



Needs Analysis for Developing Virtual Field Trips-Based Learning Media in Elementary School Science Learning

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Abstract: Since the COVID-19 pandemic, various technology-based learning media have been developed, including various museums and institutions' availability of Virtual Field Trips (VFT). This can be considered an innovation in science learning that is expected to enhance students' cognitive and affective abilities. This research aims to analyze the need for developing VFT-based learning media in science education at the elementary school level. The study adopts a qualitative approach by collecting quantitative and qualitative data from questionnaire surveys. The respondents, consisting of 33 elementary school teachers from various regions in Indonesia, are familiar with using electronic devices and internet connectivity to support technology-based learning, which is already widely implemented in their science classes. Moreover, elementary school teachers are accustomed to using technology-based learning media in science education. However, there is a need to develop technology-based learning media, particularly Virtual Field Trips (VFT), in science education at the elementary school level as an innovative approach to teaching. Therefore, further research on developing VFT-based learning media in science education at the elementary school level is warranted.

Keywords: Learning Media; Needs Analysis; Virtual Field Trips

Introduction

The development of technology has brought significant changes to the world of education. Technology has helped to expand accessibility and create new opportunities for students and teachers around the world. One thing that has significantly impacted the development of technology in education is the development and use of learning media. Technology-based learning media have been developed by researchers, both in Indonesia and around the world. These technology-based learning media include e-modules, educational games, virtual reality, augmented reality, artificial intelligence, and many others. The use of technology-based learning media is known to make learning more interactive (Alfin & Listiadi, 2021; Shalikhah, 2016; Yazdi, 2012), provide space for students

to increase self-regulated learning (Marpaung et al., 2021; Sutarno & Mukhidin, 2013; Syaputrizal & Jannah, 2019), increase student creativity (Nurmala et al., 2021; Sugandi & Rasyid, 2019) and creative thinking (Heswari & Patri, 2022; Rohimah et al., 2020), foster student interest in learning (Estapa & Nadolny, 2015; Muammar & Suhartina, 2018; Negara et al., 2019; Nursyam, 2019), improve collaboration skills (Mawaddah et al., 2022), as a numeracy-focused learning media (Santosa & Hasibuan, 2022), and increase interaction between students and teachers as well as among students (Ishak et al., 2019).

One of the possibilities of utilizing technology in learning is in the field of science, particularly in science education. Technology-based learning applications that support science education have been developed by various parties as learning media to assist students in

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understanding the concepts of science subjects. Some of these applications include ChemCraft (Han, 2021), Ubiquitous-Physics (Purba & Hwang, 2017, 2018), SimplePhy (Lago, 2021), and many more. These applications can help students and learners to study science concepts independently. Furthermore, technology-based educational games such as Minecraft: Education Edition, ChemBlaster, and Gravity Simulator can also support science education by helping students strengthen their skills in the field of science.

Since the COVID-19 pandemic hit the world, where strict restrictions on human interactions and remote learning have been implemented, most schools have shifted from conventional to technology-based learning. Various technology-based learning applications are being used to support education in virtual classrooms. Not only learning applications, but various instructional videos are also being widely published by various parties to support student learning. Offline and face-to-face laboratory activities have been transformed into virtual laboratories (Daineko et al., 2017; Vasiliadou, 2020). Similarly, learning activities outside the classroom or field trips previously conducted offline have now been replaced by virtual field trip programs provided by museums and educational institutions to facilitate off-site learning without needing to visit the locations physically. In Indonesia, several museums offer virtual tours to facilitate virtual field trips, such as the Museum Nasional <https://www.museumnasional.or.id/virtual-tour>, Museum Geologi <https://museum.geologi.esdm.go.id/virtual-tour>, Museum Sangiran https://kebudayaan.kemdikbud.go.id/virtualmuseum/sangiran_ID/index.html, and others.

A field trip can be defined as a school or class visit that enables students to interact with the environment, displays, and exhibitions to connect the learning material with the firsthand experiences of the students (Krepel & DuVall, 1981). Many studies have revealed that conducting field trips in education is effective in enhancing students' learning outcomes and cognitive as well as affective abilities (Muchsin et al., 2021; Ningsih, 2021; Nurhaedah & Pagarra, 2017; Petersen et al., 2020; Rahayu et al., 2023; Rochmadhani et al., 2019; Yuliati & Martuti, 2015). However, the technological advancements that have taken place in this decade have led to the emergence of virtual field trips, gradually replacing the traditional practice of physically visiting the destination (Seifan et al., 2019).

Woerner (1999) defines a virtual field trip (VFT) as "a journey taken without actually making a trip to the

site". Numerous studies have been conducted by researchers from various countries around the world regarding the utilization of virtual field trips in education. In Indonesia, the development of VFT-based learning media has been carried out by Melinda et al. (2017) to support social studies education in elementary schools. Melinda et al. (2017) revealed that VFT-based learning media are effective in learning. However, there have been no published research findings on developing VFT-based learning media for science learning in elementary schools in Indonesia. Nevertheless, several studies have shown that conducting field trips in science learning is an effective method for teachers to enhance students' learning outcomes (Muchsin et al., 2021; Rochmadhani et al., 2019) and has an impact on students' process skills, scientific literacy, and scientific attitudes (Dinata et al., 2018; Rifqiawati et al., 2017).

Therefore, the utilization of VFT as a combination of field trips and technology in science education is essential for teachers, especially at the elementary school level, as it aligns with the characteristics of the students and serves as an innovation in learning. Hence, research needs to be conducted to analyze the need for VFT-based learning media in science learning at the elementary school level. This is done to confirm the need for VFT-based learning media in science learning at the elementary school level. Based on this, this study aims to analyze the need for developing virtual field trips-based learning media in science learning at the elementary school level. The results of this research will serve as a preliminary foundation for conducting further research on the development of virtual field trips-based learning media in science learning at the elementary school level.

Method

This research adopts a qualitative approach. Data were collected through the distribution of a questionnaire using the Google Forms application, conducted from April to May 2023. The questionnaire consisted of 13 questions in the form of checkboxes (allowing multiple answers), multiple choice (allowing only one answer), and short answers. The questions from the needs analysis questionnaire are summarized in Table 1.

Table 1. Needs Analysis Questionnaire Questions

Questions	Types	Options
What teaching materials do you use during your science learning lessons? (Question number 1)	Checkboxes	Textbooks published by a publisher. Available textbooks in the school library. Modules only used by the school's internal community. (limited). Modules that teachers independently develop. Modules prepared by the subject teacher working group (MGMP). Presentation slides (PPT, Canva, etc.). Other ...
What electronic devices do you use during your teaching and learning activities? (Question number 2)	Checkboxes	Computer/PC Laptop Smartphone Tablet Projector Other ...
How frequently do you use the internet during your science learning lessons in the classroom? (Question number 3)	Multiple Choice	I never use the internet during science learning lessons in the classroom. I use the internet during classroom science lessons only for specific topics. I always use the internet during science learning lessons in the classroom. Other ...
If you use the internet during your classroom teaching, which network do you use? (Question number 4)	Multiple Choice	The available Wi-Fi in the school. Internet-connected through personal smartphone (tethering/hotspot). Other ...
Do you use technology-based learning media during your science learning lessons in the classroom? (Question number 5)	Multiple Choice	Yes No
Based on the statements in the following options, which statement best describes your situation regarding science education learning media in the classroom? (Question number 6)	Multiple Choice	I use science education learning media that I developed independently. I use science education learning media that others have developed. I never use learning media for science education in the classroom.
What learning media (technology-based and/or non-technology-based) do you use during your science learning lessons in the classroom? (Question number 7)	Short Answer	-
Is technology-based learning media needed for conducting science learning lessons in the classroom? (Question number 8)	Multiple Choice	Yes No
Have you ever conducted science learning lessons using the field trip method outside the classroom or school? (Question number 9)	Multiple Choice	Yes No
What topic in science learning is suitable for implementing the field trip method? (Question number 10)	Short Answer	-
Are you familiar with virtual field trips (VFT)-based learning media? (Question number 11)	Multiple Choice	Yes No

Questions	Types	Options
Virtual field trips (VFT) are a learning experience that allows students to explore specific places or locations using technology such as videos, photos, or animations, enabling observation without physically being present or having the opportunity to receive explanations from experts.	Multiple Choice	Yes No
In your opinion, is the development of virtual field trips (VFT)-based learning media needed in science education lessons in the classroom? (Question number 12)		
If there is a free virtual field trip (VFT)-based learning media available for elementary school science learning, would you use it in your future teaching? (Question number 13)	Multiple Choice	Yes No

Table 2. Respondents Information

Components	Information
Grade Currently Taught	1 respondent is currently teaching Grade 1. 2 respondents are currently teaching Grade 2. 3 respondents are currently teaching Grade 3. 9 respondents are currently teaching Grade 4. 8 respondents are currently teaching Grade 5. 10 respondents are currently teaching Grade 6.
Gender	10 males 23 females
Institution	8 respondents are teaching at private schools 25 respondents are teaching at public schools
Province	17 respondents are from DKI Jakarta 9 respondents are from Banten 6 respondents are from Jawa Barat 1 respondent is from Bali
Educational Background	27 respondents have a Bachelor's degree (S1) educational background. 6 respondents have a Master's degree (S2) educational background.

The respondents are elementary school teachers scattered across various regions in four provinces in Indonesia, namely DKI Jakarta, West Java, Banten, and Bali. A total of 33 elementary school teachers from 26 public and private institutions participated as respondents in this study. Information about the respondents is presented in Table 2.

After the data was collected, tabulation was conducted on the responses to the short answer questions, which were then processed to calculate the percentage for each item. The same process was applied

to the checkbox and multiple-choice questions, where the data was processed to calculate the percentage for each option. Data analysis focused on the percentage value of each item or option. The data analysis technique was conducted through the stages of reducing irrelevant data, then the data was presented in the form of diagrams, and further verification or conclusions were drawn based on the analysis (Hasibuan et al., 2020). The research flowchart is shown in Figure 1.



Figure 1. Research Flowchart

The findings obtained from the data analysis serve as the basis for determining the conclusion on whether virtual field trips-based learning media are needed in elementary school science learning.

Result and Discussion

The results from the questionnaire are described in the following presentation. The discussion of these results will provide a strong background for researching and developing virtual field trip (VFT)-based learning media in elementary school science education.

Teaching Materials and Technology-Based Learning Support Tools

Questions number 1-4 on the questionnaire are related to teaching materials and technology-based learning support tools used by elementary school teachers in their science classes. The results of question number 1, specifically regarding the teaching materials teachers use, are presented in Figure 2.

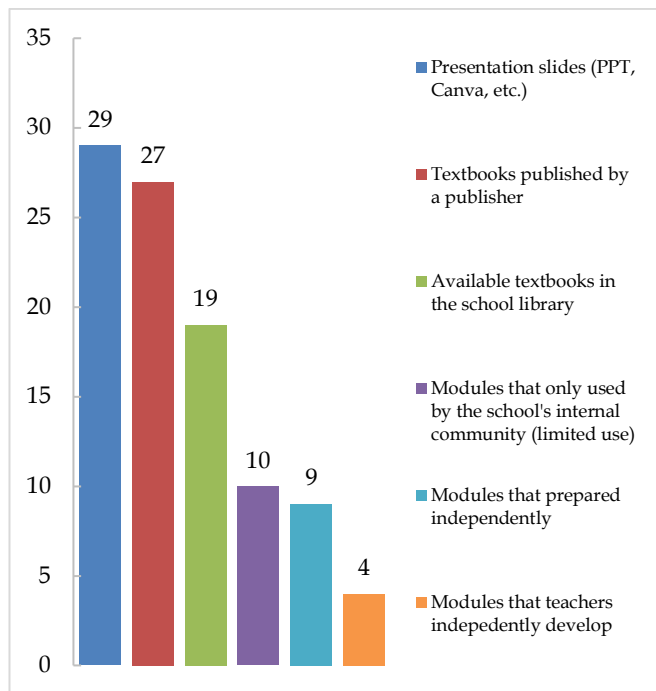


Figure 2. Teaching Materials Used by Elementary School Teachers

Based on the data presented in Figure 2, it can be observed that 88% of respondents use presentation slides such as PowerPoint, Canva, and others as teaching materials in the classroom. Furthermore, 82% of respondents use textbooks published by publishers, while 58% utilize textbooks available in the library as teaching materials. Meanwhile, only a small number of respondents use modules as teaching materials, with 30% of respondents using modules within limited institutions, 27% of respondents using self-developed modules, and only 12% using modules developed by the subject teacher working group (MGMP).

Thus, it can be stated that presentation slides and textbooks are the types of teaching materials that teachers use more than modules in their instruction. However, based on the data presented in Figure 1, it can also be noted that some teachers utilize various types of teaching materials in their instruction in the classroom. This indicates that some teachers employ a variety of teaching materials as an effort to help students comprehend the learning materials. This is consistent with the findings of Ariesandi et al. (2021) and Ali et al. (2022), that teachers use diverse types of teaching materials in their classroom instruction to facilitate students' understanding of the subject matter.

Then, questions number 2, 3, and 4 are related to technology-based learning tools. Question number 2 is about electronic devices used in science learning in the classroom, the results of which can be presented in Figure 3.

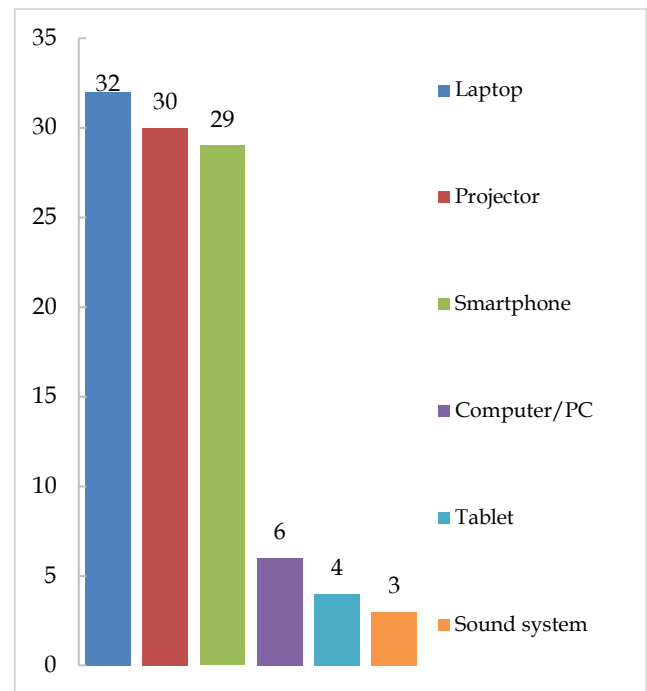


Figure 3. The Electronic Devices Used in Conducting Science Learning in the Classroom

Based on the data presented in Figure 3, it can be seen that almost all respondents, 97%, use laptops in conducting science teaching in the classroom. Similarly, the use of smartphones accounted for 88% and projectors accounted for 91% of the total respondents. This indicates that most respondents are accustomed to using electronic devices to support technology-based learning. Therefore, it is not impossible for teachers who are familiar with electronic devices to be able to present technology-based learning media supported by these electronic devices. Next, questions number 3 and 4 are related to using the internet to support technology-based learning in the classroom. The results of these questions are presented in Figure 4.

Based on the data presented in Figure 4, in the first diagram, it can be seen that most respondents use the internet in their classroom teaching. Out of 33 respondents, only one person never uses the internet during classroom teaching. Furthermore, in the second diagram of Figure 4, most respondents use their self-provided internet connection through personal devices, either by tethering their personal smartphones or personal modems. Such conditions greatly support technology-based learning that requires internet connectivity (Purcell et al., 2013), including learning that utilizes VFT-based instructional media (Kundu, 2016; Woerner, 1999). Therefore, using VFT as a technology-based learning media in science learning is highly feasible to be developed, considering the number of teachers already accustomed to using the internet for classroom instruction.

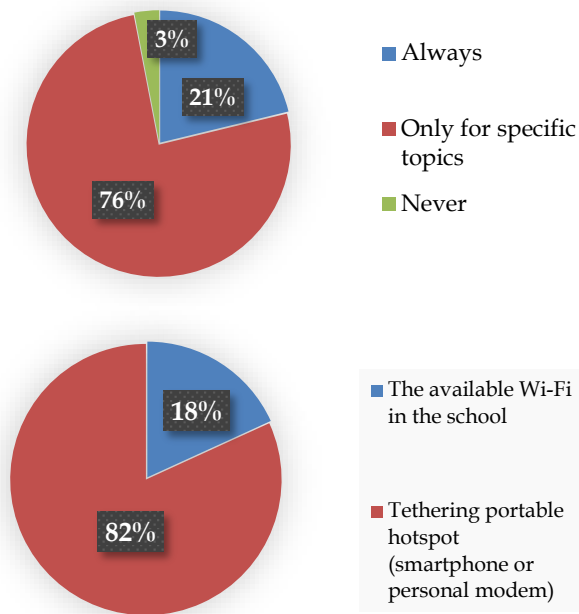


Figure 4. Using the Internet to Support Technology-Based Learning in the Classroom

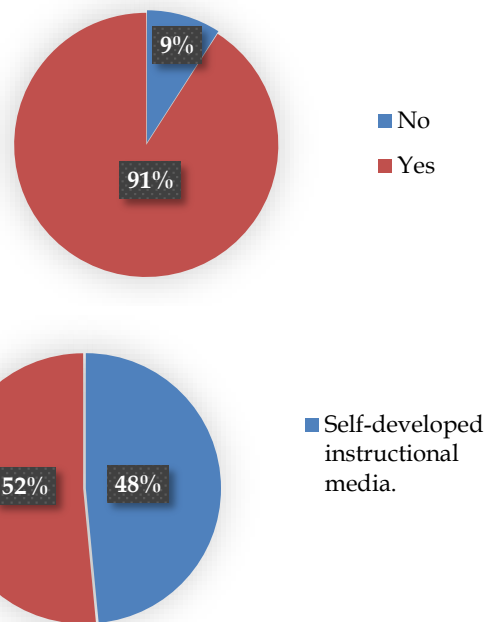


Figure 5. Using Technology-Based Learning Media in Conducting Science Learning in the Classroom

Technology-Based Science Learning Media

Questions number 5–8 are related to technology-based learning conducted by elementary school teachers in their science classes, specifically regarding the instructional media used in science learning. Questions number 5 and 6 are related to using technology-based learning media to conduct science learning in the classroom. The results of these questions are presented in Figure 5.

Based on the data presented in Figure 5, in the first diagram, it can be observed that almost all respondents, precisely 30 out of 33 respondents, use technology-based learning media in their science classes. This indicates that technology-based learning media are not new to elementary school teachers. However, referring to the results shown in Figure 5 in the second diagram, it can be seen that the use of learning media developed independently by the respective teachers is balanced with the use of learning media developed by others. This means that some teachers have creatively designed their own learning media for use in their classrooms (Babiker, 2015; Purcell et al., 2013), while others are not hesitant to use technology-based learning media developed by others. This suggests that it is possible for elementary school teachers to use VFT-based learning media that will be developed in the future.

Furthermore, question number 7 is related to the types of learning media used by the respondents in conducting science learning. The results are presented in Figure 6.

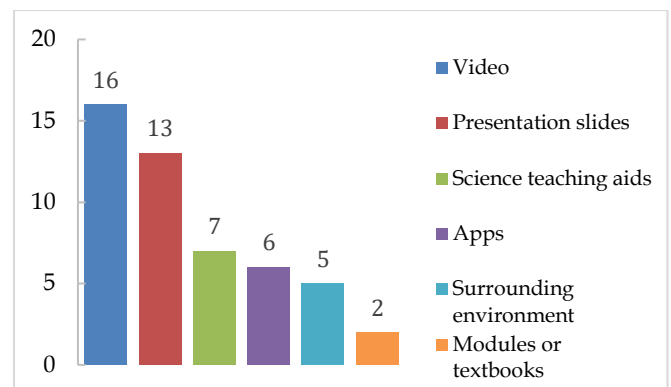


Figure 6. Types of Instructional Media Used in Science Learning

Based on the data presented in Figure 6, it can be observed that the respondents use various types of learning media, both technology-based, such as videos, presentation slides, and apps, as well as non-technology-based, such as science teaching aids, the surrounding environment, and modules or textbooks. However, from the data, it can be concluded that teachers use technology-based learning media more commonly than non-technology-based media, accounting for 71% of the total responses. This aligns with the data presented in Figure 5, which indicates that most teachers have

already implemented technology-based learning. Therefore, it can be said that technology-based learning conducted by elementary school teachers is accompanied by technology-based learning media, in line with the findings of Widiyanto et al. (2021), the statement is further supported by the results of question number 8, which is related to the need for using technology-based learning media in science education in the classroom, as seen in Figure 7.

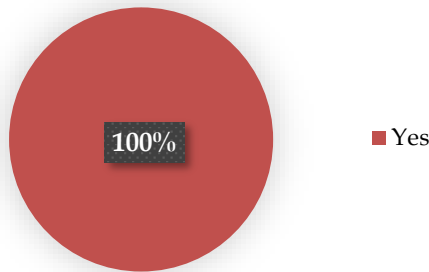


Figure 7. The Need for Using Technology-Based Learning Media in Conducting Science Learning in the Classroom

Based on the results presented in Figure 7, it can be observed that all respondents expressed their need for using technology-based learning media in science education in the classroom. This indicates that it is highly likely for elementary school teachers to use VFT-based learning media that will be developed in the future, considering that VFT is one of the technology-based learning media.

Virtual Field Trips-Based Learning Media

Questions number 9-13 are related to the need for developing VFT-based learning media in elementary school science education. Question number 9 is related to respondents who have conducted field trips outside of school in their science education. The results are presented in Figure 8.

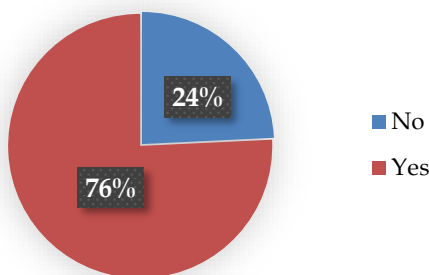


Figure 8. The Respondents Have Conducted Field Trips in Science Learning

Based on the data presented in Figure 8, it can be observed that the majority of respondents, 25 out of 33

respondents, have conducted field trips in their science education. Thus, this data indicates that field trips are not a new method for most elementary school teachers in their science education. Coupled with the results shown in Figure 7 regarding the need for technology-based learning media, these two factors provide a strong foundation for developing VFT-based learning media in elementary school science education as an alternative to actual field trips (Çalışkan, 2011; Klippel et al., 2019; Wen & Gheisari, 2020). Based on the respondents' answers regarding the science topics at the elementary school level that are suitable for field trips in question number 10, the results are presented in Figure 9.

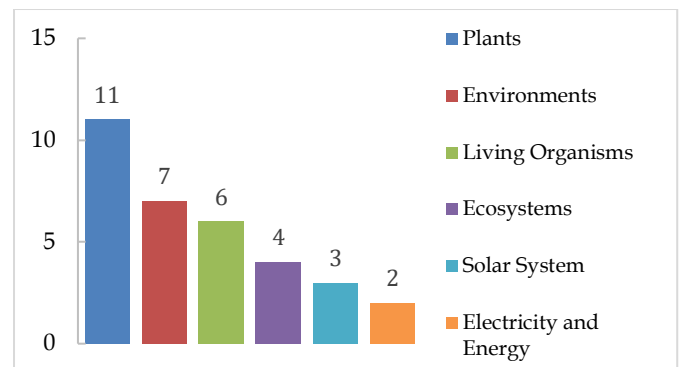


Figure 9. Science Topics that can be Learned Using Actual Field Trips

Based on the data presented in Figure 9, various science topics at the elementary school level can be covered using the actual field trips method. Therefore, VFT-based learning media can also be used for these topics or even for other topics, as VFT supports the development of students' knowledge in various subject areas (Çalışkan, 2011; Seifan et al., 2019; Wen & Gheisari, 2020). Furthermore, regarding the respondents' knowledge of VFT, question number 11 was asked, and the results are shown in Figure 10.

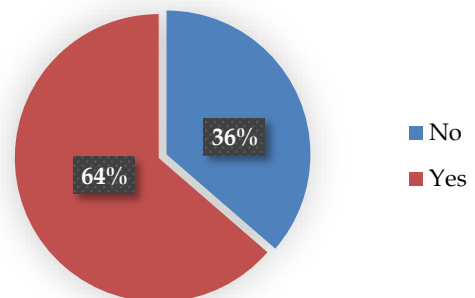


Figure 10. The Respondents are Aware of Virtual Field Trips (VFT)

Based on the data presented in Figure 10, it can be seen that there are still many respondents who are not

familiar with VFT. However, in terms of percentage, more respondents are familiar with VFT than those not. Furthermore, when information about VFT was provided in question number 12, followed by a question about the need for developing VFT-based learning media in science education at the elementary school level, the results are shown in Figure 11.

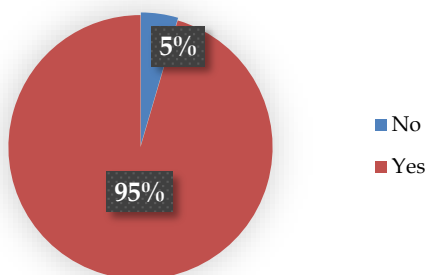


Figure 11. The Need for Developing VFT-Based Learning Media in Elementary School Science Learning

Based on the data presented in Figure 11, it can be seen that almost all respondents expressed the need for developing VFT-based learning media in science education at the elementary school level. Only one respondent stated that there is no need for developing VFT-based learning media in science education at the elementary school level. This provides a strong background for further research focusing on developing VFT-based learning media in science education at the elementary school level. This statement is also confirmed by the results of question number 13, which asked respondents about their willingness to use VFT-based learning media in science education at the elementary school level, which will be developed and provided for free to teachers. The results are shown in Figure 12.

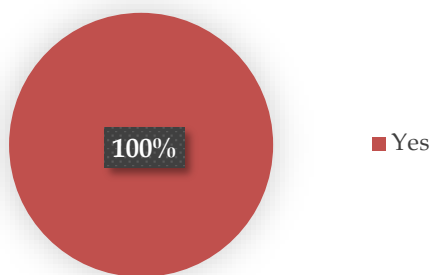


Figure 12. The Willingness of Teachers to Use VFT-Based Learning Media in Elementary School Science Learning

The diagram in Figure 12 shows that all respondents, who are elementary school teachers from various regions in Indonesia, expressed their willingness to use VFT-based learning media in science education in their classrooms. Therefore, based on the results

presented in Figure 11 and Figure 12, it can be concluded that the development of VFT-based learning media in science learning at the elementary school level is essential. The findings from the analysis of the need for developing VFT-based learning media in elementary school science learning will serve as a strong background for conducting further research in this area. Furthermore, the future development of VFT-based learning media in elementary school science learning is expected to be an innovation in teaching and learning (Çalışkan, 2011; Petersen et al., 2020; Seifan et al., 2019; Woerner, 1999) that can have a positive impact on students' cognitive and affective abilities.

Conclusion

Based on the needs analysis conducted in this study, it can be concluded that elementary school teachers are already accustomed to using electronic devices and internet networks as supporting tools for technology-based learning, which are widely implemented in their science classes. Additionally, elementary school teachers are already familiar with using technology-based learning media in teaching science. However, there is a need to develop technology-based learning media, specifically Virtual Field Trips (VFT), in science learning at the elementary school level as an innovative approach to teaching and learning. Therefore, to address these needs and based on the analysis of the collected data, it can be concluded that further research is necessary regarding developing VFT-based learning media in science learning at the elementary school level.

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Author Contributions

The main author, Heni Yunilda Hasibuan, contributed to the research design, instrument preparation, conducting the research, collecting and analyzing data, as well as writing the article. The second and third authors, Vina Oktarina and Mulki Siti Hajar Rezaini were also involved in the research design, data analysis, and article writing. The fourth and fifth authors, Lukman Nulhakim and Yayat Ruhiat, guided throughout the research process and contributed to the article writing.

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Conflicts of Interest

The authors declare no conflict of interest.

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