

Utilization Isomorphic Physics (FORFIS) Application to Improve Physics Analogical Transfer Skill of Senior High School Students

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Abstract— The ability to apply old knowledge into solving new problems encountered can facilitate the problem-solving process. Even so, the survey results indicate a lack of ability of students to analyze and solve similar problems. The purpose of this study was to determine the effect of using the Isomorphic Physics (FORFIS) application in improving students' analogical transfer skills. The method used was quasi-experimental with pretest-posttest control group design. The data analysis technique used is Anava mixed Design with the General Linear Model. The analysis results show the value of sig. <0.05 with the average difference between the experimental class and the control class at 11.03*. These results indicate that the use of the FORFIS application in physics learning can improve students' analogical transfer skills.

Keywords—*isomorphic physics (FORFIS) application, analogical transfer skill*

I. INTRODUCTION

The learning is an interaction between students, teachers and learning resources in an environment. The process of implementing learning activities will empower all potentials that are the objectives of these activities. Some factors that influence success in achieving learning goals are methods, strategies and learning approaches, and learning resources used [1]. Learning resources that can be used to achieve learning goals, one of which is learning media. A learning media can function as a source of learning material information as well as to train the abilities possessed by students. One of the problems of education in remote areas is the absence of teaching educators in schools [2]. Therefore, educators must be able to create a learning atmosphere that simplifies students [3].

Technology products that are popular in the community, especially students and can also be used as a learning media are smartphones. The smartphone base in the most widely used among people today, namely the type of android. The advantages of an Android-based smartphone are the ease of access and pleasure offered. This advantage makes students tend to like the use of android [4]. Android-based learning media is considered as one of the XXI century learning styles [5]. The utilization of Android-based smartphones in physics

learning can provide various facilities for students. The convenience provided makes students learn anytime and anywhere [6]. Learning activities anytime and anywhere can be realized by utilizing interesting android applications [7], [8]. Utilization of android applications in learning can improve the various abilities of students. Some of them are academic performance [1], learning motivation [5] ability of mathematical representation and interpretation of electrical circuit [9].

Education has a purpose to help students in applying the knowledge they have learned to new problems encountered in the future [10], [11]. This activity is known as problem-solving activities that are based on experiences that have been encountered. One indicator of problem-solving that is often the difficulty of students in physics learning in the analogical transfer activity. Difficulties experienced by students due to analogical transfer activities involve only several numbers of principles and concepts summarized in the mathematical form [12]. This analogical transfer activity not only helps students learn physics [11], [13] but is also very helpful in solving problems like experts [14].

This is in line with the opinion of the expert, that is, the analogical transfer is the ability to transfer problem-solving knowledge that has been encountered to solve the new problem [15]–[19]. Transferable problems can also have different features between problems [20]. Although there are differences in features, the solution to the problem is the same [21]. The application of analogical transfer requires similarities [18], and connections between pairs of problems [19]. Analogical transfer activities can be used to solve new problems encountered. The similarity in question is a structural relationship [10], [22], methods or procedures used in solving problems [23], [24], dan also uses the same principles and concepts. While the connection between problems is useful as an effective guide to solving new problems [19]. Analogical transfer in physics is an interesting thing because it only uses principles and concepts that are developed into concise mathematical forms [17], [25]. A problem that has been encountered can be used as a source of information. Reeves & Weisberg [26] revealed the criteria for utilizing the previous

problem by: (1) being reminded of the problem, (2) comparing the problem, and (3) evaluating the effectiveness of the transfer.

The success of analogical transfer depends on how knowledge is obtained [20]. Through the activity of comparing pairs of similar problems, it can train students to learn physics principles [27]. Besides, when resolving a new problem, students spontaneously carry out analogical transfer activities [18] so that a pattern of analogical transfer is formed in each student. The analogical transfer activity not only creates relationships between problems but also can obtain new information that is more concrete and easy to understand [28]. In addition to facilitating understanding, the ability to analogical transfer can make it possible to draw conclusions and apply problem abuse in situations that are not directly addressed [10]. This ability is influenced by the knowledge possessed, the structure of knowledge constructed, and the context of the knowledge learned. Although this ability can be assessed in a real way, basically the analogical transfer occurs through the subconscious of students. So, often students do not consciously use prior experience (analogy) when solving problems [22]. The analogical transfer can be trained regularly so students become accustomed when solving new problems. In order, a problem to be resolved properly, it must go through certain stages. Polya in his book presents four steps to solving problems [29], including (1) understanding the problem, (2) planning problem solving, (3) carrying out problem-solving, and (4) checking results.

Based on the results of interviews with teachers and classroom observations in one of the State High Schools in Yogyakarta, information was obtained that students had the same tendency when solving problems. The tendency consists of the mathematical representation skill, the analyze skill and the analogical transfer skill that are still low. Also, based on the value of the final semester exam in the class observed, the average score of student learning outcomes is 57. The results of this value can be considered as representing the students' analogical transfer skill because some of the questions given are type of problem-solving.

The use of periodic problem-solving stages can build experience in using more appropriate solutions. One of the important things needed by students to practice solving a problem is learning media. The android application in the field of physics that can be utilized is the Isomorphic Physics (FORFIS) Application. This application contains examples of questions, practice questions, and quizzes related to material momentum and impulses. Examples of questions contained in the FORFIS application contain discussions that are following problem-solving steps. This application can be used to measure students' analogical transfer skills [17]. Because this application contains steps to solve problems, it can be applied in learning. The ability measured in this study is the students' analogical transfer of physics.

II. METHODS

This research is a type of quasi-experimental research with a pretest-posttest control group design method. The samples involved in this study were students of class X MIPA 1, and X MIPA 2, SMA Negeri 6 Yogyakarta. Each class is an experimental class using different media. Class X IPA 1 uses the FORFIS application media which is an experimental class. While class X MIPA 2 is a control class. Respondents involved in this study numbered 57 students.

The research data was obtained from the result of the pretest dan posttest. The type of test given is a description related to material momentum and impulses. The aspect of analogical transfer skill in this study is adjusted to the steps of problem-solving, namely identifying, strategy, implementing strategies and conclusions. Data from the results were analyzed using the General Linear Model mix Anava technique. The aim is to analyze the increase in analogical transfer ability after the implementation of learning. The hypothesis in this study is, H0 is accepted if the value of the experimental class students is less than or equal to the value of the control class students. While H0 is rejected if the value of experimental class students is greater than the value of the control class students.

III. RESULTS AND DISCUSSION

The learning process is carried out by the physics teacher of SMA 6 Yogyakarta with teaching methods and strategies used as used by the teacher. In the experimental class, the FORFIS application was given as a learning medium. The material taught is momentum and impulse in class X. The meeting was divided into 3 meetings according to the subdivision of material namely, the first meeting was taught momentum, impulse and relationship between them, the second meeting was taught momentum conservation law material and the third meeting was taught collision material. The study was conducted to determine the effect of the media used. The steps to implementing learning in the experimental class start from giving pretest, explanation of concepts, examples of questions, practice questions and quizzes, and giving posttest to students. This experimental design can be seen in Table 1.

TABLE I. EXPERIMENTAL DESIGN

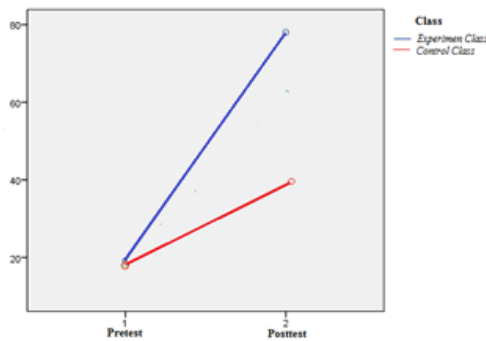
Class	Pretest	Treatment	Posttest
Experimental Class	O ₁	X	O ₂
Control Class	O ₁	-	O ₂

Data form the research result was analyzed to determine the effect and improvement of the students' analogical transfer skill after using learning media in the form of FORFIS applications. The results of the analysis of the effect of using FORFIS applications in learning are presented in table 2. The results obtained showed a comparison of the mean values of the experimental group and the control class of 11.03* with a significance of 0.000. These results indicate that there are differences in the effect of using the FORFIS application in the experiment class. The graph of increasing students' physics

analogical transfer skills in the experimental class dan control class after learning is presented in Figure 1.

TABLE II. RESULT OF THE EFFECT OF USING FORFIS APPLICATION

Class		Mean Difference (I-J)	Sig.
Experimental Class (I)	Control Class (J)	11.03*	.000



Graph of increasing students' physics analogical transfer skill

The students' physics analogical transfer skills start from the same point, namely at ± 20 . This means that the experimental class and the control class have the same initial skill. After the implementation of learning in the classroom, the results of an increase in the students' analogical transfer skills using the FORFIS application had an increase compared to the control class. The final value of the students' of physics analogical transfer skill in the control class is ± 40 . Unlike the case with the class that uses the FORFIS application media in its learning. The final value obtained is ± 80 . Based on Figure 1, it is known that the final score of students in the experimental group is greater than the final value of the control class students. This means that H_0 in this study was 'rejected'. Thus, the FORFIS application effective to use to improve students' physics analogical transfer skills.

Overall, the results of the analysis show that the use of FORFIS applications in physics learning can improve students' analogical transfer skills. The result of the analysis obtained that the FORFIS application is influential in improving the students' physics analogical transfer skill. Based on learning in the classroom, one of the factors that influence the improvement of students' analogical transfer skill is the ease of obtaining media. The use of the FORFIS application in learning makes it easy for students to make it easier for students in learning activities. The results of observations in the classroom when the teacher taught showed that all students in the experimental class using the FORFIS media application brought a smartphone that was installed by the FORFIS application. Carrying a smartphone means that students also carry the FORFIS application. Smartphones as one of the technologies that cannot be separated from the grip can help students to learn anytime and anywhere. Apart from that, smartphones a tool to use learning applications can be utilized in learning depending on the willingness of the students themselves. Thus, it can be concluded that the FORFIS application is very helpful in improving analogical transfer

skills because when students work on practice questions, they can easily transfer problems that have been encountered.

The response of students after using the FORFIS application in learning illustrates that student feel helped in problem-solving, and require the FORFIS application as a learning medium. Through questionnaire data, the response of students to the use of the FORFIS application shows that students feel helped in solving problems. On average there are 28 students take part in learning using the FORFIS application. All students answered that the FORFIS application was very helpful in solving problems. This means that the FORFIS application makes it easier for students to solve new physics problems encountered. Furthermore, on average there are 24 students answer the FORFIS application they need in physics learning, especially in material of momentum and impulses

IV. CONCLUSION

This study concludes that the use of the FORFIS application as a medium for physics learning, especially in the matter of momentum and impulses, can improve the students' physics analogical transfer skills. Factors that influence the increase in the students' physics analogical transfer skill are the ease of obtaining learning resources and helping to solve new problems encountered. Thus, the FORFIS application which contains material of momentum and impulse can be utilized in physics learning at school.

The use of FORFIS applications in physics learning must pay attention to several things including, (1) the FORFIS application can only be applied to classes where all students have an Android-based smartphone; (2) installation of applications must be done outside of learning activities; and (3) teachers must master the FORFIS application. The disadvantage of using the FORFIS application is that the teacher must ensure that all students have installed the FORFIS application before the learning process.

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