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NEED ANALYSIS OF DIGITAL TEACHING MATERIALS WITH STEM APPROACH AND FLIP BOOK-FORMED TO IMPROVE SELF-REGULATED SKILLS FOR PRE-SERVICE TEACHERS

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ABSTRACT

Technology-integrated teaching resources are a valuable tool for enhancing the teaching and learning process. Students attain less than optimal learning objectives and master competencies when innovative approaches to using technology-integrated instructional materials are not taken. In order to improve the self-regulated learning skills of students in pre-service teacher professional education programs, this research aims to identify the need for opportunities to develop interactive digital teaching materials with a STEM approach in New Technology in Teaching and Learning courses that are integrated with flip book-formed technology. The method is qualitative, using a case study approach to view and investigate certain situations to describe how an event or situation occurred. The study's findings demonstrate that students in pre-service teachers' professional education programs typically read lecturer-provided reference books and use instructional materials from the Ministry of Education. The study's findings also demonstrate that students' opinions about the possibility of creating and using flip books to support the use of interactive digital teaching resources with a STEM approach are favorable. The findings of this study are expected to lay the groundwork for future research focused on the creation and implementation of STEM-based interactive digital teaching materials in flip book format, specifically designed to enhance the professional development of pre-service teachers.

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1. INTRODUCTION

The digital era in the 21st century demands various kinds of skills that must be possessed by students, one of which is self-regulated learning skills (González-pérez & Ramírez-montoya, 2022; Karatas & Arpaci, 2021; Kusmaharti & Yustitia, 2022). Self-regulated learning skills (SRL) are defined as a level at which a person has active behavior and metacognition and is motivated in the learning process (Baldan Babayigit & Guven, 2020; Kesuma et al., 2020; Winarti et al., 2022).

Students who have high SRL mean that the student has high self-confidence and diligently searches for various sources of relevant information while learning (Martin et al., 2022; Rahmah & Permatasari, 2022). Students with high SRL are able to formulate goals, plan actions and develop strategies, monitor themselves, and evaluate whether the actions and strategies implemented can be used to achieve goals (Chou & Zou, 2020; Foong et al., 2021; Taranto & Buchanan, 2020). Beside that, self-regulated learning is another essential component in this digital era too.

As we go into the current digital era, education must keep up with technological advancements and improvements. Technology has the ability to create new learning spaces that are necessary to support educational activities (Niemi et al., 2024; Scavarelli et al., 2021). The use of technology in the field of education has been able to reform the teaching and learning process (Beardsley et al., 2021; Winter et al., 2021). Furthermore, technology has made it possible for people to learn and access learning resources outside of the classroom in a variety of ways (Fathurohman, Kurdiati, et al., 2023). Using technology has the benefit of creating a dynamic environment for teaching and learning (Cheung et al., 2021; Dakhi et al., 2020; Engeness, 2021). To take advantage of the potential uses of technology in the learning process, educators must be able to integrate technology into their classes and swap out outdated teaching methods with more modern resources and tools (Spiteri & Chang Rundgren, 2020; Taghizadeh & Hasani Yourdshahi, 2020). According to Latorre-Cosculluela et al., (2021), digital learning-which is the delivery of instruction through the use of technology to improve student knowledge and skills-must be implemented in order to meet the expectations of education in the twenty-first century. Today's rapidly evolving information and communication technology makes it possible for educational institutions to create technologically enhanced learning resources, such as flip books, that optimise student learning (Hur et al., 2024; Olufunke, 2020).

The phrase "flip book" originates from a kids' toy with multiple pages that, when you open them one at a time, give the impression that the pictures are moving (Rouse, 2022). Advancements in technology have transformed the idea of a flip book into a three-dimensional electronic book that can be opened like a book on a monitor screen (Maknun et al., 2023; Sumaryati et al., 2022). According to Kholis & Azmi (2023), flip books, also known as e-books, are more engaging and interactive than printed books since they incorporate hypermedia elements including animation, music, and video features. Digital flip books can be viewed anywhere at any time, overcoming the drawbacks of distance learning as well (Azionya & Nhedzi, 2021; Munzil et al., 2022). Using learning models into the creation of flip books digital teaching resources is possible. STEM (science, technology, engineering, and mathematics) learning model is one of the models that can be employed. STEM education is an educational strategy that can enhance abilities and produce human capital of the calibre required to satisfy 21st-century skill demands (Fathurohman, Oklilas, et al., 2023; Fathurohman, Susiloningsih, et al., 2023). This learning approach involves all four disciplines at once, so it can help students think critically and creatively.

Previous researchers have conducted analyses of the need for flip book-formed digital teaching materials. Sari & Atmojo, (2021) conducted an analysis of this need in order to empower students' 21st century skills in the context of learning science in elementary school. The study's findings indicate that while most teachers continue to use printed teaching materials that are already accessible for learning, they also see opportunities to create and use flip books as a means of encouraging the use of digital teaching resources. The results of that study also indicate that

there is a significant need for digital instructional resources in the format of flip books. According to the aforementioned justifications, innovation plays a critical role in the learning process, particularly when it comes to material delivery. The usage of flip books as digital learning resources can be very beneficial when integrated into the learning process. The purpose of this study is to determine whether interactive digital learning tools in the form of flip books, utilising the STEM method, are necessary to help students in pre-service teacher professional education programs enhance their ability to self-regulate. However, based on the researcher's observations through literature studies, no research has been found that identifies the need to develop interactive digital teaching materials using the STEM approach in the form of flip books, especially those that can improve self-regulation skills in students of pre-service teacher professional education programs. Therefore, in this study, the researcher intends to conduct research that fills this gap, namely conducting research that identifies the need to develop interactive digital teaching materials with the STEM approach in the form of flip books to improve self-regulation skills in students of pre-service teacher professional education programs.

2. METHOD

The method used in this research is qualitative, using a case study approach to view and investigate certain situations to describe how an event or situation occurred. Qualitative research is a technique that helps investigate and comprehend how people and groups interpret social issues. The subjects of this research were 58 students of pre-service teacher professional education program Universitas Sriwijaya in 2023. Research subjects are identified by random sampling, namely the process of selecting samples or elements randomly from a population, with each element or member having the same opportunity to be selected as a sample (Akkaş & Meydan, 2024). Interviews were the primary method of gathering data, with the use of documentation and requirements analysis questionnaires. To learn more about the issues that crop up in the field, interviews were done. Based on fieldwork, the interview protocols and instruments in this study address the following three primary research areas: needs, context, and challenges (Jain, 2021). Google Forms are used to distribute questionnaires in order to track issues that emerge in the field. The findings of the surveys and interviews pertaining to the completed study analysis require documentation. The Milles and Huberman data analysis technique was applied in this study. Figure 1 illustrates the steps involved in data analysis: data gathering, data reduction, data presentation, and conclusion drawing (Miles & Huberman, 1994). After that information, which is not suitable to ignore, focus on relevant research. The interview and observation data were then matched with the documents that had been carried out. The effectiveness of data obtained from the same source using different techniques, such as triangulation techniques.

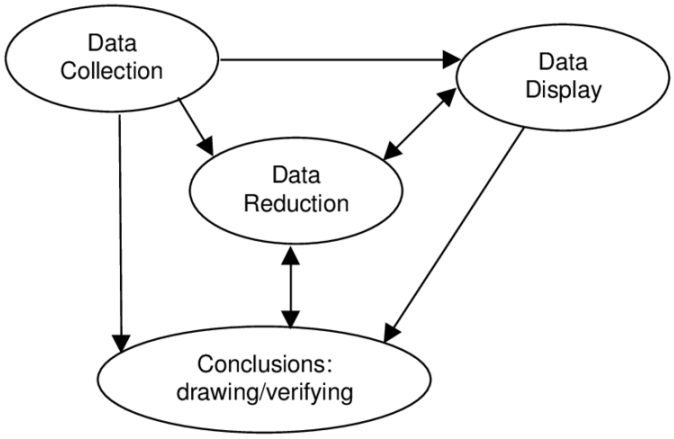

Figure 1. Miles and Huberman Model Data Analysis Steps

3. RESULTS AND DISCUSSION

The problems identified in the field were identified using interview techniques for student of pre-service teacher professional education program of Universitas Sriwijaya. The table 1 below summarizes responses from identified informants. It is clear from an overview of the findings from student surveys and interviews about what they need in the way of STEM-based digital teaching resources for the New Technology in Teaching and Learning course that the available resources are not up to the challenges of 21st-century learning. Table 1 illustrates that, aside from reference books suggested by instructors, students have mostly depended on instructional resources supplied by the Republic of Indonesia's Ministry of Education, Culture, Research, and Technology. However, the absence of interactive digital teaching materials, particularly those utilizing a flip book format with a STEM approach, presents a significant gap in the educational experience.This lack of modern, interactive resources is problematic given the increasing emphasis on integrating technology into teaching and learning processes. Traditional methods, while foundational, are often inadequate in equipping students with the skills and knowledge required to navigate the complexities of contemporary STEM fields. The need for more dynamic and engaging educational tools is further underscored by the rapid advancements in technology, which have transformed both the content and delivery methods of education (Fathurohman &; Kusuma, 2023; Hundredmanan, 2022; Singh, 2016; Suradi, 2018).

Furthermore, students perceive that flip book-formed teaching materials are not only interesting but also serve as highly effective learning tools. This perception stems from the interactive nature of flip books, which engage students more deeply compared to traditional static resources. The dynamic content presentation in flip books, such as embedded multimedia elements, interactive quizzes, and hyperlinked resources, enhances students' engagement and motivation to learn. By interacting with the content in a more engaging and responsive format, students are better able to absorb complex concepts, especially in subjects that require a deep understanding of interconnected ideas, such as those within the STEM fields. Students also recognize the significant benefits that these interactive digital teaching materials bring to their development as future educators. The integration of technology through flip books mirrors the modern educational environment, where digital literacy is increasingly essential. By using flip books in their studies, students are not only learning the subject matter but also gaining valuable experience in utilizing digital tools that they will likely incorporate into their own teaching

practices. This hands-on experience with technology prepares them to be more effective educators who can seamlessly integrate digital resources into their classrooms, thereby enhancing the learning experience for their future students.

Table 1. Summary of Interview Results and Questionnaires

No	Indicators	Results of Interviews and Questionnaires
1	Frequently used teaching materials	Teaching materials provided by the Ministry of Education, Culture, Research and Technology in Portable Document Format (PDF) file format and reading reference books provided by lecturers.
2	The usefulness of interactive digital teaching materials in the form of flip books	Very useful, the use of interactive digital teaching materials in the form of flip books provides significant benefits to student of pre-service teacher professional education program as prospective educators. The flip book form makes it easier for students to access learning materials anytime and anywhere. Also, the interactive nature makes learning more interesting and helps students understand concepts more deeply.
3	The urgency of using interactive digital teaching materials in the form of flip books in increasing SRL	It is very necessary, because the use of interactive digital teaching materials in the form of flip books has an important role in improving Self-Regulated Learning (SRL) skills for student of pre-service teacher professional education program. The characteristics of the flip book form provide a foundation for developing independent learning skills in students, which is one of the vital aspects in preparing student of pre-service teacher professional education program as prospective educators.
4	Availability of interactive STEM approach digital teaching materials in the form of flip books	The unavailability of digital teaching materials for New Technology in Teaching and Learning courses in the form of interactive flip books , especially those based on STEM
5	Student opinions on STEM approach teaching materials	Agree, because integrating STEM into digital teaching materials provides student of pre-service teacher professional education program with a more effective and relevant learning experience. By combining science, technology, engineering, and mathematics, students can see the relationship between disciplines and understand how these concepts can be applied in real-world situations.
6	Student opinions on the development of interactive STEM approach digital teaching materials in the form of flip books	Totally agree, because digital teaching materials in the form of flip books create a dynamic learning experience. The use of flip book forms in teaching materials is in line with the improvement of independent learning, which is one of the main pillars in the development of comprehensive prospective educators. Also, the use of STEM approaches prepares

	student of pre-service teacher professional education program to teach their students later in life with a more integrated and contextual approach.

The flexibility offered by flip books is another critical factor that contributes to their perceived usefulness. In today's fast-paced academic environment, where students often juggle multiple courses, extracurricular activities, and part-time jobs, the ability to access learning materials anytime and anywhere is invaluable. Flip books, being accessible on various devices, allow students to study on the go, making productive use of their time, whether they are commuting, waiting between classes, or studying late at night. This accessibility ensures that students can keep up with their studies without being tied to a specific location or time, thereby accommodating their busy schedules and reducing the stress associated with managing academic responsibilities. (Dewandono &; Sutiyarti, 2022; Puspita et al., 2021; Princess Kumalasani &; Eilmelda, 2022; Sumartini, 2022). Interactive engagement through videos, simulations, and interactive activities makes learning more engaging and helps students understand concepts more deeply (Basiran & Ningsih, 2023; Fathurohman & Susiloningsih, 2022). This gives students the opportunity to discuss questions as they arise, collaborate with fellow students, and stimulate students' critical thinking. As expressed by Nakajima & Goode (2019), a flipbook (e-book) has the characteristics of hypermedia.With animation, music, and video features, it is more interesting than printed books. Next Flip Book Digital also overcomes the challenges of distance learning so that it can be accessed anytime and anywhere (Roemintoyo & Budiarto, 2021). This statement is made clear by Komalasari & Rahmat (2019): digital flipbooks provide great opportunities for distance science learning.

Furthermore, students as a whole state that it is important to use teaching-based materials like Flip Book to improve self-regulated learning skills in college students. Students argue that the use of interactive digital teaching materials in the form of flip books has a crucial role in improving self-regulated learning (SRL) skills. In addition, students consistently emphasize the importance of utilizing teaching materials such as Flip Books to enhance self-regulated learning (SRL) skills in college students. Flip Books, by their design, support the development of SRL skills by offering an interactive and engaging medium that requires active participation from students. Unlike traditional textbooks, Flip Books are designed to be more than just repositories of information; they are interactive tools that promote critical thinking, self-assessment, and reflection. Features such as embedded quizzes, instant feedback, and customizable study paths allow students to monitor their understanding of the material in real-time, identify areas where they need improvement, and adjust their study strategies accordingly. This process of self-monitoring and adaptation is at the heart of self-regulated learning, as it empowers students to take ownership of their education. Flip books provide a solid foundation for the development of students' independent learning skills and independence (Hasanudin et al., 2022), which is a very vital aspect in the preparation of students for pre-service teacher professional education programs as prospective educators. The need to use flip book-formed teaching materials to improve abilities for self-regulated learning Students are then strengthened by research conducted by Susantini et al., (2021), which states that flip books (e-books) have the potential to be used in digital learning modes as well as train metacognitive skills and self-regulated learning skills.

Moreover, students almost entirely approve of integrating STEM approaches into digital teaching materials. By combining science, technology, engineering, and mathematics, students can see the relationship between disciplines and understand how these concepts can be applied in real-world situations (Fathurohman, Oklilas, et al., 2023; Zamista, 2018). This provides a stronger foundation to improve students' ability to design and provide meaningful learning to their students in the future. STEM in digital teaching materials not only adds dimension to the student learning experience but also creates a solid foundation for the role of students in pre-service teacher professional education programs as educators in the ever-evolving world of education. Through this approach, students will receive thorough and relevant preparation to produce a generation that has deep skills and understanding in science, technology, engineering, and mathematics. Students ultimately expressed their strong agreement with the development of interactive STEM approach digital teaching materials in the form of Flip Books. This agreement brings hope for the widespread use of technology by teachers because the potential of technology can create new learning spaces needed to facilitate learning activities (Arizal et al., 2023; Fathurohman, Susiloningsih, et al., 2023; Marta, 2019; Pustikayasa, 2019). Ultimately, harmony between the content of new technology-based teaching and learning courses and the currently required self-regulated learning skills can be achieved through the approval of the usage of Flipbook-formed teaching materials. The aforementioned analysis's results indicate that, in order to help students in pre-service teacher professional education programs build self-regulated learning skills, it is critical to provide interactive digital teaching materials that use a STEM flip book method.

4. CONCLUSION

The lack of appropriate digital teaching materials necessitates the development of teaching materials that meet their needs, according to the findings of the analysis of the need for STEM-approach interactive digital teaching materials using flip books, which are able to improve self-regulated skills for students of pre-service teacher professional education program above. It is intended that study programs will be able to use the research findings as input to select suitable teaching materials for instruction, particularly in the course on new technology in teaching and learning.

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