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Problem-Based Learning Flipbook E-Module in Improving Students' Critical Thinking Skills in "*Always Save Energy*" Thematic Learning

Sri Adhi Endaryati[1*], St. Y. Slamet[2], Kartika Chrysti Suryandari[3]

[1,2,3] Fakultas Keguruan dan Ilmu Pendidikan, Universitas Sebelas Maret, Surakarta, Indonesia

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ABSTRAK

Ancaman krisis energi dunia menjadi topik bahasan yang sangat perlu ditekankan pada pembelajaran di kelas. Ditambah lagi pengintegrasian teknologi menjadi salah satu hal yang tidak dapat dipisahkan dengan tuntutan pembelajaran abad 21. Tujuan penelitian ini yaitu menganalisis penggunaan e-modul flipbook berbasis problem based learning dalam pembelajaran tematik "Selalu Berhemat Energi". Penelitian ini merupakan penelitian eksperimen semu dengan desain pretest-posttest control group design yang menguji efektivitas e-modul tersebut dalam peningkatan keterampilan berpikir kritis pembelajaran tematik "Selalu Berhemat Energi". Penelitian ini dilakukan pada siswa kelas empat sekolah dasar yang diambil dengan cara purposive sampling dan berasal dari empat sekolah yang berbeda. Kelompok kontrol berasal dari 1 sekolah yaitu 31 siswa, dan kelompok eksperimen terdiri dari 3 sekola yang berjumlah 70 siswa. Teknik tes menjadi data primer dalam pengumpulan data, sedangkan observasi dan wawancara menjadi data pendukung penelitian. Teknik analisis data dilakukan dengan uji independent sample t test. Hasil penelitian menunjukkan bahwa e-modul flipbook berbasis problem based learning memiliki pengaruh yang tinggi terhadap keterampilan berpikir kritis siswa kelas empat sekolah dasar. Fitur-fitur yang dihadirkan dalam modul elektronik tersebut membuat siswa antusias dalam mengikuti proses pembelajaran sehingga mampu membentuk sikap belajar positif dalam pemecahan masalah.

ABSTRACT

The threat of the world energy crisis is a topic of discussion that needs to be emphasized in classroom learning. In addition, the integration of technology becomes one of the things that must be connected to the demands of 21st-century learning. This study aims to analyze the use of problem-based learning flipbook e-modules in thematic learning "Always Save Energy". This research is a quasi-experimental research with a pretest-posttest control group design that tests the effectiveness of the e-module in improving critical thinking skills in thematic learning "Always Save Energy". This research was conducted on fourth-grade elementary school students who were taken by purposive sampling and came from four different schools. The control group came from 1 school, namely 31 students, and the experimental group consisted of 3 schools, totalling 70 students. Test techniques become primary data collection data, while observations and interviews become research-supporting data. The data analysis technique was carried out by testing the independent sample t-test. The results showed that the flipbook e-module based on problem-based learning greatly impacted the critical thinking skills of fourth-grade elementary school students. The features presented in the electronic module make students enthusiastic about participating in the learning process to form a positive learning attitude in problem-solving.

1. INTRODUCTION

Human resources are the main capital of countries facing global challenges. These resources must be superior so that they can solve their problems. One of the efforts to form superior resources is through education. Education itself cannot be separated from adjustments to the output needs of digital-era education, so educators need to present learning contents that can help students to face the challenging realities of the 21st century (Prayogi & Estetika, 2019; Rastoder et al., 2015; Walton & Rusznyak, 2020). Such learning content is known as 4C's which stands for communication, collaboration, critical thinking and problem-solving, and creativity and innovation (Hidayatullah et al., 2021; Meilani et al., 2020; Widodo & Wardani, 2020). Regarding 21st-century skills, the Indonesian government has been striving to provide more meaningful learning experiences for students such as the application of a scientific approach to learning through the implementation of the 2013 curriculum (Daga, 2022; Suarman et al., 2018; Suryawati & Osman, 2018). However, apart from using this innovative approach, teachers also need to develop their digital competence as capital in presenting learning media. It is known that this digital era requires all

*Corresponding author.
E-mail addresses: sriadhiendaryati@student.uns.ac.id (Sri Adhi Endaryati)

educators to incorporate information and communication technology in their teaching-learning activity so that students can learn the real-life context through the use of technology (Oktavian & Aldya, 2020; R. Rahayu et al., 2022; Sutama et al., 2021).

Integrating technology as a learning medium is one thing that cannot be separated from the demands of 21st-century learning (P. Rahayu, 2019; Safitri et al., 2020; Tambunan & Sundari, 2020). This is also a challenge for teachers, especially elementary school teachers, in designing relevant learning media because the developmental stage of elementary school students is at the concrete operational stage (Kurniawati & Koeswanti, 2020; Nabila et al., 2021). Thus, the learning media created must be able to represent abstract materials. Concerning learning materials, the 2013 curriculum in elementary schools uses thematic learning models. Thematic learning is a learning method that provides several concepts so that it becomes a topic as learning materials for students (Helmon, 2017; Setiawan, 2020). Thematic learning also integrates attitudes, knowledge, and skills from various subjects with the surrounding environment (Nugroho & Arrosyad, 2020; Sari et al., 2018). Thus, students need higher-order thinking skills in participating in this thematic learning. One of the thematic lessons in grade IV elementary school is the "Always Save Energy" theme. This theme is very interesting because it is related to environmental issues and the world energy crisis. This issue is a threat to every individual around the world. As we all know that Indonesia is facing a crisis that threatens human security, namely the energy crisis. Another arising problem is climate change due to the use of fossil energy (Alghaffar et al., 2022). Therefore, "Always Save Energy" is a theme that is very necessary for instilling critical thinking skills so that individuals are expected to be concerned about the environment.

Concerning the aforementioned description, thematic learning carried out by elementary school teachers must be able to stimulate critical thinking skills so that it can become an asset for students in dealing with the problems in their life (Desyandri et al., 2019; Suryaningsih & Rimpiati, 2018). Critical thinking skills are complex skills because they do not only apply cognitive skills such as forming hypotheses, designing, conducting, and analyzing a series of investigations but also a psychological construct because they are related to reflexive thinking which focuses on deciding what to believe or do and evaluating statements (Amin et al., 2020; Hart et al., 2021; Liu & Pásztor, 2022). The indicators of critical thinking ability can be seen from students' ability to logically search for the truth of assumptions, assess the coherence between problems and decisions that have been taken, and be able to analyze and draw conclusions (Darhim et al., 2020; Nurbaya, 2021). The complexity of critical thinking skills is a challenge for teachers regarding how to design learning materials that can stimulate critical thinking skills (Amin et al., 2020; Changwong et al., 2018; Pramestika et al., 2020). Moreover, the integration of technology is necessary in the classroom due to the digital era (Eze et al., 2019; Lomicka & Ducate, 2021). The government has also prepared printed student modules as media in implementing the 2013 curriculum. However, to achieve the learning objectives, printed modules should not be the only media used by teachers in classrooms. However, the teaching of the "Always Save Energy" thematic learning in seven elementary schools in Wonogiri Regency relies only on printed modules. As a result, students' achievement in the theme is low. Even though the questions presented did not meet the elements of higher-order thinking skills. This is a sign that the stimulation of critical thinking skills in school is not optimal. Moreover, the lack of technology use also causes poor digital competence for both teachers and students. Therefore, researchers developed an electronic module that can be used in the "Always Save Energy" thematic learning.

The electronic module developed by the researcher was made using a problem-based learning model approach. The problem-based learning model focuses on forming student learning attitudes such as problem-solving skills, independent learning, responsibility, and exploration (Ariyatun & Octavianelis, 2020; Jayadiningrat & Ati, 2018; Muga et al., 2017; Palupi et al., 2020). As a result, it is very suitable for stimulating critical thinking skills. In addition, the problem-based learning model has a collaborative interaction aspect that can direct students to prepare specific ways for problem-solving activities so that it can become a level of sustainable development during the learning process (Darhim et al., 2020; Davidsen et al., 2019; Umarella et al., 2019; Vleuten & Schuwirth, 2019). Therefore, this product is hoped to create a learning environment that stimulates the improvement of students' critical thinking skills. Moreover, the features available in the flipbook e-module in "Always Save Energy" thematic learning provide views of music, materials, concrete images, learning videos, and quizzes so that students are motivated to learn (Triwahyuningtyas et al., 2020). Regarding the characteristics of the materials, it is necessary to add various types of media to its delivery. The presence of a problem-based learning flipbook e-module can be a solution in presenting media that can penetrate the boundaries of material abstractness. In addition, elementary school students are in the concrete operational stage. Even the features presented by this e-module can be a real picture for students in understanding the subject matter. In this regard, the purpose of this study is to test the effectiveness of problem-based learning flipbook e-modules in improving critical thinking skills in the thematic learning "Always Save Energy".

2. METHOD

This research is a quasi-experimental study with a pretest-posttest control group design. Quasi-experimental research is experimental research in which researchers cannot fully control external variables, but researchers used a pure experimental design on samples with 2 groups, namely the control group and the experimental group (Sugiyono, 2017). Furthermore, the pretest-posttest control group design uses two groups that are randomly selected, then both of the groups were given a pretest to find out if there is a difference between the experimental group and the control group. After that, a posttest was given to find out if there was a significant difference between the control group and the experimental group (Sugiyono, 2017). The sample of this study consists of 4 elementary schools with 101 four grade students. Purposive sampling is used as a sampling technique because the researcher selects subjects based on specific criteria, namely only using printed modules in the "Always Save Energy" thematic learning. The four elementary schools are divided into two groups. One school consisting of 31 students becomes the control group, while the experimental group consists of 70 students coming from three different elementary schools. Data collection techniques are carried out through tests, observations, and interviews. Tests are the main research data, while research-supporting data are in the form of observations and interviews. The data analysis technique is performed by independent sample t-test. An independent sample t-test is conducted to find out the difference in the average score of the experimental group (group 1) which receives the treatment in the form of using problem-based learning flipbook e-modules with the control group (group 2) without treatment or only using printed modules from the government as usual.

3. RESULT AND DISCUSSION

Result

Based on the results of the research, the score results for the pre-test and post-test of the effectiveness test showed in Table 1.

Tabel 1. The Scores of Pre-Test and Post-Test Results of the Effectiveness Test

Group	Number of students	*Pre-test*			*Post-test*				
		Mean	Min	Max	Mean	Min	Max	S	S^2
Control Class	31	55.87	30	73	67.9	37	87	12.6	158.76
Experimental class	70	58.67	37	87	78.7	47	97	8.6	73.96

As soon as the pre-test and post-test scores are known, the balance test is conducted for the pre-test and the test of differences is conducted for the post-test. Before carrying out the test of differences in post-test scores, a balance test is carried out first to determine the initial abilities of the control and experimental groups. The results of the balance test for the two groups showed in Table 2.

Table 2. The Balance Test Analysis

Tests	Test types	Results	Decision	Conclusion
Normality	Kolmogorov-Smirnov	Control class (Sig. 0,051) Experimental class (Sig.0,38)	H0 is accepted	Data is normally distributed
Homogeneity	Lavene Statistic	Sig. 0,190	H0 is accepted	Homogeneous data
Test of differences	Independent Sample t-test	t_{count} = 0,127 df = 99 t_{table}= 1,984 Sig. 0,230	H0 is accepted	No differences (balanced)

Table 2 shows that the normality test for the control class has a significance of 0.05 and for the experimental class is 0.38. The significance is greater than α (0.05) so H0 is accepted, and the data can be said to be normally distributed. While the homogeneity test has a significance of 0.190 which is greater than α (0.05), so H0 is accepted and the data is considered homogeneous. In the independent sample t-test, it is known that t_{count} = 0.127 which is smaller than t_{table} = 1.984. Furthermore, the probability value reaches a significance of 0.230 which is greater than α (0.05). This shows that there is no difference between the control class and the experimental class so it can be said that the two groups are balanced or have the same initial abilities.

An effectiveness test is carried out to determine the effectiveness of the problem-based learning flipbook e-modules in improving students' critical thinking skills in "Always Save Energy" thematic learning. It is carried out after the analysis requirements are fulfilled. The prerequisite tests are normality and homogeneity tests. Here are the details of the results showed in Table 3.

Table 3. The Analysis of Effectiveness Test Results

Tests	Test types	Results	Decision	Conclusion
Normality	Kolmogorov-Smirnov	Control class (Sig. 0.055) Experimental class (Sig.0.58)	H0 is accepted	Data is normally distributed
Homogeneity	Lavene Statistic	Sig. 0.303	H0 is accepted	Homogeneous data
Difference Test	Independent Sample t-test	t_{count} = 4.986 df = 99 t_{table}= 1.984	H0 is rejected	No differences (balanced)
The effect size		Sig. 0.345		
Test	Cohen's	d = 1.44		High category

Table 3 above shows that the prerequisite test is fulfilled because the data is normally distributed and homogeneous. While the independent sample t-test shows that tcount is greater than ttable. Therefore, it can be concluded that there is a significant difference between the control and the experimental classes. After knowing that there are differences in class groups that use problem-based learning flipbook e-modules and do not use the product, the next step is to calculate Cohen's effect size. Cohen's effect size test is conducted to determine the magnitude of the effect obtained from the use of problem-based learning flipbook e-modules in improving students' critical thinking skills in "Always Save Energy" thematic learning. The result of Cohen's effect size calculation shows a score of 1.44. It means that the use of problem-based learning flipbook e-modules has a high influence in improving students' critical thinking skills in "Always Save Energy" thematic learning in fourth-grade elementary school students.

In addition to the test results on the posttest showing a high influence of the problem-based learning flipbook e-module, the results of observations during the learning process also showed that students were very enthusiastic about the features provided by the e-module, namely the appearance of music, materials, pictures, videos, and quizzes. Moreover, technology-based media such as video can help students understand abstract materials to be more concrete because they become more visible and understandable so that students can see things better without having to imagine them. Considering that the "Always Save Energy" theme learning is also very concrete with everyday life, students can directly relate it to their activities that require various types of energy. In addition, from the results of interviews, it is known that students admitted that they are more interested in learning with the problem-based learning flipbook e-module because it is more practical to carry anywhere. They can also review the material again while studying at home to strengthen their understanding of this theme.

Discussion

The problem-based learning flipbook e-modules are a combination of concrete media and digital media in one medium. The features of the flipbook e-module consisting of pictures and videos make the media a concrete medium for various abstract materials (Rusli & Antonius, 2019; Sriyanti et al., 2021; Triwahyuningtyas et al., 2020). The combination of the two types of media in the flipbook e-module completes each other. The media and the flipbook e-modules cover each other's weaknesses because concrete media are good at improving students' problem-solving, creative thinking, and visual thinking skills. Whereas digital media can increase the effectiveness and efficiency of the learning process both in terms of time and use (Khairunnisa & Ilmi, 2020; Linda et al., 2018; Saraswati et al., 2019). So, the merging of the two types of media into one in the form of problem-based learning flipbook e-modules can answer the challenges of learning activity in the era of the industrial revolution 4.0 (Sidiq & Najuah, 2020; Triwahyuningtyas et al., 2020).

The existence of this electronic module can also be a means for teachers and students in developing their digital competencies (Darmaji et al., 2019; Komikesari et al., 2020; Misbah et al., 2021). Moreover, the use of the internet in Indonesia is increasing, which is indicated by the large number of people using technology to find learning resources to fulfill their daily needs (Ilmi et al., 2021; Indarta et al., 2022). Its presence is a real step in the world of education in adapting strategies, models, and teaching methods based on the digital era and technological advances. In addition, the presence of such digital media can empower

21st-century critical thinking skills, so the use of this e-module can also reflect teachers' pedagogical and professional competence (Darmaji et al., 2020; Jannah & Atmojo, 2022).

The result of the effectiveness test on 70 students proved that the features available in the flipbook e-module of "Always Save Energy" thematic learning can stimulate students' critical thinking skills well. The appearance of music, materials, concrete images, learning videos, and quizzes can increase students' learning motivation (Hadiyanti et al., 2021; Triwahyuningtyas et al., 2020). Besides, students' increased motivation to learn does not only affect their learning achievement but also their passionate learning attitudes (Jannah & Atmojo, 2022; Jemudin et al., 2019). As a result, the features in the flipbook e-module are very effective in training elementary school students' independent learning and critical thinking skills (Aprilia, 2021; Asrial et al., 2020). Improving critical thinking skills in "Always Save Energy" thematic learning cannot be separated from the important elements of the problem-based learning model, namely the scientific process skills in this model (Murniyati & Winarto, 2018). It can stimulate students' independence in learning and their higher-order thinking skills (Sugeng & Suryani, 2020; Syahrial et al., 2021). Problem-based learning can also provide students with conceptual, strategic, and metacognitive support (Kim et al., 2022; Seibert, 2020). Teachers need to carefully prepare experiences and projects concerning the principles of problem-based learning that are given to students to provide them with the competencies and learning skills needed (Ariyatun & Octavianelis, 2020; Davidsen et al., 2019). In addition, the problem-based learning model is also more effective in increasing students' self-efficacy, so it can make them more relaxed in studying, communicating, working together, and strengthening their understanding with fast feedback (Cetin et al., 2019; Triwahyuningtyas et al., 2020).

The topic of "Always Save Energy" thematic learning becomes a very crucial discussion amidst the endless adverse effects of globalization which have caused an energy crisis throughout the world. The problem-based learning model approach can be confirmed as a positive teaching method because it can influence students' learning behavior in problem-solving (Sugeng & Suryani, 2020). Thus, the discussion on thematic learning that uses the problem-based learning model is relevant to the topic of this research. Moreover, problem-based learning e-modules have a positive effect on critical thinking skills and environmental care attitudes (Aufa et al., 2021; Priantini & Widiastuti, 2021). They conducted their research at senior high school levels whose students are more mature both in terms of their thinking skills and learning behavior. While this research is conducted on elementary school students where there are a lot of abstract topics or discussions. Therefore, teachers have to be able to deliver them more concretely according to the stages of their development to help students master the learning materials more easily.

Even though the use of this e-module has been proven to be able to improve students' critical thinking skills, some things need to be considered in the use of digital media by teachers. One of which is the need for teacher quality improvement as a counterweight to digital competencies both as users and developers. Even though elementary schools have various thematic learning, this electronic module is only limited to "Always Save Energy" thematic learning. Therefore, it is necessary to develop digital media in other thematic learning so that the challenges of 21st-century learning can be fulfilled. Moreover, the integration of information and communication technology is urgent in increasing the effectiveness and efficiency of learning so that technological devices are not just a complement but a primary component for the continuity of learning (Syahid et al., 2022). The logical consequence is that teacher professionalism also prioritizes digital skills as a primary skill in designing, managing, and assessing learning using information and communication technology.

4. CONCLUSION

Based on the research and discussion results, it can be concluded that the flipbook e-module based on problem-based learning effectively improves students' critical thinking skills in thematic learning "Always Save Energy". In addition, the results of the effect size test show that the use of problem-based learning e-module flipbooks has a high impact on improving students' critical thinking skills in the thematic learning "Always Save Energy" in grade IV of Elementary School. This electronic module is also a means for teachers and students to develop their digital competence. This electronic module is a fundamental step in the world of education in adapting strategies, models and teaching methods.

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