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Optimization of mobile learning in land surveying material for vocational high school students: A preliminary study

Ardana Dika Anggara[1+]
Roemintoyo[2]
Triana Rejekiningsih[3]

[1,2,3]*Department of Educational Technology, Sebelas Maret University, Indonesia.*
[1]*Email: ardanadikaanggara@student.uns.ac.id*
[2]*Email: roemintoyo@staff.uns.ac.id*
[3]*Email: triana_rizq@staff.uns.ac.id*

(+ Corresponding author)

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ABSTRACT

This study aimed to identify students' learning needs related to integrating mobile device technology and creative thinking skills in learning land surveying. This was done by looking at students' responses based on media use, opportunities for media development, and supporting facilities for developing learning media. The participants of this study were 155 second-year students of the building engineering study program at Vocational High Schools. Mobile learning needs analysis indicators were prepared as a questionnaire instrument to achieve research objectives. This study used a quantitative approach, and the results of student responses were analyzed descriptively and presented in percentages. The findings revealed that 59.7% of respondents "agreed" and 40.3% "strongly agreed" to support the development of learning media that integrated cellular technology and creative thinking into the learning process of land surveying and was supported by the availability of learning support facilities. The conclusion is that the use of cellular technology in the learning process is directly proportional to students' abilities in operating and owning a smartphone, and that in the development of mobile learning as an alternative learning medium for land surveying has enormous opportunities. This study recommends the product of learning media using mobile learning methods and creative problem-solving approaches to train students to get used to creative thinking skills in developing their life skills.

Contribution/Originality: This study contributes to developing a new perspective on developing mobile learning media combined with creative thinking skills. It identified students' needs in optimizing their facilities' use for mobile learning and developing learning media.

1. INTRODUCTION

When the first COVID-19 case was reported in Indonesia on March 2, 2020, most educational institutions were closed and students almost all over the world were asked to stay at home. Therefore, in response to the call not to stop teaching during the pandemic, teachers made a significant transformation in the learning process (Ożadowicz, 2020). Learning, which was originally carried out face-to-face in the classroom or laboratory, became learning with a mixed online strategy (Sengupta, 2022).

The development of Information and Communication Technology (ICT) and the current situation of the COVID-19 pandemic have presented challenges in various fields of daily life. Educational institutions around the

world have been forced to switch partially or completely to the online learning model in order to keep the teaching and learning process running (Adedoyin & Soykan, 2020). However, there are many things that make this learning ineffective. One of them is the use of learning media to explain analytical material that is difficult to understand. Hence, in order to facilitate students to understand lessons during learning, the teacher tends to often give material and assignments if it is not possible to provide in-depth explanations of the material.

The results of the learning are expected to help the student to acquire a relatively permanent change in the behavioral potential resulting from the experience (Levy, 2021). Hence, learning is not observed directly; only when looking at changes in behavior in students as a result of the corresponding experience can it be concluded that learning has occurred. Therefore, educational institutions should help their students by facilitating useful 21st century skills for their future. Learning in the 21st century emphasizes the development of life skills that include technology and digital literacy, it is hoped that students can adapt to changing times. The necessary abilities include listening skills, observing, evaluating, analyzing, interpreting, comparatively relating, empathy and critical thinking skills (Bourn, 2018).

Learning activities will be more meaningful if students are directly involved in the learning process (Januszewski & Molenda, 2013) and the encouragement that arises from within oneself (Spector, 2015). Mobile technology has become a practical solution in learning during the pandemic, due to mobility and the ability to facilitate informal learning outside the classroom (Kumar, Osman, Sanmugam, & Rasappan, 2022). This technology offers students access to information anytime and anywhere, as well as the ability to share experiences and knowledge with others for the purpose of improving performance and interest in learning(Kukulska-Hulme & Viberg, 2018). Meanwhile, international framework "21st Century Competencies" underscores the importance of digital competencies as an axis to improve other competencies. In short, the development of digital competencies supports the safe, critical, and creative use of ICT for work and learning.

The direction of the policy of the Ministry of Education and Culture (2018) implies the strengthening of the character education process and learning activities of higher-order thinking skills. Higher-order thinking skills involve three aspects of skills, namely knowledge transfer, critical and creative thinking, and problem solving. However, the development of these skills depends on the learning scenarios carried out by the teacher. The integration of technology in the curriculum has made great strides in the world of education, but at the same time faces many significant challenges for the future. Teachers can take advantage of these strategies to improve students' critical thinking, learning and analytical abilities, autonomy, sharing in their learning, being more responsible, and preparing them for the world of work (Abdullah, 2016). Meanwhile, the results in (Mahmudah, Cahyana, & Purwanto, 2021) showed that the use of online and mobile media was more effective than learning with traditional media in improving creative thinking skills. Therefore, teachers should develop learning media that are appropriate to the current pandemic and refer to learning indicators based on student characteristics and time (Yaniawati, Supianti, Fisher, & Sa'adah, 2021).

Mobile learning has developed rapidly in the last few decades (Zhang & Yu, 2022). Mobile learning has certain advantages that can be a learning solution for teachers and students, especially during distance learning (Khan, Ali, & Alouraini, 2022). It can train students' creative thinking independently (Kumnuansin, Khlaisang, & Koraneekij, 2022). Mobile learning is a new multi-context learning model that involves interaction with personal electronic devices (Danish & Hmelo-Silver, 2020) which in this case refers to using smartphones, tablets, or computers for educational purposes (Sung, Lee, Yang, & Chang, 2019). Learning in the 21st century emphasizes creative thinking skills supported by digital competence (Martínez-Bravo, Sádaba Chalezquer, & Serrano-Puche, 2022). creative thinking can be applied in mobile learning to improve performance (Yaniawati et al., 2021).

This model has an influence on learning, such as concretizing knowledge, strengthening learning, or demonstrating learning activities (Hsieh & Tsai, 2017). In addition, mobile learning has the potential to improve student learning outcomes (Yaniawati et al., 2021), allowing learners to learn according to the needs and

preferences of each one (Troussas, Krouska, & Sgouropoulou, 2022) as well as being able to increase student motivation because they are involved in the learning process directly (Li & Heng, 2021). Another study Alturki and Aldraiweesh (2022) explained that although the use of mobile learning has a positive impact on learning, it is necessary to consider several factors that can influence the desire to take advantage of mobile learning, such as possible conditions and social influences. The use of mobile platforms needs to be developed in such a way that it is in accordance with the learning needs of students and the resulting external goals. This is expected to make it easier for students to receive knowledge. The results of studies like Almanza-Arjona, Miranda-Camargo, Venegas-Andraca, and García-Rivera (2021) show that the application of technology as a learning tool had a positive impact on educational performance and the development of student skills.

In learning, mobile learning is usually adopted to see the effectiveness of mobile learning on students' creative thinking (Du, 2022). Some of the research on mobile learning has been developed specifically designed for learning. However, most of these applications focus more on material content and the use of technology and do not touch on the integration of innovation and creativity together. Using a mobile learning model integrated with creative thinking shows that the ability to think creatively has a more positive impact on developing life skills in the future (Almanza-Arjona et al., 2021) compared to mobile learning, which only contains material, especially in developing digital competencies.

This study aims to obtain information about the use of media in learning, student perceptions of developing learning media for land surveying techniques at Vocational High School, and media supporting facilities which will then be used as the basis for developing mobile learning integrated with creative thinking abilities. This research is expected to produce information as a form of needs analysis to develop mobile learning model products based on creative thinking for Land surveying subjects. This research also bridges the gap from the previous literature in using learning media, especially to find out the need for the importance of developing mobile learning based on creative thinking.

2. METHODOLOGY

2.1. Research Design

This research adopted a quantitative research design, with survey as the research method to collect the data. Surveys are expected to explore and identify students' opinions on opportunities for using mobile learning for learning land measuring instruments in vocational high schools (Sugiyono, 2019).

2.2. Sample and Data Collection

This research was conducted at Vocational High School (VHS) majoring in Civil Engineering, which involved 155 class XI students. The sample was randomly selected from the student population. The survey instrument was developed based on the points of needs analysis of the implementation of the study (Adhiono & Purnomo, 2021; Budiarto, Rejekiningsih, & Sudiyanto, 2021).

Data collection was carried out using the survey in the form of questions that used the Likert scale to measure the responses. The Likert scale was modified with specific details such as 1 (Strongly disagree), 2 (Disagree), 3 (Agree), and 4 (Strongly agree) (Sutrisno, 1991). A total of 10 question items were determined, consisting of three main indicators, the use of media in learning, student perceptions to develop learning media land surveying at SMK, and media support facilities.

2.3. Analyzing of Data

After collecting sufficient data, descriptive analysis was adopted for further analysis. The results of the student's responses were analyzed descriptively and presented in percentages. This aimed to make it easier to recognize the conditions and problems that occur in the classroom (Sudaryana & Agusiady, 2022).

3. FINDINGS / RESULTS

The research results are presented in the form of a brief discussion. This section consists of findings about media use in learning, participants' perceptions and opportunities for learning media development, and supporting facilities for learning media.

3.1. Use of Media in Learning

The first aspect of this study was to identify the use of media by teachers so far in learning land surveying. Based on the response to the use of learning media, most students argue that teachers use modules provided by the government, both hardfile modules and softfile modules. As many as 69.0% of students agreed that in the process of learning land surveying, teachers often used modules provided by the government. Information about learning activities was also obtained. Teachers used the medium to learn, but only sometimes. The results of open discussions with teachers showed that the most commonly used media were powerpoint-based presentation media and learning videos. The following questionnaire item related students' responses to agreeing or disagreeing that teachers used various learning media; most students "Agree" (51.6%). This refers to the previous item where teachers and students considered PowerPoint presentations containing material as the use of learning media. Related to this aspect, Figure 1(a) shows the use of module-based learning media, and Figure 1(b) varied learning media.

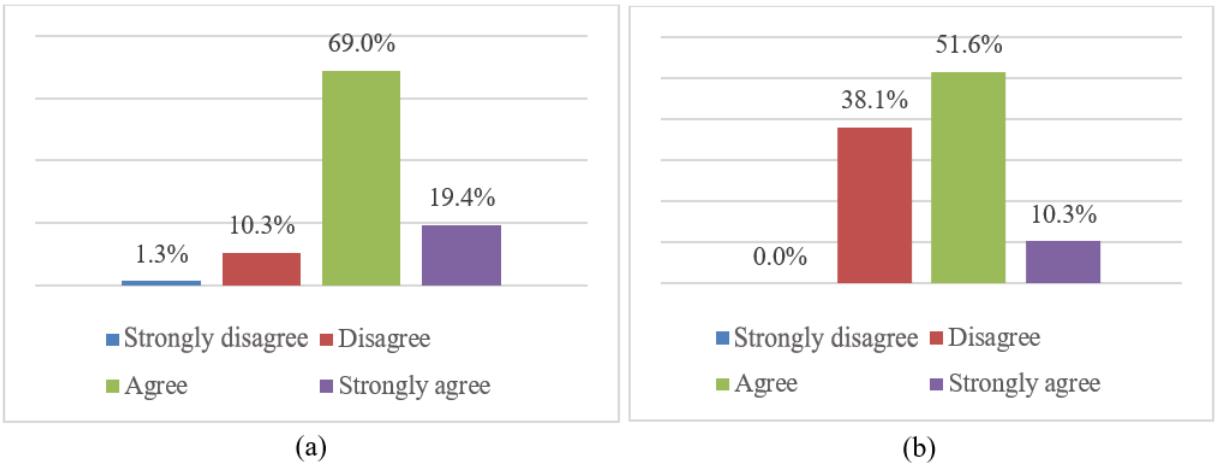

Figure 1. Student responses regarding use of (a) module-based learning media and (b) varied learning media.

3.2. Perceptions and Opportunities for Learning Media Development

This section describes the results obtained from students' responses to perceptions and opportunities for the development of mobile learning as an alternative learning medium land surveying. The results of the students' response are presented in Figure 2(a) development of mobile learning media and Figure 2(b) ability to use smartphones. There were 65.2% of students who agreed "to develop mobile-based learning media to support the learning of land surveying. This was also supported by 27.1% of students who expressed "Strong Agree" to develop mobile learning media. Therefore, considering that smartphones are very easy to use, the development of mobile learning as an alternative learning medium for land surveying has a great opportunity. The ease of using smartphones because many students have them, is shown by the results of high student responses where 72.3% answered "Agree" and 22.6% answered "Strongly agree".

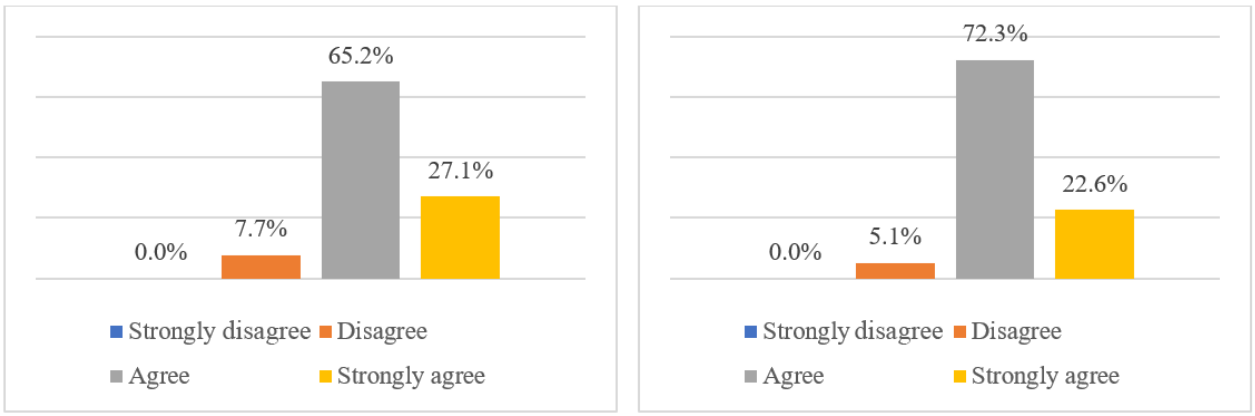

Figure 2. Student responses regarding use of (a) development of mobile learning media and (b) ability to use smartphones.

3.3. Supporting Facilities for the Development of Learning Media

This section describes the results obtained from the response of students supporting the development of mobile learning as an alternative learning medium for land surveying. Smartphone ownership is a major component of the development and application of mobile learning. In addition, the connection to connect to the internet is also an important supporting aspect of the analysis of the needs of this study. Supporting facilities in order to determine needs as innovations in the use of learning media are shown in Figure 3(a) smartphone ownership and Figure 3(b) availability of internet networks in schools.

The results of the student's response regarding smartphone ownership are presented in Figure 3(a). A total of 68.4% of students answered "Agree" and 31.6% of students answered "Strongly agree". This explains that all students at SMK Sragen have smartphones. In addition, school institutions also allow their students to bring smartphones in class.

The students' response to the availability of connection facilities to connect to the internet owned by the school s shown in Figure 3(b). There were 63.9% of students who responded "Agree" that there were internet facilities provided by the school that were expected to support the learning process, supported by 28.4% of students answered "Strongly Agree". However, 7.7% of students responded "Disagree" that the school provided internet connection facilities. According to the response of students who replied "Disagree", the internet network provided by the school did not reach their class.

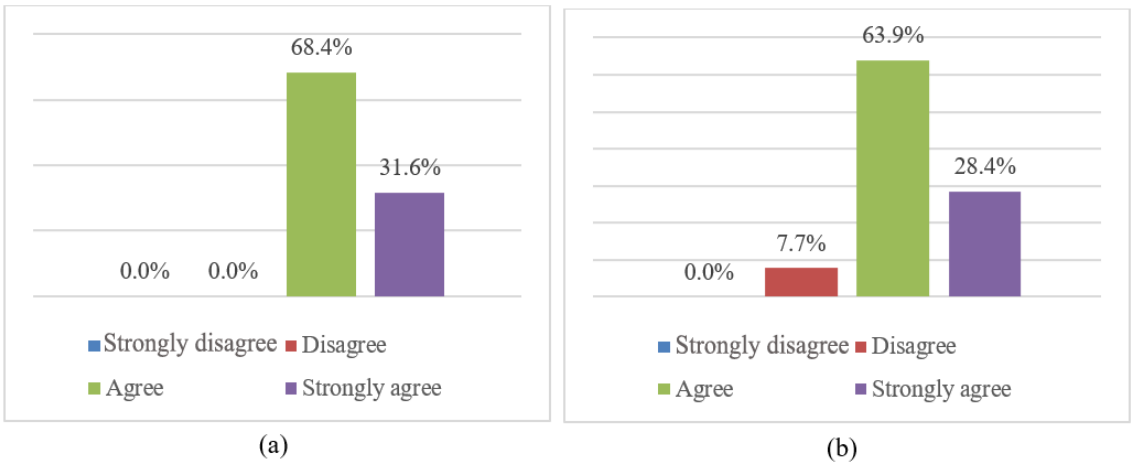

Figure 3. Student responses regarding use of (a) smartphone ownership and (b) availability of internet networks in schools.

4. DISCUSSION

The vocational education system is oriented toward improving the ability and skills of students to be ready to enter the world of work so that learning at SMK must carry out its learning activities in accordance with the needs

of the competencies needed in the world of work. As a teacher, it is necessary to prepare learning activities by designing the media, strategies, and quality of teaching materials needed by students to achieve 21st century competencies (Milheiro Silva, García-Docampo, Marques Silva, & del Mar Lorenzo-Moledo, 2022). The framework of the 21st century provides strategies to identify the skills that students must acquire to enter the future world of work (González-Pérez & Ramírez-Montoya, 2022). Therefore, the teacher has the task of analyzing whether current competencies and learning methods are designed to achieve this.

The last few years have witnessed the emergence of several advanced mobile applications that combine mobile technology with the education system (Al-Bashayreh, Almajali, Altamimi, Masa'deh, & Al-Okaily, 2022; Al-Hamad et al., 2021), with the aim of keeping their students competitive in the globalized 21st-century (Almaiah et al., 2022). Therefore, the use of mobile technology in learning has become a practical solution today (Alkhwaldi & Abdulmuhsin, 2022; Jeong, 2022; Kumar et al., 2022). This is because the material presented in mobile-based learning has several advantages, such as being flexible and open, namely by designing according to student needs (Hidayati & Bentri, 2022) and the atopic and asynchronous nature of the learning provided (there are no limitations on space and time) so as to produce higher learning performance (Drolia, Papadakis, Sifaki, & Kalogiannakis, 2022) as well as easy access anywhere and anytime (Cao & Nguyen, 2022). Before being applied in the learning process, the learning media developed must be validated by experts to ensure their feasibility. This is like research conducted by Cahya, Suprapto, and Lusiana (2020) developing and producing android-based learning media on mathematics subjects on quadratic equation material for SMK students, and the media developed received a validation score from media experts of 97.33%, a validation score from material experts of 88.33%, and a practicality score of 83.68%. From the results of these experts, the learning media developed is suitable for use in the learning process.

In addition, the use of mobile-based learning media can affect student learning achievement (Cheng & Chen, 2022; Mergany, Dafalla, & Awooda, 2021; Tian et al., 2021; Yaniawati et al., 2021); increase their involvement in the educational process (Li & Heng, 2021); ease student's access to information anytime and anywhere (Cao & Nguyen, 2022; Kukulska-Hulme & Viberg, 2018); and can train students' creative thinking skills (Du, 2022; Suharno, Irmawan, Saputro, Agung Pambudi, & Jumintono, 2022). The results showed that the group of experimental students who learned through mobile learning had a higher creative thinking ability than students who learned through traditional learning media (Mahmudah et al., 2021). Other studies have shown that the use of mobile-based learning media improved students' conceptual knowledge of Mathematics (Anupan & Chimmalee, 2022). The use of mobile technology in the form of both hardware and software integrated into learning activities producedinformation conveyed by teachers for the better because teaching materials can be made more varied with the aim of inspiring student interest in learning, increasing student concentration, enriching curriculum content, and increasing learning comfort (Ateş & Garzón, 2022; Sinaga, Febrianti, & Candra, 2022).

In line with several opinions and discussions about the integration of mobile technology in learning, mobile learning media can convey the message of teaching materials to be more effective. Mobile technology that supports the birth of the concept of mobile learning as a new teaching and learning technique has an adaptable nature (Khery et al., 2020) which requires technology to be adapted to the needs of students to learn simultaneously while learners develop by developing skills and knowledge (Punithavathi & Geetha, 2020). The value of creative thinking skills can be used as one of the parts in integrating with learning materials, especially the subject of land surveying such as previous research (Du, 2022; Rudyanto & Ghufron, 2019), which successfully optimizes the use of technology and creative thinking skills in the learning process. Learning land surveying is not only taught with conventional learning media but also the need for innovation to help students have creative thinking skills as demanded in this era (Dolezal et al., 2021; Rosli, Sern, & Chik, 2017). The existence of media innovations in learning is a solution for students to overcome learning difficulties and improve their learning outcomes.

This research was conducted to identify learning media that are integrated with technology, especially cellular technology in the subject of land surveying. Based on the results of the analysis, opportunities, and discussions, other research is needed to identify opportunities for the development of cellular learning media. The findings of this study can be used as a reference in developing cellular learning media combined with creative thinking skills in land surveying subjects at SMK. This has been explained before that the development of cellular-based media is supported by the availability of students having smartphones, the availability of internet networks in schools, the lack of variety of learning media made by teachers, and the ability of students to operate smartphones that are quite good (Budiarto, Rejekiningsih, & Sudiyanto, 2021). Obviously, the findings of previous studies show that the use of mobile technology in learning has a positive impact on students. So this needs analysis research is indeed important to provide an overview of the development of alternative mobile learning media.

5. CONCLUSION

This study identified the need for the development of mobile learning based on students' creative thinking abilities as measured by paying attention to student opinions related to opportunities for development and learning support facilities. Using mobile learning based on creative thinking shows that the learning model developed is ideal for current conditions. The results show that student responses regarding the use of mobile technology in the learning process are directly proportional to students' abilities in operating and owning smartphones but inversely proportional to the teacher's use of various media. In addition, interactive learning media makes students more motivated to learn. Based on the needs of students aware of technological developments and efforts to optimize their facilities, mobile learning as a learning medium for land surveying techniques needs to be implemented.

Our study also reveals that surveying techniques have enormous opportunities in the development of mobile learning as an alternative learning medium. This is because smartphones are effortless to use and can be accessed anytime and anywhere. However, because most students use smartphones during learning hours, they do not listen to the material presented; most students do not control their learning activities, which means that learning is ineffective. In addition, the results of this study imply that mobile learning can help improve the competencies needed, especially by integrating creative thinking skills. The results suggest considering creative thinking-based mobile learning as an alternative learning medium in class, especially material on land surveying techniques.

Integrating mobile technology into the learning process provides convenience and benefits for students and teachers alike as part of efforts to improve the quality of vocational education in the twenty-first century. Implementation of learning Land surveying techniques teachers still use modules provided by the government and PowerPoint slides. However, the material comes from printed modules, and learning media that utilizes available facilities is not optimal. A practical solution to improve the quality of learning is to use cellular technology in the learning process, bearing in mind that students have smartphones and schools provide internet facilities that support mobile-based learning.

6. RECOMMENDATIONS

In order to shift from conventional learning to technological transformation, current research recommends developing learning media using mobile learning methods and creative problem-solving approaches that provide students with the means to communicate and interact with teachers, such as creatively designed material discussions. The results of the study show that the use of mobile learning has a significant role in developing students' skills; this is due to the characteristics of the media that are easy to use and can be accessed anytime and from anywhere, as well as the availability of learning materials for students.

This study also recommends developing learning media using mobile learning methods and creative problem-solving approaches to train students to get used to creative thinking skills in developing their life skills. The essential strategies that can enhance the development of these skills should be included in the development of the

media later. The results of this study suggest creative thinking skills in media development based on an analysis of each student's device ownership needs and the availability of supporting facilities.

In addition, several implications emerge based on the research findings:

1. It is recommended to examine the teacher's ability regarding mobile learning applications internally.
2. Learning media should be developed using and adopting mobile learning through a creative thinking approach.
3. Teachers should strengthen collaborative efforts to ensure the integration of mobile technologies in content development.
4. In material and media planning, it is necessary to pay attention to the needs of students.
5. Teachers proficient in developing mobile learning must teach their skills to other teachers.

Further research can be conducted regarding the views of students in educational institutions about the benefits of using mobile learning. In other studies, the research could be conducted to assess teachers' skills in using mobile technologies to enhance creative thinking. Finally, further research can be carried out on developing school policies to utilize mobile learning optimally.

7. LIMITATIONS

This research is limited to only covering students' perceptions of the use of media in learning, media development opportunities, and supporting facilities for the development of mobile technology-based media. Therefore the findings cannot be generalized on a wider scale. This research is limited to identifying needs using cellular technology-based learning media with populations in one region. Because the sample only covers one district in the province of Central Java, Indonesia, it is not representative of all of Central Java or Indonesia. However, because there are no empirical studies that develop mobile learning based on creative thinking, this study provides a unique contribution to the needs analysis for the development of mobile learning media. Therefore, future researchers can use the results of this study to develop learning media products that are integrated with cellular technology and creative thinking or can increase the focus of research studies, such as the ability of teachers to adopt cellular technology to achieve learning goals. Apart from that, the results of this research can also be used as a basis for school institutions to make regulations so that they can utilize mobile learning media to make it more optimal (Nikolopoulou, 2022).

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