An e-module analysis for problem-based learning with a focus on developing students' critical thinking skills

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ABSTRACT
21st century education is expected to produce competent human resources in 21st century skills. Teachers must integrate information technology facilities to help participants learn with teaching materials, methods, and technology-based teaching media. This study aimed to describe PBL-based E-Modules to empower critical thinking skills in elementary school learning at SDN 01 Sangkaran Bhakti. This research is a descriptive qualitative research. Data and data sources were collected from interviews and questionnaires for 6 teachers and 15 students, then the data were analyzed by interactive analysis. The results showed that PBL-based E-Modules can empower critical thinking skills in elementary school learning as a 21st century digital media innovation. E-modules as learning media are combined with text, narration, video, practice questions and integration with learning models. PBL-based E-Modules as an effective solution for 21st century learning are in accordance with the character of the material and learning styles of 21st century students as digital natives.

KEYWORDS
e-module; PBL; skills; critical thinking

Introduction
Education is the main pillar of developing quality, creative, critical human resources in developing the nation and state in order to answer challenges in the current 21st century era. 21st century education is expected to produce human resources who are capable in communication, collaboration, critical thinking skills and creative problem solving. 21st century learning is adapted to technological developments in competencies, learning objectives, media, and learning strategies. Thus, there are many challenges, especially for the world of education in Indonesia. This is what makes educators must be able to hone the skills needed to face every revolution in education in the 21st century. In connection with the challenges of 21st century learning, learning technology must have a good impact on oral, written, graphic communication, and students’ critical thinking. Technology-rich learning will improve critical thinking. This is nothing but 21st century learning that emphasizes mastery of technology in addition to other mastery such as literacy, knowledge, and attitudes (Martini, 2018).

Digital technology is becoming a trend, occupying the educational space (Singh, 2021). Digital learning is a major issue in technology-integrated education. Teachers act as digital citizens who are responsible for achieving educational goals. 21st century students are known as digital natives, characterized by jumping cognitive structures, multitasking, familiar with digital devices, spending more time with technology. This character is the reason it is easier for students to learn with technology (Faisal, M. et al 2020).

Regarding the application of 21st century learning, Indonesia currently applies the 2013 curriculum which adapts 21st century learning. This curriculum emphasizes character education, attitudes, knowledge, and critical thinking (Acesta, 2020). Critical thinking involves evaluating reasoning through deciding classifications. Critical thinking as a cognitive skill, optimizing thinking towards a complex stage (Davidi, 2021).

Filsaime in (Syamsudin, 2020), explains about several indicators of critical thinking skills, including inference, recognizing assumptions, concluding statements, and interpreting facts based on data. Critical thinking skills are empowered through quality learning. Piaget said that the developmental stage of elementary school-age children enters the concrete operational stage of thinking through objects and real problems (Haryani, 2017).

Critical thinking is an important ability for students to be able to adapt to the conditions of a pluralistic society and as a provision to face the various challenges of life in the 21st century (Safitri, 2019). Critical thinking is considered a higher order thinking ability. This ability is needed to analyze and manipulate information. However, the critical thinking skills of Indonesian students are still underdeveloped. The overall underdevelopment of the thinking skills of Indonesian students can be seen from the results of the PISA survey. Based on the results of PISA
In the field of Science, Indonesia is ranked 70th out of 78 survey participating countries (Gal et al., 2019). Indonesia's low ranking in the PISA results is related to the inability of students to think at higher levels. This low critical thinking skill indicates that the applied learning has not fully accustomed students to think critically in solving problems. One way to develop students' critical thinking skills is through innovative learning media. Moreover, in the 21st century, in its application, there have been many advances in the field of technology. Therefore, the learning media presented are also based on technological advances thus their impact can improve learning processes and outcomes (Sari et al., 2019). In connection with the development of technology-based innovative media described above, one example is Problem Based Learning-based e-modules. This e-module is an editing software that can add hyperlinks, images, videos, and sounds or other supporting materials. In addition, it can also be turned over like an original book (Sa’diyah, 2021).

Thus, the features presented in this e-module can improve understanding of the material because there are interactive media that are interesting and not monotonous. Therefore, this e-model is a medium that should be a reference for teachers and education practitioners to support and fulfill 21st century skills.

This is corroborated by Andini (2018) which found that e-modules are more effective than printed books. This is none other than because the e-module is attractive, interactive and effective according to the character of the material and learning style. In addition to learning media which plays a very important role in students' critical thinking skills, learning models and techniques also have the same role. Thus, innovative media will provide maximum results if there is an approach or learning model that supports students' thinking skills. One of the learning models that support critical thinking skills is the Problem Based Learning model.

In addition to learning media which plays a very important role in students' critical thinking skills, learning models and techniques also have the same role. So, innovative media will provide maximum results if there is an approach or learning model that supports students' thinking skills. One of the learning models that support critical thinking skills is the Problem Based Learning model. This Problem Based Learning (PBL) model trains students not to depend on the teacher because a problem is presented which students then think about how to solve it by themselves independently. Article (Palupi, 2020) also mentions that the PBL model will always demand a solution to a particular problem, where the process must be united in groups so that students are encouraged to work together in identifying problems and providing possible solutions. The application of Problem Based Learning is one way to train students' critical thinking skills. The problems that exist in PBL learning will stimulate students to think critically. Therefore, this model is suitable for improving students' critical thinking skills. However, PBL learning has a weakness, namely the limited time available for students to master the expected skills to the fullest. To overcome this problem, learning resources are needed in the form of modules that can be used by students anytime and anywhere (Prawita & Prayitno, 2019). Thus, by using the module students can build knowledge from their own learning experiences independently. Based on this background, the researcher was interested in conducting research on e-module analysis based on Problem-Based Learning for students' critical thinking skills at SDN 01 Sangkaran Bhakti.

**Method**

This research is a descriptive qualitative research that describes an e-module based on Problem-Based Learning to empower critical thinking skills in elementary schools, especially at SDN 01 Sangkaran Bhakti.

Qualitative descriptive method is a research method based on the philosophy of postpositivism used to examine the condition of natural objects (as opposed to an experiment) where the researcher is the key instrument, the data collection technique is carried out by trilogue (combined), the data analysis is inductive/qualitative, and Qualitative research emphasizes meaning rather than generalization (Sugiyono, 2016).

The data of this study were collected through interviews and questionnaires for 5 teachers and 15 students at SDN 01 Sangkaran Bhakti. Interviews and questionnaires were conducted to find out a deeper understanding of students' critical thinking skills. In addition, interviews and questionnaires were also conducted to find out in depth about teachers' knowledge about PBL e-modules. Then, the data from interviews and questionnaires were analyzed by using Miles and Huberman's interactive analysis technique which began with collecting raw data, displaying data, reducing data, verifying data, and concluding data (Moleong, 2017).

**Results and Discussion**

**Teacher knowledge about e-module**

Based on the results of interviews and questionnaires obtained, the six teachers at SDN 01 Sangkaran Bhakti who became informants did not know about the e-module concept. The six teachers also did not know about the concept of e-module based on Problem Based Learning. However, elementary school teachers in Way Kanan Regency had used media/teaching materials to empower students' 21st century skills.

Media as a bridge for presenting material from educators to students. The media must be able to provide a clear picture of the most abstract form. Teachers can use learning media related to the preferences of technological devices such as current gadgets. In addition, teachers can use gadgets as learning media. In accordance with Elmunsyah's explanation that 21st century students are very familiar with gadgets. Gadgets are currently the easiest technological devices for students to use for learning media.

Technology has also been developed as a tool to empower critical thinking. However, there were still learning difficulties experienced by students in accepting and understanding abstract subject matter. For example, the presentation of one of the teachers, who was currently still doing distance learning, wanted to explain the material on energy and electricity. Teachers could not provide direct explanations through experiments. Therefore, the...
The selection of learning media before learning should be carried out by the teachers. This is because the use of inappropriate learning media can affect critical thinking skills (Devi & Bayu, 2020). Learning media and teaching materials commonly used by teachers were mostly videos from YouTube. Then the media that was then used were printed student books from schools as the main teaching materials, students' worksheets containing practice questions and materials, power points, the environment, story books, and google sites.

According to the teachers' explanation, the use of google sites had been very helpful for online learning so far. This google site contains materials, learning videos, pictures, and questions by inserting a google form link in the form of a quiz. There are also teachers who used comic book-based media, students really liked it because it contained pictures. However, it had eaknesses, namely limited number of media and it is also difficult to make.

Elementary school teachers in Way Kanan Regency had implemented the use of technology in 21st century education. Teachers could integrate other learning technologies such as the use of digital teaching materials, interactive whiteboards, mobile, video conferencing, computer software applications, games, tablets, and smartphones.

This is in accordance with Liu's opinion, that in today's digital learning teachers must carry out education that is integrated with information technology (Lin et al, 2017). The advantage of youtube as learning media is that it is easier to understand with the audio visuals displayed on the video, it is very suitable for the current pandemic situation. By sharing YouTube links, students can watch the actions contained in YouTube as well as listen to the material through YouTube videos. In addition, the use of YouTube videos can be more practical for teachers because they are readily available online, have efficiency and attractiveness, and can be repeated.

The advantages of using textbooks are easy to get and can be used at any time, it is also easier to anticipate network problems. Furthermore, books are the main media in learning. The weakness of textbooks is that students will feel bored if they only learn to use textbooks every day. On the other hand, PowerPoint has the advantage of being able to display images, media, and writing.

The weakness of textbooks is that students are less active, and less interested in textbooks. Students feel bored with the use of textbooks. The use of YouTube really depends on the smoothness of the internet and the availability of students' internet quotas. When the teacher shares the youtube link, the thing to worry about is that after the students watch the learning video, they might be watching other inappropriate content because sometimes adult content ads appear. In addition, it is less interactive when teachers give questions to students, they have to provide a new link from the google form or share photos of questions through the whatsapp group. Besides that, the use of power points also takes a longer time because they have to prepare material or questions beforehand so they are less effective. Meanwhile, the weakness of google sites is that the display that is presented tends to be monotonous depending on the creativity of the teacher, unlike digital teaching materials that can be made like books.

Elementary school teachers felt that the current technology-based learning media and teaching materials used so far had not met the needs of students to empower 21st century skills (communication, collaborative, critical thinking, and creative). The teachers felt that it was very necessary to develop themselves to learn technology thus the needs of students could be fulfilled.

The selection of learning media, models or approaches must be adjusted to the characteristics of the material and learning styles of students (Abidin, 2016). Teachers need digital interactive media that packs materials, videos, audio visuals, and quizzes containing sample questions based on HOTS (Higher Order Thinking Skills). Such interactive digital media will attract students' interest, make it easier for them to understand the material, and it will not be boring for them. This is in line with the opinion that the use of structured digital media integration makes it easier to achieve learning objectives (Maltman, 2018). Based on the questionnaire, most of the teachers had never used e-modules. The teachers needed digital learning media that are in accordance with current learning styles and learning interests which are integrated with technology. The researcher showed an example of an e-module to the teacher. After being shown an example of a flipbook e-module based on Problem-Based Learning, the teachers were interested in using it because it was easier to apply and able to meet the needs of students in empowering 21st century skills such as critical thinking.

According to Herlina (2020), digital learning media using e-modules with the appropriate learning approach, such as contextual learning according to research can improve learning outcomes and train students to get used to critical thinking (Herlina, 2020). The researcher distributed links to digital flipbook teaching materials to teachers, then the teachers were given the opportunity to express their opinions. The responses given by the teachers showed that the display of e-module teaching materials such as original books that could be opened on each page with music features was very attractive and effective.

E-module based on Problem-Based Learning

Based on the results of interviews and questionnaires conducted with elementary school teachers, the researchers studied more deeply about e-modules based on Problem-Based Learning. The PBL approach was selected because in this module problem-solving-based material was presented thus it could encourage critical thinking. This is in line with Butler et al (2012) opinion which states that critical thinking skills involve achieving the desired results with deep rational reasoning.

The Problem-Based Learning model is also effective in improving reading comprehension skills. The use of electronic modules can significantly improve memory and comprehension levels, as well as students' rational reasoning in understanding concepts in different ways in learning. E-modules assist teachers in explaining, making subject matter understandable and increasing student motivation during the teaching and learning process (Olayinka, 2016).
In addition, e-modules can also lead to independent learning thus they can foster self-confidence, motivation, initiative, discipline, and responsibility. As research conducted by Simatupang & Sormin (2020) states that learning outcomes and critical thinking skills can be improved by implementing digital media as learning media. In addition, the implementation of learning media can also be collaborated with various learning approaches that are adjusted to the needs of students therefore it has implications for the achievement of learning that is innovative, fun, active and able to facilitate students to achieve the expected competencies.

The role of e-modules as learning media is quite large. This media has a different appearance from ordinary textbooks, it also looks more motivating and interactive for students. The content presented and displayed in the e-module is designed as attractive as possible with the aim of being more easily understood by students. The animated image design is developed in e-module-based digital teaching materials.

The e-module media is useful as an intermediary for delivering material from the teacher to students. Overall, PBL-based e-modules have a function to empower critical thinking skills as one of the digital learning media innovations that are indispensable to support learning in the current technological era in order to achieve predetermined learning objectives. There have been many benefits of Problem Based Learning-based e-modules as learning media to support learning activities. In addition, the element of interactivity can be a plus point about e-modules because this electronic media has multimedia properties that can be combined with text, narration, video, practice questions and integration with various approaches in the implementation of learning.

In accordance with the results of the literature review, e-modules can be considered as digital media or appropriate digital teaching materials that can be used by teachers to assist the process of empowering 21st century skills such as critical thinking for elementary school students. In line with Faisal’s opinion (2020), that students are now very familiar with the use of gadgets. Therefore, this character is the reason why it is easier for students to learn with technology.

In addition, e-modules can be developed using a Problem-Based Learning approach which is believed by the researcher is can train students to get used to solving problems thus they are skilled in critical thinking. According to Twiningsih (2019), the syntax of the learning model used in the module affects the effectiveness of the learning module. Digital media, namely PBL-based e-modules, can be presented by teachers with complete coverage such as written material, interesting videos that the teacher can make themselves or taken from YouTube content, there is background music to make students not bored when they are studying, and there are quizzes containing HOTS-based questions, in one digital media at once. E-module digital media can also be used anytime, anywhere as long as there is an internet network. The advantages of this media are that it is very practical, efficient, and effectively used during a pandemic, both online and offline. Digital-based learning modules can empower critical thinking through a PBL approach (Ridho, 2021).

The weakness of using this e-module is that when using this digital media, an internet network is needed which sometimes becomes an obstacle for students in the areas that do not have access to an internet network. Despite it weaknesses, based on the findings in previous studies there are many advantages of using this e-module with the development of both the approach used and the content adapted to the character of the material and learning styles of students. In addition, the quality and appearance of multimedia e-modules depends on the quality criteria from the results of study on the development of the media made.

E-modules can be considered as interactive digital media that are suitable for empowering 21st century skills such as critical thinking in elementary school student learning. In addition, the flipbook e-module can be developed based on PBL which trains students to solve problems thus they are skilled in critical thinking. Problem Based Learning-based e-module digital media can present material in the form of writing, interesting videos that the teacher can make themselves or taken directly from YouTube, background music that makes students not feel bored when they study, and HOTS-based quizzes in one interactive media. Digital-based media can also be used anytime, anywhere as long as there is an internet network. The advantages of this media are that it is very practical, efficient, and effectively used during a pandemic, both online and offline. The weakness of using this e-module is that when using an e-module requires an internet network which sometimes becomes an obstacle for students who are in the areas that do not have access to an internet network. E-module digital media can be used as an alternative solution in 21st century learning.

Conclusion

Based on the description of the results and discussion, the PBL-based e-module can be used as a teachers references in learning at SDN 01 Sangkaran Bhakti. This is because e-modules can include hyperlinks, images, videos, and sounds or other supporting materials.

So, 21st century skills can be applied in the classroom. 21st century education is expected to produce human resources who are capable of communication, collaboration, critical thinking skills and creative problem solving. Teachers must integrate information technology tools to help students learn with teaching materials, teaching methods, and various technology-based teaching media.

Regarding the advantages and disadvantages of e-modules, further research is needed to test the effectiveness of e-module media. This article has not really proven the effectiveness of this e-module, but the researchers have provided a real theoretical framework through a literature review that is integrated with the results of interviews and questionnaires for teachers.

Thus the author expects this article could become a reference either for teachers or educational practitioner in searching for various kinds of learning media, especially in primary school learning.
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