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Al Ibtida

## Elementary School Students' Perceptions of STEM-Based Mobile Learning Applications

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### Abstract

Research conducted by the "We Are Social" institution shows that Indonesian people are a significant resource in utilizing the internet. The ability of Indonesian elementary school students in using digital technology is quite good; however, its use is primarily for entertainment. Observing this phenomenon, researchers have taken the initiative to harness digital technology to enhance the learning experience, moving away from conventional methods. This study aims to investigate how elementary school students perceive STEM-Based Mobile Learning Application Technology. The research method used for this study is qualitative, emphasizing discourse analysis and conversational analysis. Participants in this study included ten fifth-grade elementary school students in the city of Cirebon. The results of the study have been quite positive, as this application makes it convenient for students to study anywhere and at any time, as long as their smartphones are connected to the internet. Nonetheless, the use of STEM-Based Mobile Learning Application Technology has received feedback regarding its limitations and weaknesses, such as the small screen, which makes it challenging for users to read text.

Keywords: *mobile learning application, STEM, elementary school students.*

### Abstrak

Riset yang dilakukan oleh lembaga *We Are Social* menunjukkan bahwa masyarakat Indonesia merupakan sumber daya yang sangat besar dalam mendayagunakan internet. Kemampuan siswa Sekolah Dasar Indonesia sudah cukup baik dalam menggunakan teknologi digital. Namun pemanfaatannya masih bersifat hiburan. Melihat fenomena tersebut, peneliti berinisiatif untuk memanfaatkan teknologi

digital untuk memfasilitasi pembelajaran sehingga tidak lagi bersifat konvensional. Penelitian ini bertujuan untuk mengetahui bagaimana persepsi Siswa Sekolah Dasar terhadap Teknologi Aplikasi Mobile Learning Berbasis STEM. Metode yang digunakan untuk jenis penelitian ini adalah metode penelitian kualitatif. menekankan pada fokus analisis wacana dan analisis percakapan Partisipan dalam penelitian ini yaitu melibatkan sepuluh siswa sekolah dasar kelas lima di kota Cirebon. Hasil penelitian ini yaitu Mendapatkan respon yang positif karena aplikasi ini memberikan kemudahan siswa untuk belajar dimanapun dan kapanpun asalkan smartphone mereka terhubung dengan internet. Namun penggunaan Teknologi Aplikasi Mobile Learning Berbasis STEM juga mendapatkan respon terkait kelemahan atau kekurangannya yaitu memiliki keterbatasan seperti perangkat lainnya diantaranya yaitu layarnya kecil sehingga pengguna kesulitan untuk membaca teks.

Kata kunci: *aplikasi mobile learning, STEM, siswa sekolah dasar.*

## **INTRODUCTION**

Information and communication technology is very influential on the development of education. The world of education is affected by the digital technology industry and the internet (Rasmitadila et al., 2020; Widyasari et al., 2019). This impact is considered positive because it encourages various stakeholders, including educators, teachers, educational organization managers, and students, to adapt to innovation in the global era. with the current technological developments, learning activities, especially in elementary schools, require the development of technology-based learning media (Mystakidis & Christopoulos, 2022). Attractive technology-based learning media will make it easier for teachers to increase students' motivation and understanding in absorbing learning materials. However, in practice not all teachers can develop learning media (Febriyanti & Mustadi, 2020; Kao et al., 2016; Mayer, 2019; Ulia et al., 2022).

The rapid development of information technology enables individuals to explore data and information more comprehensively and practically. Utilization of technology as a learning medium can increase student interest in learning (Heidari et al., 2022). However, even though the technology is currently developing rapidly, in reality, the learning process is never separated from various problems, one of which is paying attention to signs that must be considered, namely that learning media should be adapted to the uniqueness of the concept or subject matter and the development of thinking of elementary school students or Madrasah Ibtidaiyah. From the various problems that occurred in the field, it was identified that the current application of learning media was very dull. According to (Sahronih et al., 2019), in multiple educational institutions, several technology-based learning media are not in optimal condition, such as; the number and components are lacking, the quality is poor, and the media is not accessible. The students' lack of interest in the media is demonstrated through a noticeable 'averse' attitude. and not enthusiastic about carrying out the learning process when using certain learning media. So that if the media is forced to be used, the student's position will be burdened; from feeling burdened, students will not be interested because before using the media, students have to be faced with problems to use and understand the media used (Beckman et al., 2018).

Furthermore, the current era of globalization requires educators and students to be able to master and apply technology in the learning process (Setiawan et al., 2022). Young educators (millennials) must be able to build connections and share. In addition, the era of the industrial revolution 4.0 has challenges ahead which, if not realized and not prepared properly, will undoubtedly cause to fall behind (Elfrida Yanty Siregar et al., 2019). Therefore, it is necessary to innovate and initiate reforms and improvements, which should commence from within the school. One way to achieve this is by enhancing the quality of education through the use of Android-based learning media that is integrated with the Science, Technology, Engineering, and Mathematics (STEM) approach. Because in this modern era, smartphones that use the Android OS are things that are mandatory to use in various ways, one of which is during the learning process. The existence of exciting and interactive learning media makes it helpful for teachers when providing understanding to students (Barakabitze et al., 2019; GÜLEN et al., 2022; Hsieh & Yu, 2022).

STEM learning in elementary schools can be more meaningful and useful for improving the quality of human resources if it allows students to develop their knowledge and apply it to solve everyday problems. However, based on the results of observations at research sites, it is evident that STEM learning has not been successful. This is primarily due to suboptimal learning media. Therefore, it is necessary to conduct research aimed at addressing these issues (Asmilyah et al., 2021).

Research that discusses STEM-based Mobile Learning Application Technology is still rarely done even though this study is important to do according to Rifan & Hamdu (2020) and Gusteti et al., (2021) in his research suggested that mobile learning makes it easy for teachers to convey teaching material because all the material has been explained in the application, while Ibáñez & Delgado-Kloos (2018) in his research stated that mobile learning can be used by students as a means of learning at home because it can be accessed alone via a smartphone. Mobile learning that teachers can use in learning can be in the form of digital modules which contain teaching materials based on the application of the Science, Technology, Engineering, Mathematics (STEM) learning model. STEM can be an alternative learning so that students can study independently at home by utilizing their digital technology. Based on this statement, this research is important to improve the quality of learning. One of the alternative technology-based learning media that can be used in the development of STEM-based Mobile Learning Application Technology is adapted to the subjects taught in elementary school.

The development of this media uses software such as Unity3D, Blender, CorelDRAW X7, and Vuforia. This research produces an application of STEM-Based Mobile Learning Application Technology. This captures student perceptions as users of this application which is expected to become one of the alternative learning media for STEM-based Mobile Learning Application Technology that can attract student learning interest. The STEM-based mobile learning application is a breakthrough innovation in digital learning in the industrial 4.0 era. This is because it can prepare students to face new challenges that arise in the future due to technological developments. In its use, STEM-based mobile learning applications can be used as a way to foster new competencies in students. As a country with a very large population and undergoing rapid economic and technological growth, STEM subjects should be integrated into education from an early age, starting in elementary, middle, and high schools. This will help prepare students for the ever-increasing global competition in the future. There are also several benefits to introducing STEM subjects at an early age, including: 1)

Cultivating high-quality human resources for the future who can contribute to the creation of new technologies, thus improving the quality of life for humanity. It's not just about being an active user, as you are now; 2) Developing students' logical, systematic, and critical thinking skills, which can be applied in their daily lives as well as in various other subjects; 3) Enhancing students' soft skills, including effective problem-solving, perseverance, teamwork, character, and a variety of mental skills that are applicable in everyday life. The integration of mobile learning technology into STEM education aligns with the characteristics of 21st-century learning. 21st-century learning aims to equip the current generation with three main subjects in learning: 1) Learning and innovation skills; 2) Information, media, and technology skills; and 3) Life and career skills.

## **METHODS**

This study aims to investigate the perceptions of elementary school students regarding the use of STEM-Based Mobile Learning Application Technology. The research method employed is qualitative, employing a descriptive study design. In descriptive research, no treatment, manipulation, or alteration of the studied variables is carried out; instead, it simply describes the existing conditions. The only intervention applied was the research itself, conducted through observations and interviews. In this study, the researcher served as the primary research instrument, in contrast to quantitative research, which employs statistical analysis to address research questions. According to Creswell (2014) and Lê and Schmid (2022) qualitative research focus on discourse analysis and conversation analysis.

The research procedure involves three stages: data reduction, which involves simplification, abstraction, and transformation of raw data obtained from field records or recordings; data presentation, which prepares information for drawing conclusions; and data verification, which entails drawing conclusions based on the data's reduction, interpretation, and presentation. The process of analysis and data collection is interactive and occurs through these three stages.

The research approach employed aligns with the concept of qualitative research, which aims to unveil holistic-contextual phenomena by collecting data from natural settings, using the researcher as the primary instrument. Qualitative research seeks to comprehend the experiences of research subjects in a holistic manner, exploring behaviors, perceptions, motivations, actions, and more, while presenting this understanding through words and language within the unique natural context, utilizing various natural methods.

The participants in this study included ten fifth-grade elementary school students in the city of Cirebon. The selection of these participants used a purposive sampling technique. The choice of these participants' characteristics was based on the results of interviews between researchers and teachers to determine the research respondents. The participants in this research have used STEM-Based Mobile Learning Application Technology applications. In this study, researchers used data obtained from primary sources and secondary sources in qualitative research. These sources include text or written transcripts as well as audio recordings.

The data collection technique is the most strategic step because the study's primary purpose is to obtain data. For data collection on "elementary school students' perceptions of the use of STEM-Based Mobile Learning Application Technology," the researchers used the method (1) structured interviews. Structured interviews are interviews conducted by first

making questions and then compiling questions in the form of a list of questions that will be asked to informants (2) Using direct observation techniques, namely, the observer is straightforward with the object under study, and indirectly, namely, research conducted not on at the time of the incident under investigation. The focus of his observations is on the learning media of students. The researcher only observes and examines these activities.

The qualitative data analysis used by the researcher was descriptive in nature. It involved describing the obtained data using individual words or sentences to draw conclusions, aiming to understand various aspects such as what, how, and to what extent. During interviews with the research subjects, the researcher posed questions to gather data relevant to the research objectives and to address the predetermined problem statement. If, after analyzing the responses from the research subjects, any gaps or deficiencies were identified, the researcher continued to ask questions until the responses aligned with the research, encompassing data reduction, data presentation, and concluding stages. The researchers conducted data analysis and drew conclusions with the assistance of NVivo software. NVivo offers the advantage of connecting coding results, performing queries, and creating analytical maps based on research data (Allsop et al., 2022).

## RESULTS AND DISCUSSION

The research findings are depicted in Figure 1. There are two main focuses discussed, namely (1) Student Perception of the ease of Exploitation of STEM-Based Mobile Learning Application Technology and (2) Student's Perception of the weaknesses of STEM-Based Mobile Learning Application Technology Exploitation. The results of the discussion are as follows:

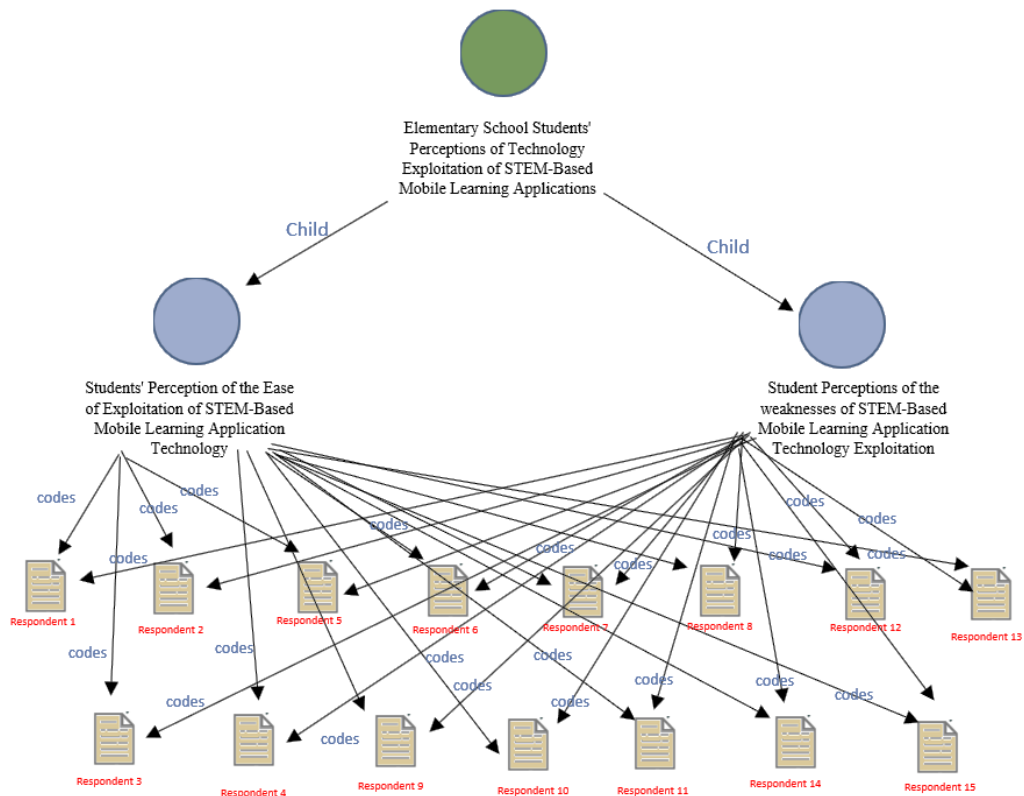


Figure 1. Research project map of Elementary School Students' Perceptions of Technology Exploitation of STEM-Based Mobile Learning Applications.

### **Students' Perception of the Ease of Exploitation of STEM-Based Mobile Learning Application Technology**

The development of learning resources based on Android Smartphones is based on several facts in the field showing that Android technology is not used optimally, especially by research respondents, namely, the fifteen students are Android users. Still, Android has only been used as a communication tool and game. Media games and Android is still rare. as a means of learning activities, so researchers take the initiative to develop STEM-Based Mobile Learning Application Technology.

Students' perceptions of using STEM-Based Mobile Learning Application Technology, namely the teaching and learning process, can generate new desires and interests, motivation and stimulation of activities, and even psychological effects on students. STEM-Based Mobile Learning Application Technology makes learning a means of delivering learning messages related to the direct learning model, namely by how the teacher acts as a transmitter of information. In this case, the teacher should use various appropriate media. STEM-Based Mobile Learning Application Technology is a teaching and learning process tool. Everything can be used to stimulate the learners' thoughts, feelings, attention, and abilities or skills to encourage the learning process.

STEM-Based Mobile Learning Application Technology combines various media (in various file formats) such as text, images, and games, which are transformed into digital files (computerized) used to convey messages to the public. Simultaneously, it fosters interactive understanding related to two-way or multi-directional communication, using the components of multimedia communication as independent learning materials. Out of the fifteen students interviewed in the research, all of them provided a positive response to the use of STEM-Based Mobile Learning Application Technology. The students' responses were nearly identical, as they felt that with the help of mobile learning applications, they could easily access information and learning materials from anywhere and at any time. Students could manage their learning on their own terms, choosing when and where they wanted to access learning resources.

### **Students' Perceptions of the Weaknesses of Exploiting STEM-Based Mobile Learning Application Technology**

As software that serves to help humans facilitate their activities, the Android operating system also has various advantages and disadvantages in its operation. The use of Android in the office environment, education, and in other fields, of course, has become a familiar sight. Because at this time, advanced technology is increasingly mastering and keeping pace with the times. The use of computers, or what is known as information technology, in delivering teaching materials allows students to involve students and get feedback quickly and accurately actively. Computers are becoming popular as a teaching medium because computers have unique features, and STEM-Based Mobile Learning Application Technology is a potential alternative to expanding access to education. However, there is not much information about mobile/smartphones, especially cellular phones, as learning media. This is unfortunate, considering that the level of ownership and use already relatively high is not being utilized to be directed towards education.

Disadvantages of STEM-Based Mobile Learning Application Technology include limited internet access. In areas with unstable or limited internet coverage, accessing e-

learning services can be challenging. This issue still persists in Indonesia, particularly in some 3T areas (lagging, leading, and outermost) where internet access is not yet available. Another drawback is that STEM-Based Mobile Learning Application Technology results in one-way e-learning. This reduces the interaction between teachers and students, making it challenging for students to seek further explanations on complex topics. This statement is also supported by the opinions of respondents (Respondent 2 and Respondent 3).

*This application is good, but unfortunately, the internet where I currently have signal interference, so I find it challenging to use the STEM-Based Mobile Learning Application Technology application. This application has a heavy capacity. When installed on my smartphone, it is prolonged (Respondent 2)*

*Using STEM-Based Mobile Learning Application Technology, I feel unsatisfactory because I am used to learning to meet teachers at google meet. So if I don't understand the material, it's easier for me to ask directly on google meet (Responden 3)*

STEM-Based Mobile Learning Application Technology has limitations, similar to other devices, such as the small screen, which can make it difficult for users to read text, and limited application data storage. Furthermore, many mobile devices are not specifically designed for educational purposes, which can pose challenges for students when completing tasks assigned by the teacher. These limitations are related to the initial design of some devices and the lack of ongoing development for mobile devices.

The development of mobile learning-based technology has the potential to greatly change the way people learn, acquire information, and adapt. Mobile learning also provides opportunities for educators to develop learning techniques to produce maximum results. Likewise, it is hoped that with mobile learning, students will more easily determine what and how they can absorb information quickly and efficiently. Sources of information are no longer limited to the text within books; they have expanded. Mobile learning technology connected to the internet will further enhance the ease of accessing the desired information.

The results of this study showed that the respondents gave positive responses regarding the use of STEM-based Mobile Learning Application Technology, This aligns with research conducted by Zhu & Wang (2020), which indicates that mobile learning significantly impacts student learning outcomes, while Shurygin et al (2023) explained in his research that mobile learning is learning using mobile technology. devices such as smartphones, tablets and notebooks. Due to the high mobility of students, mobile learning allows students to interact with portable technology anywhere and anytime so as to have a positive impact on the learning outcomes of elementary school students. For example, learning people who rarely have free time and are busy working can use STEM-Based Mobile Learning Application Technology on their Gadgets to access the information they need. This is in line with research conducted by (Barakabitze et al., 2019) e-learning allows students to learn outside the classroom. Like when they were at home. The use of Mobile Application Technology is important so that the learning process is not too abstract and has variations (Beckman et al., 2018; Fahrurrozi et al., 2020; Kanematsu et al., 2014; Suri & Rachmadtullah, 2021). Media is a component of various types used in the environment of students as a tool to stimulate their abilities in learning activities. Media as a learning resource means that the media used by the

teacher can serve as a place where the learning materials are located (Garzón et al., 2022; Iasha et al., 2018; Marini et al., 2022)

However, this study also found obstacles or shortcomings in using Mobile Application Technology. This statement follows the opinion of the respondents. Android is always connected to the internet (Abdulah et al., 2020; Pelman & Zoran, 2022; Ultra Gusteti et al., 2021). This Android-based cellphone requires an active internet connection. Although the number of ads displayed above or below the application does not affect the application that is being used, these ads are pretty annoying. It is hoped that with the student's response, STEM-Based Mobile Learning Application Technology can be improved and developed again because learning media has a vital role in the teaching and learning process. Using optimal learning media can make it easier for students to digest the subject matter (Martin-Hansen, 2018; Purwaningsih et al., 2020).

The characteristic of using a smartphone as a learning medium, often referred to as mobile learning, is its high level of flexibility. As a complement to traditional learning methods, mobile learning enables users to access learning materials, guidance, and information from anywhere and at any time. Mobile learning serves as an alternative for developing learning resources that empower students to learn independently. (Almaiah et al., 2022; Lutfi et al., 2022).

## **CONCLUSION**

Based on the research results obtained, student perceptions of the ease of technology exploitation of STEM-based mobile learning applications Get a positive response because this application makes it easy for students to learn anywhere and anytime as long as their smartphones are connected to the internet. However, the use of STEM-Based Mobile Learning Application Technology also received feedback regarding its limitations and shortcomings, namely, it has limitations similar to other devices, such as a small screen, which can make it difficult for users to read text. Additionally, it has limited data and multimedia storage. Therefore, improvements and future developments are needed to enhance the effectiveness of this application.

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