



Analysis of The Need for Using Geospatial Technology in Developing Electronic Student Worksheet

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Abstract: This study aims to determine the need to develop student worksheets based on Geospatial Technology as a learning resource for physics students in high school. This study focuses on quantitative research using questionnaires that are analyzed using descriptive statistics. This study involved 23 respondents spread across several schools in Padang, West Sumatra and 32 students in one of the high schools in Padang City, West Sumatra. The instrument in this study uses a needs questionnaire with several statements addressed to teachers and students. Based on the teacher needs questionnaire, as many as 60.9% of the 23 teachers do not know this technology, so only 39.1% know it but only 8.7% apply it in learning. The results of the needs questionnaire analysis show that student worksheets developed with Geospatial Technology, especially on the topic of renewable energy sources, are needed and are expected to help students achieve their desired learning goals. Based on this, the use of technology as a learning resource is urgently needed by students, so it is necessary to conduct a needs analysis in developing student worksheets based on Geospatial Technology.

Abstrak: Studi ini bertujuan untuk menentukan kebutuhan pengembangan lembar kerja siswa berbasis Teknologi Geospasial sebagai sumber belajar bagi siswa fisika di sekolah menengah atas. Studi ini berfokus pada penelitian kuantitatif menggunakan kuesioner yang dianalisis menggunakan statistik deskriptif. Studi ini melibatkan 23 responden yang tersebar di beberapa sekolah di Padang, Sumatera Barat dan 32 siswa di salah satu sekolah menengah atas di Kota Padang, Sumatera Barat. Instrumen dalam penelitian ini menggunakan kuesioner kebutuhan dengan beberapa pernyataan yang ditujukan kepada guru dan siswa. Berdasarkan kuesioner kebutuhan guru, sebanyak 60,9% dari 23 guru tidak mengetahui teknologi ini, sehingga hanya 39,1% yang mengetahuinya tetapi hanya 8,7% yang menerapkannya dalam pembelajaran. Hasil analisis kuesioner kebutuhan menunjukkan bahwa lembar kerja siswa yang dikembangkan dengan Teknologi Geospasial, terutama pada topik sumber energi terbarukan, sangat dibutuhkan dan diharapkan dapat membantu siswa mencapai tujuan pembelajaran yang diinginkan. Berdasarkan hal ini, penggunaan teknologi sebagai sumber belajar sangat dibutuhkan oleh siswa, sehingga perlu dilakukan analisis

INTRODUCTION

In today's digital era, the use of technology in the world of education is becoming increasingly important to improve the quality and effectiveness of learning. The increasing development of information and communication technology, especially in the field of the internet, can make human work easier, both in the field of education. Through and education, it is hoped that the Indonesian nation can keep up with developments in the field of science, information technology and communication.

Education is a process that is carried out to develop a potential possessed by students. This is done to answer future challenges. Education can be used as a means of creating educated and quality human resources. There are several aspects that support a learning process, one of which is learning resources. Learning resources are everything that contains knowledge that has been systematically arranged and based on the curriculum according to the characteristics of students (Hendriyani et al., 2018).

Physics learning based on the 2013 curriculum students are required to be active, critical, innovative and creative during learning (Anggraini et al., 2017). This is so that students are able to answer the challenges of Indonesia's future. Teachers are given more creative freedom in choosing learning media so that students are more active in the implementation of learners. In the era of the 4.0 revolution, there are many new technological developments that can be used as learning media. Various kinds of learning resources that can be used as a means in the learning process can be in the form of

audio or audio visual. Audio-visual media is an intermediate medium for presenting material that is absorbed through sight and hearing in the hope of helping students to acquire knowledge (Widaryanto, 2016). The learning process that uses adequate teaching materials is able to keep up with the development of technology and the demands of the times. Through learning that uses information technology, students will be interested in learning (Liu & Su, 2018).

Incorporating technology into physics education has resulted in the development of a range of innovative learning resources that enhance student engagement and understanding (Marlina & Asrizal, 2022). E-books and digital platforms have emerged as essential tools, providing interactive content that replaces traditional textbooks and supports blended learning environments. These resources are designed to improve critical thinking and problem-solving skills among students, which are essential for success in the 21st century (Sari et al., 2022). Then there are simulation-based technologies, such as PhET simulations, which serve as additional materials that help visualize complex concepts such as projectile motion, making them more accessible to students (Yurchenko et al., 2023). This technology has been positively evaluated by students and educators for its effectiveness in improving comprehension. In addition, there are also collaborative online tools combined with programming to allow students to engage in experimental activities virtually, which encourages hands-on learning experiences even in remote environments (Beltran et al., 2023). This integration of digital technologies not only

facilitates a deeper understanding of physics concepts but also encourages a collaborative learning environment (Tenti et al., 2021).

One of the innovations that offers great potential is e-LKPD (student worksheets) based on geospatial technology. This technology integrates digital maps, location data, and other spatial information in the learning process, allowing students to visualize and understand the concept of geography in a more interactive and immersive way (Kerski et al., 2013). Electronic student worksheets (e-LKPD) are digital tools designed to improve the learning process by providing interactive and engaging materials for students. e-LKPD can be used at various levels of education and subjects, supporting a variety of teaching methodologies. One of the key features of e-LKPD is its interactivity, where students can participate in various question formats such as multiple-choice, essays, and drag-and-drop activities, making learning more engaging and game-like. Additionally, the e-LKPD can be accessed through a variety of devices, allowing students to learn at their own pace and convenience. Many platforms also provide instant feedback mechanisms, helping students understand their mistakes and learn from the experience firsthand. e-LKPD can be aligned with certain curricula, such as the Independent Curriculum which emphasizes independent learning.(Hiola et al., 2023; Novike Bela Sumanik et al., 2023)

The advantages of using e-worksheets are varied; One of them is increasing student engagement. The interactive nature of e-worksheets keeps students motivated and keeps them active in the learning process, which has been shown to be directly related to better learning outcomes. In addition, e-worksheets are effective in developing higher-order

thinking skills (HOTS), where research shows a significant increase in HOTS when using these tools in subjects such as science. E-worksheets can also facilitate project-based learning (PjBL) by allowing students to engage with real-world problems, thereby improving their creative thinking abilities.(Julianti et al., 2023; Prayogi et al., 2023)

Geospatial technology refers to the devices and techniques used to collect, analyze, and manage data related to the earth's surface. This technology involves the use of geographic information systems (GIS), global positioning systems (GPS), and remote sensing (Adedoyin, 2012). This technology is very close to human life today. Examples of this technology are global positioning systems (GPS) which are widely used in car navigation systems, smartphones, and other devices to provide real-time location and directions as well as geographic information systems (GIS) that can monitor and respond to natural disasters, such as hurricanes, floods, and earthquakes (Reddy & Singh, 2018).

E-LKPD based on geospatial technology, especially for high school students, offers a more modern and contextual approach to learning. Using geospatial data, students can analyze and interpret information related to location, distance, and spatial relationships between various objects or phenomena. This not only enriches the learning experience, but also equips students with skills relevant to the needs of the times, such as data analysis and a deeper understanding of geography (Falkner, 2019).

However, before implementing geospatial technology-based e-LKPD in the curriculum, it is important to conduct a comprehensive needs analysis. This analysis aims to ensure that the

development of e-LKPD is in accordance with the needs of students, the applicable curriculum, and the availability and ability of technology in schools (Tawafak et al., 2019). Without proper analysis, the development of e-LKPD can be ineffective or even deviate from the desired educational goals (Amartyah & Rusmini, 2022).

First of all, the needs analysis should involve an assessment of the basic competencies and learning objectives that must be achieved by high school students. This includes an in-depth understanding of the subject matter to be integrated with geospatial technology, as well as how it can improve students' understanding of the material (Arora et al., n.d.). Additionally, it is important to evaluate the readiness of the technology infrastructure in schools, including adequate hardware, software, and internet access (Alghamdi et al., 2022).

In addition, needs analysis must also consider aspects of training and support for teachers. The use of geospatial technology-based e-LKPD requires special understanding and skills from teachers in order to be able to effectively utilize the tool in the learning process (Csachová, 2020). Therefore, adequate training and ongoing support need to be designed so that teachers can integrate these technologies in a way that supports learning objectives (Janssen & Lazonder, 2015)

In addition, input from students and parents is also an important component in needs analysis. Students need to be given the opportunity to provide feedback on learning methods that they find interesting and useful, while parents can provide perspectives on how this technology can affect their children's learning process (Terras & Ramsay, 2016). The

involvement of all parties will help ensure that the e-LKPD developed truly meets the needs and expectations of the end user (Repenning & Ioannidou, 2006).

The biggest challenge in the application of this technology is the lack of teachers' knowledge about this geospatial technology. Many teachers are not given technology training which is not as difficult as they think because technology exists to make it easier, this training is in the form of effective use of technology in its use in the classroom (de Koff, 2021). In addition, resistance is also an obstacle to technology adoption because many institutions are comfortable using traditional teaching methods (Płoński, 2019). This happens due to a lack of institutional support due to the assumption that the application of a technology requires large funds (Coleman et al., 2016). Even though this assumption is not entirely true because the development of a technology does not always require large expenditures. Today's technology is very easy to find, even cellphones that have become a necessity can get the latest technology very easily (Kurniawan et al., n.d.).

Finally, it is important to identify and assess the challenges and obstacles that may be encountered during the development and implementation of geospatial technology-based e-LKPD. These challenges can include technical issues, resource limitations, or resistance to change from certain parties (Simamora et al., 2020). By knowing potential problems from the beginning, effective mitigation strategies can be designed to overcome these obstacles (Reiser, 2018). In addition, technology is present to provide opportunities for teachers to apply more interactive and interesting learning methods, so

that students do not feel bored (Syifa et al., n.d.).

By conducting a comprehensive needs analysis, the development of e-LKPD based on geospatial technology can be carried out in a more planned and effective manner. This will ensure that this technology not only enriches the learning process but also provides maximum benefits for students in preparing them for future challenges (Ahmed & Opoku, 2022).

This study aims to explore and analyze the needs and perceptions of students and teachers related to the development of student worksheets (LKPD) based on geospatial technology in high schools. More specifically, this study aims to identify the needs of teachers and students related to the use of technology, especially geospatial technology, in the physics learning process. By understanding these needs, the development of LKPD can be adjusted to the expectations and demands of users. Of course, this research also aims to provide recommendations for the development of a better curriculum by including the use of geospatial technology as an integral part of physics learning in high school. By achieving these goals, this research is expected to make a significant contribution to improving the quality of education through the use of geospatial technology, as well as preparing students with relevant skills to face the challenges of the 21st century.

Based on the background of this research, some research questions can be taken as follows.

Q1: How is technology used in learning today? Especially in several schools in Padang, West Sumatra.

Q2: What are the needs of teachers for the development of technology-assisted e-LKPD?

Q3: What are the needs of students for the development of technology-assisted e-LPPD?

Q4: How do I determine the steps to meet the needs of technology-assisted e-LKPD development?

METHOD

This study uses a statistical descriptive research design. The data collection technique used in this study is using questionnaires that are distributed directly to students and physics teachers. This approach was chosen to explore and describe the needs and perceptions of high school students and teachers related to the development of student worksheets (LKS) based on geospatial technology (Creswell, 2019).

The data analysis technique in this study uses quantitative data analysis techniques and is concluded quantitatively. The participants of this study were 23 teachers from several high schools selected by purposive sampling and 32 students at one of the high schools in Padang City, West Sumatra. This method allows the selection of individuals who have special knowledge or experience with geospatial technology, thus ensuring a relevant and informative sample (Palinkas et al., 2015).

The data collection technique is through the distribution of structured questionnaires to collect quantitative data on teachers' perceptions and needs regarding LKS based on geospatial technology (Cohen et al., 2017). Each question item used in the questionnaire is tested for validity and reliability to determine whether the instrument is feasible to obtain the data needed by the researcher.

The teacher questionnaire consists of several statements that are approved or disapproved by teachers as well as obstacles encountered by teachers in applying technology in learning. The statement totaled 10 divided into 3 core aspects, namely 3 statements about the ease of learning with technology, 3 statements about technology making learning more interesting, and 4 statements about the need to develop learning using technology. In addition, teachers were also asked about their challenges in using technology in their learning.

The student questionnaire consisted of 17 statements and students responded to the statements in the form of answers strongly agree, agree, disagree or strongly disagree. The statement is divided into several aspects of student needs in learning. These aspects include the need for technology to make learning more interesting with 6 statements, the need to connect learning with daily life 6 statements, and the need for the application of physics in the immediate environment 5 statements.

The stages of implementing this research began with the determination of research subjects, namely 31 high school Physics teachers spread across several schools in Padang, West Sumatra and MIPA class X even semester for the 2024/2025 school year totaling 32 students. Then the researcher compiled an instrument in the form of an observation sheet and questionnaire on the needs of teachers and students. Tests are carried out on the validity and reliability of the instrument to determine whether the research instrument is good or not (Yusup, 2018). The researcher distributed a needs questionnaire to respondents. The last step taken by the researcher is to analyze the data. Each questionnaire item was assessed

using a likert scale assessment of points 1 to 4 (Sugiyono, 2017) as shown in Table 1.

Table 1. Assessment Likert Scale

Alternative Answer	Weight Score
Strongly agree	4
Agree	3
Disagree	2
Strongly disagree	1

The next step is to analyze the percentage calculation. The needs of teachers and students for learning media based on the lectora inspire application are assessed as shown in Table 2.

Table 2. Value Criteria

Percentage	Interpretation
0%-25%	Strongly disagree
26%-50%	Disagree
52%-75%	Agree
76%-100%	Strongly agree

(Latifah et al., 2020)

RESULTS AND DISCUSSION

This study distributed a free learning survey questionnaire to 23 teachers who teach in Padang City, West Sumatra. Respondents were taken through random sampling selected based on the population of high school physics teachers in Padang City, West Sumatra. This learning survey will examine the methods that are most often tried by teachers in schools, then related to the use of technology in the learning carried out. The questions given are of course aimed at the use of electronic-based media. Regarding the use of media in carrying out learning, all teachers replied that they had done it. The media is divided into several forms such as PPT, learning videos, student worksheets and modules both in print and electronic form with the percentages seen in Figure 1 as follows.

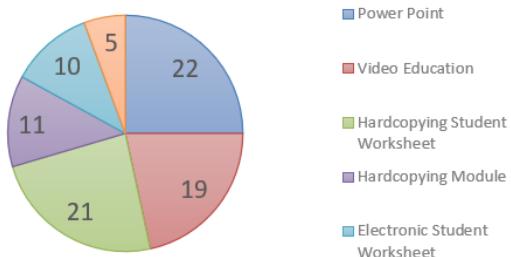


Figure 1. Teacher's Choice Media Diagram

Teachers were also asked about their knowledge of technology that can be used in physics learning, namely geospatial technology. As many as 60.9% of the 23 teachers did not know this technology, so only 39.1% knew it but only 8.7% applied it in learning. This means that out of 23 teachers, only 9 people know about geospatial technology and only 2 people have just applied it in learning.

Through the questionnaire, teachers were also asked about the difficulties they faced in applying technology in learning. On average, teachers answered that their biggest obstacle is in terms of facilities and infrastructure. After being asked more clearly, many teachers assume that developing learning using technology requires special skills, and for this it also requires high costs. In addition, there are also people who assume that the use of technology requires a high internet network. Even though there are many applications that support this that are easy to use for the creation of applications and the use of internet quota is also not much. Many of them also do not realize that the light applications that they often use can be used in learning.

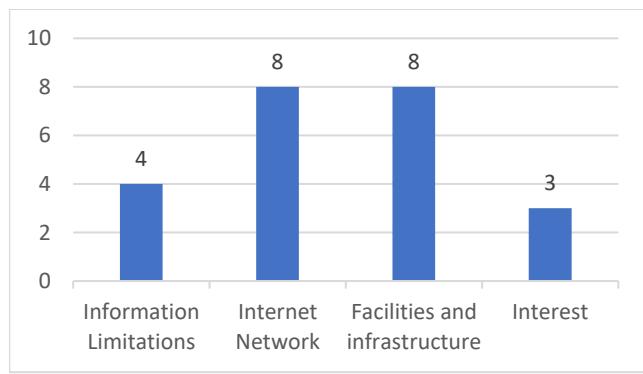


Figure 2. Teacher's Choice Media Diagram

In Figure 2, it can be seen that the biggest obstacle falls on problems in the internet network and infrastructure with 8 teachers each choosing it. This is again due to the assumption of teachers that using technology requires a lot of networks and very adequate facilities. While the integration of technology in education does not always require high-tech facilities or constant internet connections. Various forms of educational technology can improve the learning experience using simple tools and offline methods. Here are some key points that illustrate how technology can be used effectively in learning without relying on advanced resources. (Tran, 2023)

Cost-effective solutions can also be implemented. For example, using open-source software or applications that do not require a subscription can make the technology accessible to all students. Even basic computer programs can adapt to an individual's speed and learning style. This personalization does not require a high-tech environment, but rather an effective use of available resources. (Shihab et al., 2023)

After that, teachers were presented with several brief statements about the need to use technology in learning which can be seen through Table 3 as follows.

Table 3. Aspects of Teacher Needs Observed

Aspects observed	Score Percentage	Group
Technology will make it easier for students to learn.	81,52%	Strongly agree
Technology makes learning more interesting.	88,04%	Strongly agree
Technology development in learning.	85,87%	Strongly agree
Middle.	85,14%	Strongly agree

Based on Table 3 above, it can be seen that all aspects of the category were strongly approved by the 23 teachers who filled out the questionnaire. The technology aspect will make it easier for students to learn to get a score of 81.52%, the technology aspect that makes learning interesting gets a score of 88.04%, and the aspect of the need for technology development in learning gets a score of 85.14% and the average of all aspects gets a score of 85.14%. The aspect of technology that makes learning more interesting gets the highest score, this is expected as long as the teacher carries out his learning using technology to attract the attention of his students to pay attention to the ongoing learning. Technology has played a significant role in increasing the appeal of learning for learners. With a variety of digital devices and platforms, teaching can now become more interactive, adaptive, and relevant to the needs of modern learners (Haleem et al., 2022).

The response from students as respondents to the student needs questionnaire on the use of technology in Physics learning and its

application in daily life can be seen from the following Table 4.

Aspects observed	Score Percentage	Group
Learning is more interesting and easier with technology.	79,10%	Strongly agree
Using technology to connect learning with everyday life.	78,91%	Strongly agree
Apply Physics to the surrounding environment.	71,35%	Agree
Middle.	76,45%	Strongly agree

The learning aspect is easier and more interesting with technology getting a score of 79.10% with the category of strongly agreeing. Then the aspect of connecting learning with life using technology received a score of 78.91% in the category of strongly agreeing and the aspect of applying Physics with the surrounding environment received a score of 71.35% in the category of agreeing, and the average score of all aspects received a score of 76.45% in the category of strongly agreeing. Learning to be easier and more engaging using technology is the highest-scoring aspect of this questionnaire. This strengthens the previous teacher needs questionnaire which also makes the technological aspect more interesting as the highest score.

Based on the questionnaire, teachers and students expect student worksheets that can make them play an active role, attract and increase their interest in reading the application of material in students' daily lives, because the learning process using technology will be more

effective and efficient (Hendriyani et al., 2018). Learning using technology in media or tools will have a significant influence on the learning process (Nesti et al., 2022). Therefore, it is necessary to have a student worksheet that is able to meet the limitations of previously used student worksheets through geospatial-based student worksheets that are attractive, easy to use and easy to implement.

CONCLUSION

The results of this study show that the use of electronic-based learning media is still minimal among high school physics teachers in Padang City, West Sumatra. Only a small number of teachers know and apply geospatial technology in learning. This shows a gap between the potential of the technology available and its implementation in the field. Of the 23 teachers surveyed, most have used various forms of learning media such as PPTs, learning videos, printed student worksheets, printed modules, e-LKPD, and e-modules. However, the percentage of use of electronic-based media (e-LKPD and e-module) is still lower than that of print media. This can be caused by several factors, including a lack of training or knowledge of teachers on how to integrate technology into learning and limited access or infrastructure that supports the use of technology in schools.

Only 39.1% of teachers know about geospatial technology and only 8.7% apply it in learning. This shows that although some teachers are aware of the existence of this technology, its use in teaching and learning activities has not been optimal. The lack of application of geospatial technology can be caused by a lack of understanding or skills of teachers in using these technologies and a lack

of supporting resources such as adequate hardware and software in schools. Meanwhile, on the other hand, students gave a statement emphasizing that they still need student worksheets that are more concise, engaging and demonstrate the technology in them.

These findings show the need to improve technology literacy for teachers and provide adequate facilities to support the use of technology in learning. In addition, it is necessary to develop student worksheets based on geospatial technology that can make it easier for teachers to integrate this technology into the physics curriculum in high school. This study reveals that although there is great potential to utilize geospatial technology in physics learning in high school, its implementation is still limited. The results of the study show that the use of electronic-based learning media is still low and only a few teachers understand and apply geospatial technology.

In terms of student needs, many students choose to need a more interesting and easier learning with technology. Students also agree with the existence of technology, learning can be connected with daily life. This is also in accordance with the concept of technology created, namely to help humans in their daily lives.

The conclusion of this study is that there is an urgent need to improve teachers' knowledge and skills regarding geospatial technology and its use in education. The development of geospatial technology-based student worksheets is expected to be a solution to help teachers integrate this technology into learning, so as to improve the quality of education and prepare students with 21st century skills.

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