perangkat pembelajaran fisika kesehatan berbasis masalah yang telah diuji oleh tiga ahli layak untuk diterapkan dalam pembelajaran di kelas. N-gain penalaran mahasiswa kelas eksperimen adalah 0,6 dan kelas kendali 0,3 sedangkan N-gain penguasaan konsep mahasiswa kelas eksperimen adalah 0,55 dan kelas kendali 0,43. Sehingga dapat disimpulkan penggunaan perangkat pembelajaran fisika kesehatan berbasis masalah efektif untuk meningkatkan penalaran dan penguasaan konsep mahasiswa*

Kata kunci: *pendidikan kesehatan, penalaran konsep fisika, penguasaan konsep.*

▪ INTRODUCTION

The COVID-19 pandemic has lasted for almost three years in Indonesia with the number of infected people reaching 5.7 million people and causing 150 thousand people to die. The outbreak of a new variant of the SARS-CoV-2 Omicron virus caused the third wave of COVID-19 cases to occur in Indonesia since the end of January 2022. In response to this emergency, the government decided to continue the policy of Implementing Restrictions on Community Activities (PPKM) proportionally throughout Indonesia taking into account developments in daily cases and the readiness of an area's medical services. This aims to reduce the spread of COVID-19 through restrictions on

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mobility and community interaction while taking into account the sustainability of economic activity which is gradually recovering.

The effectiveness of handling the COVID-19 pandemic is highly dependent on people's behavior. Without discipline in implementing health protocols, the spread of the coronavirus will be very difficult to control. The emergence of new variants with a faster deployment rate is also a challenge that must be a concern for all parties. On the other hand, the government continues to strive for acceleration and expansion of vaccination targets. Since mid-December 2021, the government has started implementing a COVID-19 vaccination program for children aged 6-11 years.

This policy is a follow-up step from the previous COVID-19 vaccination that has been given to residents aged 12 years and over. Apart from efforts to provide vaccines by the government, public participation and awareness are also very much needed. Several policies that have been taken by the government appear to be bearing fruit. Economic activity has slowly started to strengthen in some areas. Until the arrival of the third wave of COVID-19, the daily cases seemed to be getting more and more sloping. However, some challenges still have to be faced to free Indonesia from COVID-19. In addition to public awareness and behavior, health education factors also need attention, especially Health Education which is applied in the education sector (BPS RI, 2021).

Health education is the main focus of education units in fostering their students. The reason is that health education is fundamental to starting a healthy life in an educational environment. Health education is an effort that is given in the form of guidance and or guidance to students about health which includes all aspects of personal health (physical, mental, and social) so that their personality can grow and develop properly through curricular and extracurricular activities. The goal to be achieved from health education is that students can apply Clean and Healthy Behavior in the educational environment. In addition, they are also expected to have skills in carrying out matters relating to maintenance, assistance, and health care in the school environment.

Based on the results of an initial questionnaire to FIK Class A students, it was found that around 30% of students came from non-science majors and 50% of students stated that physics in high school was difficult. This is to Gok and Siley's research (Desa et al., 2018) Physics learning outcomes are always lower than in other fields, this is because physics is considered one of the subjects that are difficult to understand by some students so students are less interested in studying physics. Health Education material in physics concepts, understanding, reasoning, and mastery of concepts and principles are needed to solve problems (Miriam, 2020). The reasoning ability that has not developed is due to the tendency of teachers to develop more learning by providing as much material as possible in the hope that students can master and apply the knowledge gained (Gunawan, 2016).

According to Leibman (Krisdiana, 2016), Learning knowledge should be related to the real world and explained how it is applied. Without this, it can lead to a lack of motivation to learn. One of the efforts to motivate students is the existence of contextual teaching and evaluation of the learning process (Rohim et al., 2021). The contextual learning model in question is a problem-based learning model (PBM). According to (Fahkrudin, 2013) PBM is built on four underlying principles, namely constructive, independent, collaborative, and contextual learning

The success of a lesson will depend on the preparation of a teacher. Without good planning, learning will not run smoothly and the results will not be as we expected (Fitri et al., 2020). The learning tools used must of course continue to be developed so that they can continue to produce innovations in learning. The learning device developed in this study is a problem-based Health Education learning tool with the concept of health physics

▪ METHOD

Participant

Field trials were conducted using a pretest-posttest system for the experimental class and the control class. 49 FIK Class A students were selected as the experimental class and 39 FIK Class B students were selected as the control class.

Research Design and procedures

The research development design consists of a 10-step Borg & Gall development model (Citrawati et al., 2018) These ten steps can be seen in Figure 1

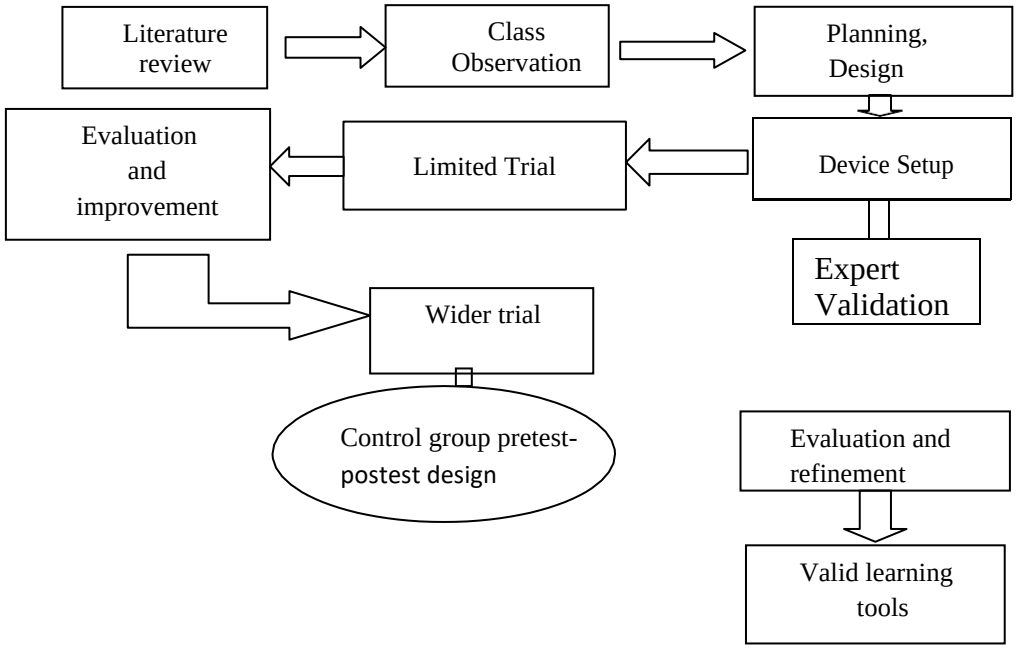

Figure 1. Borg & Gall development research design (citrawati et al., 2018)

Instrument

The first meeting was used for a pretest of reasoning and mastery of concepts as well as the introduction of learning models for 90 minutes. The second, third and fourth meetings each for 120 minutes for the learning process, and the fifth meeting is used for post-test reasoning, mastery of concepts, and a questionnaire of interest in learning for 90 minutes.

Data Analysis

The data collection instruments in this study were learning device validation sheets, learning implementation observation sheets, learning interest questionnaire

results sheets after learning, and pretest and posttest sheets of reasoning abilities and mastery of concepts. Data analysis techniques for the feasibility of the learning tools developed were assessed by three. The assessment of the implementation of the teaching syntax phases using learning tools is carried out by three observers who have been trained so that they can operate the observation sheet correctly. The three observers are permanent lecturers at FIK, Medan State University.

For assessment tools, in addition to being validated in theory, they must also be empirically validated. Empirical validation consists of item validity and reliability. Field test analysis consisted of normality tests, difference tests, improvement index, and questionnaire data. Test the normality of the data using the Chi-square test (Russell et al., 1998). Test the difference between the experimental class and the control class using the two-sample Kolmogorov-Smirnov test (Razali & Wah, 2011). The index of increasing the results of the reasoning test and concept mastery test is calculated using the gain score formula (Hake, 1998)

▪ RESULT AND DISSCUSSION

The results of the validation assessment of learning tools consisting of the syllabus, lesson plans, teaching materials, student worksheets, and complete assessment instruments can be detailed as follows :

The results of the validation of learning tools, namely the syllabus, have an average of 3.7 with good categories and valid criteria. RPP has an average of 3.6 with a good category and valid criteria, Teaching Materials with an average of 3.7 with a good category and valid criteria, LKM with an average of 3.6 with a good category and valid criteria, Interest Questionnaire with an average of 3.7 with good categories and valid criteria, Reasoning Questions with an average of 3.9 with good categories and valid criteria and Problem mastery of concepts with an average of 3.8 with good categories and valid criteria. So it can be concluded that all the results of the validation of learning tools have good categories and valid criteria.

From the normality test, it was found that all pretest and post-test data on reasoning and mastery of the experimental class and control class concepts were not normally distributed so the different tests used were using non-parametric statistics, namely the Kolmogorov-Smirnov test.

Table 1. Different tests of reasoning ability and concept mastery of experimental class and control class

Test	Class	Pretest	K_D count	K_D table	Criteria	Post-test	K_D count	K_D table
Reasoning	experiment control	62.71 51.75	0.267	0.292	No different	84.59 67.13	0.388	0.292
Concept Mastery	experiment control	37.94 35.97	0.258	0.292	No different	70.92 57.92	0.40	0.292

From Table 1, it was found that before learning the reasoning abilities and mastery of concepts in the control class and experimental class students were not different, but after learning the experimental class students' reasoning abilities and mastery of concepts were different from those of the control class.

The results of the student's reasoning abilities in the control class and the experimental class can be seen in Figure 2.

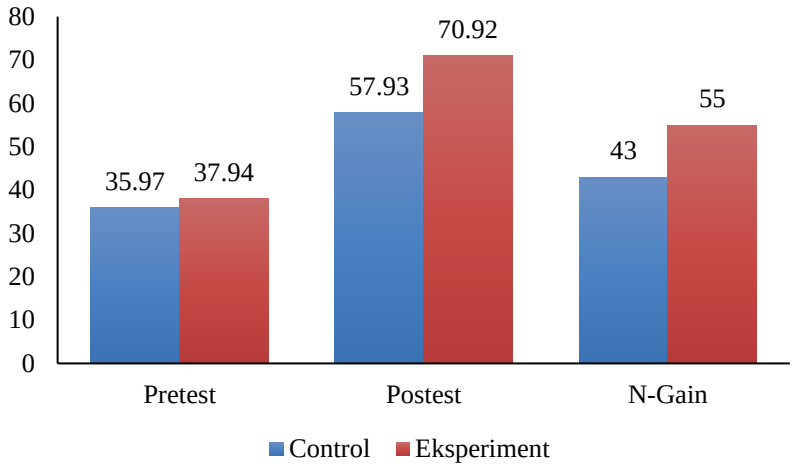

Figure 2. Graph of pretest, posttest, and n-gain (%) student reasoning

The average pretest scores for the control and experimental class students were 51.75 and 62.71, while the post-test scores were 67.13 and 84.59. For normal gain control and experimental classes are 0.31 and 0.60. It can be concluded that the increase in the reasoning ability of the experimental class students is higher than the control class

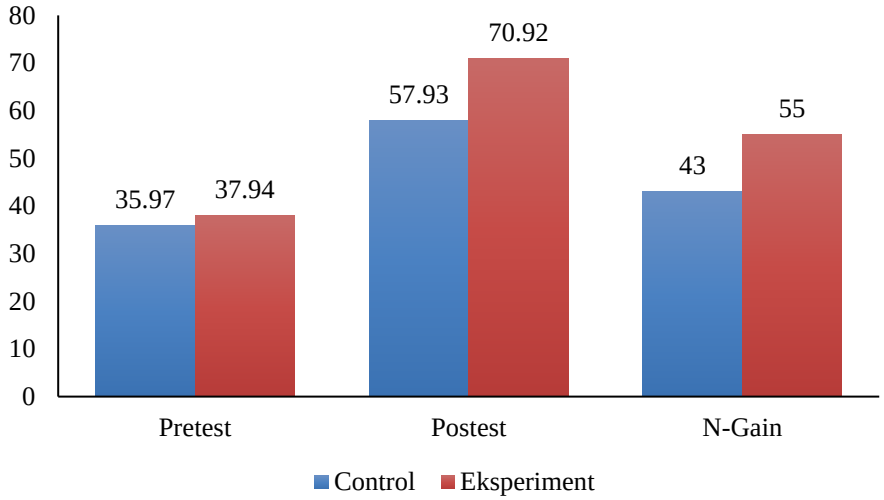

Figure 3. Graph of pretest, posttest, and n-gain (%) mastery of student concepts

The average pretest scores for the control and experimental class students' conceptual mastery abilities were 35.97 and 37.94, while the posttest scores were 57.93 and 70.92. The percentage of normal gain for the control class and the experimental class is 0.43 and 0.55. It can be concluded that the increase in the concept mastery ability of the experimental class students is higher than the control class. In health physics lectures on thermophysics, students are given four problems related to real and

contextual life, namely about children suffering from fever, people suffering from typhoid fever, breast cancer testing with thermography, and physiotherapy on soccer players who have knee injuries. Next, the students submit the problem formulation. Then students work in groups to find information about problem-solving from textbooks and the internet and present the results of solving the problem.

According to (Nurdin, 2017) The problems used in PBM are the starting point for the process of integrating the knowledge that students already have with new knowledge. According to (Surya, 2012) The problem is used as a starting point for learning and the problem is real and contextual (Anderson & Glew, 2002) said that the involvement of students in discussing real problems will hone their ability to find the best solution to the problem by using appropriate learning resources. Students in the PBM group actively seek information, access learning materials, and communicate the knowledge they get to other students. Support for each group member is needed to help overcome problems in the topics discussed (Tsui et al., 2007). From research results (Zakaria & Iksan, 2007) the learning process is more effective if they work together with other students in doing assignments. According to (Rohim et al., 2021) that learning together can improve students' understanding of course material, communication, teamwork, and self-confidence.

Lectures designed in PBM are expected to train students' thinking and reasoning skills because during the lecture process students are trained to focus, collect information, remember, understand, analyze, conclude, integrate and evaluate (Citrawati et al., 2018). (Ko et al., 2010) said that PBM can develop thinking skills, including the ability to think critically, analyze and solve complex problems. This is also supported by Arends (Ten Brink et al., 2004) that PBM is designed primarily to help students develop thinking skills and problem-solving skills. From the results of the study, it was found that the increase in the reasoning ability of the experimental class students was higher than the control class. The results of the study are by the research (Fahkrudin, 2013) which states that there is an increase in clinical reasoning ability in midwifery and nursing students after problem-based learning. According to Ibrahim and Nur (Ibrahim & Nur, 2000), PBM can stimulate high-level thinking students who are oriented to real problems. The ability to solve problems is needed to face the challenges of life in the real world.

The ability of students to analyze a problem requires thinking skills. With the thinking skills they have, students can select and sort out the appropriate and necessary information. According to Liliasari (Mulyani et al., 2016), Thinking skills are always evolving and can be learned. According to (Umar, 2010) PBM can encourage students to do metacognitive thinking, which means reflecting on their thoughts on something and then improving the process that is carried out. This thinking is useful for finding solutions to problems, and seeking and finding information related to the problem. From the results of the study, it was found that the increase in mastery of the concept of the experimental class was higher than the control class. These results are by the research (Saudavel, 2012) stated that there had been an increase in student achievement in midwifery and nursing after problem-based learning. This is in line with Russman's opinion (Rusman et al., 2010) which states that PBM encourages students to gain knowledge and mastery of the essential concepts of the course material.

According to Amir (Amir, 2009), Problem-based learning can improve students' mastery of concepts about what they are learning so that it is hoped that they can apply it in real conditions in everyday life. When the PBM learning model is applied, students better understand the concepts being taught because they discovered the concept. Students not only get information about the material being taught but also build their concepts to form a complete knowledge structure.

▪ CONCLUSION

Characteristics of valid problem-based Health Education learning tools in health physics are (1) problems are used as the beginning of learning; (2) the problem is real in the health sector and is related to the physical sciences; (3) the problem challenges students' knowledge to be able to develop their thinking skills so that they can solve the problem; (4) learning is carried out independently, collaboratively, communicatively and cooperatively; and (5) utilizing various sources of knowledge, not from one source only. The application of problem-based health physics learning tools is effective for improving students' reasoning skills and mastery of concepts. This has been proven from the results of the different tests of students' reasoning ability and concept mastery that there was a difference after learning between the experimental class and the control class, and an increase in the N-gain of the experimental class students' reasoning ability and concept mastery compared to the control class.

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