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The Effect of Problem Based Learning Integrated E-Books to Improve Learning Motivation in Physics for High School Students

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Abstract: The Effect of Problem Based Learning Integrated E-Books to Improve Learning Motivation in Physics for High School Students. Objectives: This study aimed to determine the effect of problem based learning integrated e-book to increase physics' learning motivation of high school students. **Methods:** A quasi-experimental design with a pretest-posttest control group design. The research sample was taken using a random sampling technique. The sample consisted of 68 students in grade XI of State Senior High School in Randudongkal, Indonesia. They were divided into two classes, namely 34 students in the experimental class and 34 students in the control class. The students' learning motivation was measured through a questionnaire instrument based on the ARCS aspect through the google form. **Findings:** The results of the paired t-test analysis of motivation to learn physics in the experimental class showed a significant value with the sig 0.000. **Conclusion:** This showed that the use of e-books was effective in increasing students' motivation to learn physics.

Keywords: physics' e-book, problem based learning, physics' learning motivation.

Abstrak: Pengaruh E-Book Terintegrasi Problem Based Learning untuk Meningkatkan Motivasi Belajar Fisika Peserta Didik SMA. Tujuan: *Penelitian ini bertujuan untuk mengetahui pengaruh e-book terintegrasi problem based learning untuk meningkatkan motivasi belajar fisika peserta didik SMA.* ***Metode:*** *Metode penelitian yang digunakan merupakan kuasi-eksperimen dengan desain pretest-posttest control group. Pengambilan sampel penelitian menggunakan teknik random sampling. Sampel penelitian terdiri dari 68 peserta didik kelas XI SMAN 1 Randudongkal, Pemalang. Terbagi menjadi dua kelas yakni, 34 peserta didik kelas eksperimen dan 34 peserta didik kelas kontrol. Motivasi belajar fisika peserta didik diukur melalui angket berdasarkan aspek ARCS pada google form.* ***Temuan:*** *Hasil analisis uji-t berpasangan menunjukkan nilai signifikan pada motivasi belajar fisika di kelas eksperimen, yakni 0,000.* ***Kesimpulan:*** *Penelitian ini menunjukkan bahwa penggunaan e-book efektif dalam meningkatkan motivasi belajar fisika siswa.*

Kata kunci: *e-book fisika, problem based learning, motivasi belajar fisika.*

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INTRODUCTION

Physics is an exact science that studies abstract issues. This abstract thing sometimes makes it difficult for students to understand the concept (Özdemir, Coramik, & Ürek, 2020). If it is sustainable, it will result in decreased student motivation. The symptom often seen is that students are reluctant to pay attention to the teacher's explanation during learning and chat with friends (Wiyoko, Sarwanto, & Rahardjo, 2014).

In overcoming these problems, the government established a new learning paradigm. This paradigm is contained in the implementation of the 2013 curriculum. In this case, a new learning paradigm is an active learning process to create interaction between students and teachers in the classroom. This learning is often referred to as the scientific approach (Eveline, Jumadi, Wilujeng, & Kuswanto, 2019; Kade, Degeng, & Ali, 2019). Unfortunately, one of physics education research revealed that learning physics in schools today are still found in teacher-centred learning (Ozkan, Gulbin, & Topsakal, 2020). As a result, there has been no active interaction between teachers and students in the classroom, so that the objectives of learning physics have not been achieved optimally.

A good educational process also needs to be carried out constructively. This paradigm is intended by emphasizing the active role of students in understanding concepts (Anggraeni & Kustijono, 2013). There are many kinds of learning models and approaches involving students including, open inquiry (Abaniel, 2021), guided inquiry (Prahani, Limatahu, Soegimin, Yuanita, & Nur, 2016), C3PDR learning model (Julfitri, Efwinda, & Zulkarnaen, 2020), STEM-based learning approach (Utami, Vitasari, Langitasari, Sugihartono, & Rahmawati, 2020), scaffolding learning approach (Eveline et al., 2019), and also problem based learning (PBL) (Yuberti et al., 2019).

Problem based learning (PBL) model tends to stimulate students with a problem. Stimulus problems are contextual that is taken in everyday life. This is intended to stimulate the activeness of students in learning and determine learning objectives (Haryanti, Wilujeng, & Sundari, 2020). Several studies have proven that the application of the problem based learning model can improve students' conceptual understanding in terms of problem solving and critical thinking skills (Shishigu, Hailu, & Anibo, 2018; Simanjuntak, Marpaung, Sinaga, & Siregar, 2021). PBL can improve students' understanding of concepts because the PBL syntax contains contextual activities. This makes it easier for students to minimize abstract concepts in physics. Thus, in order to optimize the understanding of physics learning concepts, the problem-based learning (PBL) model can be applied.

Based on observations carried out at State Senior High School in Randudongkal, the revised 2013 curriculum has been implemented. However, due to the COVID-19 pandemic, the curriculum used was the emergency 2013 curriculum with some simplifications. In this situation, the emergency curriculum has been simplified by reducing the number of core skills and the length of learning time. The implementation of learning is carried out online with teacher guidance. The teacher provides student learning materials via Moodle and WhatsApp groups. The learning method applied is just giving assignments and discussions. Submission of material in such a way makes students tend to be bored and do not respond to the teacher's explanation in the WhatsApp group. Observational data from this study revealed that as many as 82.1% of students had these symptoms. Furthermore, they think that physics is more complicated than before.

Physics' learning outcomes can be influenced by various factors. One of them is learning motivation. Not only from the teacher,

but also come from student (Afjar, Musri, & Syukri, 2020). The motivation that comes from the students themselves is often referred to as internal motivation. Meanwhile, motivation that comes from external stimuli is called external motivation. In this case, external motivation is related to the influence of teachers in the learning process, the learning environment, and even the use of learning media (Filgona, Sakiyo, Gwany, & Okoronka, 2020; Puspitarini & Hanif, 2019). In order to provide learning motivation to students, it is not only through the selection of learning methods and models. The provision of learning motivation can be through a learning medium in an e-book or physics textbook (Polonia & Yuliati, 2019; W. M. Sari, Riswanto, & Partono, 2019; Wiyoko et al., 2014). Learning media is one of the important components in determining the success of learning. In the era of the industrial revolution 4.0, technological developments have created many breakthroughs and provided convenience in education. One of them is the increasing number of smartphone users from various circles, especially students. However, the use of smartphones by students is often misused and has a negative impact. The solution to this problem is using smartphones in learning (Astuti, Sumarni, & Saraswati, 2017).

It should be realized that in the COVID-19 pandemic situation, the development of information technology is very helpful. The impact of the COVID-19 pandemic requires that learning be done virtually by utilizing the internet and information technology (IT) devices such as smartphones and laptops. Students' interest in accessing a device or smartphone with an internet network is one of the major visible impacts. Research shows that one of the innovations of learning media by utilizing ICT developments in developing android applications. In use, the application makes it easier for students to access physics learning materials anytime and anywhere (Astra, Nasbey, & Nugraha, 2015). Another study states that another contribution to technology-based learning is the use of interactive physics E-Books. In addition to being flexible in use, interactive E-Books must contain text, videos, and animations so that learning becomes more fun and interesting for students (Septikasari, Maison, & Nazarudin, 2021).

This research will focus to determine the effect of learning media in the form of problem based learning (PBL) integrated E-books in increasing motivation to learn physics for high school students in grade XI.

METHODS

This study was a quasi-experimental design using a pretest-posttest control group design. The research was carried out in March-April 2021 at State Senior High School in Randudongkal, Pemalang, Indonesia. The sampling technique used was the random sampling technique. The research sample was 68 students of class XI Mathematics and Natural Sciences. They were divided into two class groups: the experimental class (XI Mathematics and Natural Sciences 4) and control class (XI Mathematics and Natural Sciences 5). Each class consists of 34 students. Students were given online learning using the PBL integrated E-books in experimental class while the other students were given lecture methods and assignments in the control class. Each class was given an initial motivation questionnaire before being given treatment and a final motivation questionnaire after learning. The following pretest-posttest control group design in a quasi-experimental study is shown in Table 1 (Sugiyono)

Table 1. Quasi-experimental research design pretest-posttest control group

Class	Pre-test	Treatment	Post-test
Experiment	O_1	X_1	O_2
Control	O_3	X_2	O_4

Information:
X_1 = learning in the experimental class (with PBL integrated e-book)
X_2 = learning in the control class (lecture method)
O_1 = initial motivation of students in the experimental class
O_2 = the final motivation of students in the experimental class
O_3 = initial motivation of students in the control class
O_4 = the final motivation of students in the control class

The data collection instrument used was a motivational questionnaire based on Keller's model (Keller, 1987). It consisted of four aspects: attention, relevance, confidence, and satisfaction, so, the acronym of this model is ARCS. Keller's theory about ARCS model has some strategy that can be used to increase students' motivation. ARCS model has four indicators that useful to increase students' motivation, such as: (1) attention indicator is useful to increase students' attention on subject material; (2) relevance indicator is for connecting the subject material with its application in daily life; then (3) confidence indicator is useful to increase students' confidence in the subject material given by the teacher; and the last (4) satisfaction indicator is useful to realize student satisfaction in the learning process and the material being studied (Chrisnawati, Usodo, Kurniawati, & Kuswardi, 2015). These aspects are thought to be able to determine students' internal motivation in learning physics before and after employing media as an external motivator. Therefore, this research is suitable to refer to his model.

The motivational questionnaire scoring rubric was based on a Likert scale of 1-4. Score 1 = strongly disagree, score 2 = disagree, score 3 = agree, and score 4 = strongly agree. The data analysis technique for students' learning motivation was descriptive quantitative with paired t-test. Paired t-test was used to determine the effect of treatment in using PBL integrated E-books. Before being implemented in the classroom, the e-books have been assessed by the experts with the average score for each aspect (learning, physics material, language, display, software engineering) of the e-books assessment is 4. This shows that the e-books are declared eligible in the very good category. Other statistical tests such as normality and homogeneity tests were performed as prerequisites for the paired t-test. The data were analyzed using the statistical program SPSS version 19—the results of quantitative data analysis aimed to test the following hypotheses.

H_0 : the use of PBL integrated E-books is not affecting students' motivation to learn physics
H_a : the use of PBL integrated E-book is effective in increasing students' motivation to learn physics

In addition, the student's motivation to learn physics questionnaire data obtained was also calculated based on the percentage of each aspect or ARCS indicator as follows.

$$M = \frac{X}{Y} \times 100\%$$

Information:
M : percentage of each aspect of ARCS
X : scores obtained in each aspect of ARCS from all student motivation questionnaires
Y : ideal/maximum score from ARCS aspect

RESULT AND DISCUSSIONS

Students' learning motivation data were obtained in this study as measured through a learning motivation questionnaire based on the ARCS indicator. The questionnaires were delivered to the students at the beginning of the meeting. The data on the results of student motivation were analyzed by paired t-test to determine the effect of using PBL integrated e-books through their significance value before testing for normality and homogeneity as prerequisites for the paired t-test. The normality test and homogenity test were carried out in the experimental and control classes in the pretest-posttest questionnaire of students' learning motivation.

The normality test results in the experimental class showed that the significance value of the pretest and post-test data on motivation to learn physics was 0.855 and 0.619. Both values were greater than 0.05, which means the data was normally distributed. In the control class, the significance value of the pretest and post-test data on the motivation to learn physics was 0.191 and 0.085. The significance value from both was more than 0.05. Thus, the data included a normal distribution. The results of the analysis of the complete normality test can be seen in Table 2.

Table 2. Normality test analysis results students' learning motivation

Class	Shapiro-Wilk Sig.
Pre-test of Learning motivation in Experiment Class	0.855
Post-test of Learning motivation in Experiment Class	0.619
Pre-test of Learning motivation in Control Class	0.191
Post-test Learning motivation in Control Class	0.085

The next prerequisite test was the homogeneity test. The homogeneity test results in the experimental class and control class obtained a significance value of 0.208. This value was greater than 0.05 (Sig.> 0.05). Therefore, it was concluded that the variance of the post-test data of the experimental class and the control class was homogeneous. The results of the homogeneity test analysis through SPSS are presented in Table 3.

Table 3. Results of homogeneity test analysis

Levene Statistic	Sig.
1.619	0.208

The data on students' motivation to learn physics that have passed the prerequisite test were then analyzed in paired t-test. The results of the paired t-test analysis on the pretest-posttest data can be seen in Table 4.

Based on Table 4, the significance value of the pretest-posttest data on learning motivation in the experimental class was 0.000. The value was less than 0.05 (Sig. <0.05), so that H_0 was rejected and H_a was accepted. While in the

Table 4. Paired T-Test analysis results

		t	df	Sig. (2-tailed)
Pair 1	Early Learning Motivation from Experiment Class - Final Learning Motivation from the control class	-20.041	33	0.000
Pair 2	Early Learning Motivation from Control Class - Final Learning Motivation from the control class	-1.959	33	0.059

control class, the significance value of the pretest-posttest data obtained was 0.059. This value was more than 0.05 (Sig.> 0.05), so that H_0 was accepted (Santoso, 2015). The difference in the significant value of paired t-test in the control class showed that the use of PBL integrated E-books is proven to increase students' learning motivation in physics.

This study also obtained the percentage of students' motivation to learn physics on each indicator or aspect of ARCS. Table 5 below presents the motivation to learn physics in the form of pretest-posttest in the experimental and control classes.

In Table 5, it is known that there was an increase in students' motivation to learn physics in both the control class and the experimental class. However, in the control class, the increase in students' motivation to learn physics was not too high. Keep in mind again that students' motivation did not only come from their-self (internal motivation) but also from external stimuli

Table 5. Percentage results of physics learning motivation in each aspect

Aspect	Percentage of Motivation of Each Aspect (%)			
	Control Class		Experiment Class	
	Pre-test	Post-test	Pre-test	Post-test
Attention	67.9	70.0	64.5	71.3
Relevance	65.8	65.8	58.2	69.5
Confidence	62.1	65.3	55.5	67.3
Satisfaction	79.7	80.0	54.6	85.9

(external motivation). The external motivation was an encouragement that came from outside the students. This external motivation is usually in the form of using media during learning (Iskandar, 2012). In this study, external and internal motivation are related to each other. External motivation in the form of PBL integrated E-books plays a role in increasing students' internal motivation to learn physics. This can be seen through the data that has been obtained. The difference in the percentage increase in the experimental and control classes in Table 5 shows that using learning media in the form of PBL integrated E-books increased students' external motivation in learning physics. For more details, in Figure 1 the percentage of motivation to learn physics after learning in each aspect of ARCS in both classes is presented.

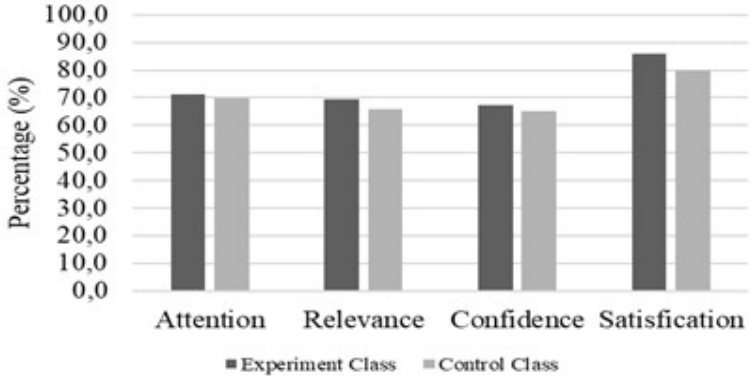

Figure 1. Percentage of students' motivation to learn physics after learning in the experimental class and control class

From Figure 1, students' motivation to learn physics was influenced by the four ARCS aspects or indicators with different values. The four aspects included attention, relevance, confidence, and satisfaction. From previous work ARCS' model is a model that can help student to build knowledge based on the problem from the teacher, as a consequence students can show learning motivation that comes from external conditions (Afjar et al., 2020). In the experimental class, the attention aspect obtained a percentage result of 71.3%. Attention aspect is the most important part of the ARCS model. Indicators of learning motivation on the aspect of attention included the interest of students with the subject matter presented, the curiosity of students towards the physics material further (Malik, 2014). Students' interest in physics lessons was usually in the form of students' willingness to take notes and pay attention to the teacher's explanations not to do other activities that interfered with learning. Figure 1 shows that attention to learning motivation gave a fairly high contribution to the second order. That was mean that the media used in learning physics can attract the attention of students.

Following some previous research, the aspect that gives the highest contribution to students' learning motivation is satisfaction (N. Sari, Sunarno, & Sarwanto, 2018; Vania, Setiawan, & Wijaya, 2018). In the data presented, the satisfaction aspect obtained a percentage of 85.9%, this satisfaction aspect can be seen from how student feeling satisfied after got the achievement or high score from the exercise in physics learning and in this case the students show that they were feeling satisfied with the implementation of PBL integrated E-books. When the students appreciate the results, they will be motivated to learn. The next aspect is a relevance. The percentage score of relevance was 69.5%. The score means that the students motivated to learn because of the physics learning materials in PBL integrated E-book related to daily life. In learning, the teacher uses PBL integrated E-books as a tool to provide the examples from the characteristics of sound waves in daily life, such as in sound reflection events. The lowest contribution was shown in the aspect of confidence, which was 67.3%. The confidence's score means that the teacher could give student believes and also trust the student. In this case, the teacher could motivate the students to improve their performance in physics learning by using PBL integrated E-books.

The ARCS' model applied to not only in the experimental class but also the control class that also can be seen in Figure 1. The percentage score in attention aspect from Figure 1 in control class was 70%; meanwhile on the relevance aspect got 65.8%; followed by the aspect of confidence was 65.3%; on the satisfaction aspect the percentage score was 80%. Thus, we can compare that there is a slight difference between the percentage scores in the control and experimental classes of each aspect of motivation. The slight difference in student motivation in the two classes was caused by online learning. As a result, activities in E-books based on PBL syntax are not optimum. Interaction between students is less developed, particularly during the solo or group investigation stage. learning environment conditions are also included in the external motivation. Students' internal motivation has been shown to be increased by using E-books. However, external motivations such as the learning environment obtained online and offline will be different.

The data obtained in Figure 1 can be conclude that after learning using the PBL integrated E-books, students felt satisfied in doing questions, assignments, and understanding physics material. Students were also more focused on learning. Thus, they were able to link

the physics concepts to their application in everyday life. However, students still lacked confidence in working on assignments and questions. Weaknesses in confidence could be improved by giving assignments in more complex forms in projects, articles on the application of physics in technology, and others. Thus, students would be more confident in working on simpler physics problems and assignments.

The selection of media and learning models was very influential on students' learning motivation. These two things were included in external motivation. The external motivation was closely related to the teacher's role in managing learning in the classroom. This study proved that the media in the form of PBL integrated E-books affected students' learning motivation. Similar research also stated that using learning media to combine scientific learning models can increase students' learning motivation in physics lessons (Piraksa & Srisawasdi, 2014; Sastrawan, Dantes, & Renda, 2017).

From the data and statements above, it was stated that learning physics was best accompanied by the use of learning media with a combination of scientific learning models. Thus, it created an interaction between students and teachers. In learning this model, the teacher would easily motivate students in learning physics so that the objectives of learning physics following the revised 2013 curriculum could be achieved easily.

■ CONCLUSIONS

The significance value of the pretest-posttest data on learning motivation in the experimental class was 0.000. The value was less than 0.05 (Sig. <0.05). Thus, it can be concluded that using PBL integrated E-books as a learning media is more effective in increasing students' learning motivation than learning using conventional methods.

The implementation of PBL physics E-books in learning has just a slight difference in the percentage score of each aspect of motivation in control and experiments classes. This is due to inconvenient online learning activities in the classroom. Mostly, all activities in e-books using PBL syntax aren't entirely in accordance with the designed scenario. However, the findings of this research have implications for physics instruction. This study demonstrates that PBL integrated E-books could be used as an alternative choice of media in teaching physics, as well as providing references and early assessments for future learning media research.

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