Journal of Physics: Conference Series

PAPER • **OPEN ACCESS**

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To cite this article: H Herliantari *et al* 2020 *J. Phys.: Conf. Ser.* **1572** 012066

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Teachers perceptions and anxiety about using multimedia in learning geometry optics concept: A preliminary research on STEM learning makerspace

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Abstract. One of the effects of the rapid development in 21st century that has raised the attention of practitioners, international organizations is the demand in education. Learning activities are a major part of education in schools. So in the learning process infrastructure updates are needed including multimedia learning. This research was conducted to analyze the form of multimedia as a learning resource that supports STEM learning and teacher anxiety levels in the use of multimedia in physics lessons. The research method used is a mixed method. The study was conducted in several high schools in Lampung with research subject is 90 Teachers of physics subjects. Data collection techniques used questionnaires, interviews and observations. The results showed that teachers tended to use print media and had not used multimedia. Teachers have considerable anxiety when they only teach physics using print media. Multimedia that is expected according to the perceptions of teachers is able to present the lessons in a clear, detailed, easy to use, easy to understand the language, presenting images, animations, and videos that clarify the material. So in future research, it is necessary to develop multimedia that is expected to be able to support STEM learning and student learning independence.

1. Introduction

One of the effects of the rapid development in 21st century globalization that has led to the attention of practitioners, Teachers, and international organizations in the world is the demand in education[1]–[3]. Education plays a very important role in the development and progress of a country [4]. Learning activities are a major part of the education sector in school. Therefore, to increase the interest of students in the learning process, facilities and infrastructure are needed in the form of multimedia related updates that are used packed with interest[5].

Learning media is one of the important learning resources in the classroom to make creative, communicative, and innovative learning that can support students' learning outcomes.[6], [7]. The use of media or learning technology in the classroom will improve teaching and facilitate learning [8]. The purpose of learning media is to improve learning by selecting relevant information, organizing information into a structure, and integrating information with other knowledge [9]. Based on the form of presentation and the way it is presented, the media classification includes seven groups: (a) graphics, printed material, and images; (b) silent projection media; (c) audio media; (d) silent audio-visual media; (e) live audio media /film; (f) television media; (g) multimedia [10]. Teachers have expanded the list of media used by integrating the development of new technologies for learning including the use of computers, CDs, DVDs, communication channels and the internet[11]. The use of multimedia is

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expected to facilitate learning process in the classroom so that the process of delivering material can be done easily.

Some of the demands of the skills are emphasized in the education sector in the 21st century, one of them is, students are able to understand and solve problems through creative and innovative thinking skills, critical thinking, problem solving and communication and group skills [12]. These 21st century skills demands certainly apply to physics learning. Physics is a part of science in which it explains physical phenomena and explains the reason why it is happened[13], [14]. The effort to meet the demands of the ability of students in the 21st century is to design learning that links several scientific disciplines such as integrated STEM (Science, Technology, Engineering, and Mathematics).

Engineering design practice and engineering science and technology offer the opportunity to learn directly to students to bring up innovative and creative thinking of students [15]–[18]. Geometric optics is part of the topic of physics that requires the practice of engineering science and technology such as in STEM to improve students' understanding of concepts. This is in line with previous research which stated that one of the elusive physics material is geometric optics [19], [20].STEM has proven effective to improve the quality of education in several developed countries. But in Indonesia, STEM learning is still a new phenomenon and has not received special attention [21], [22]. Seeing STEM learning can integrates all four disciplines, multimedia that is able to facilitate learning in the classroom is needed so that the process of delivering material can be done easily. On the other hand, the use of multimedia commonly used in school is not a media that is made by Teachers themselves, so that the media has not been integrated with STEM. Previous research has shown that an integrated STEM approach has a positive impact on students' active learning[23]–[25]. So it is necessary to do research to analyze the form of multimedia as a learning resource that supports STEM learning according to Teachers and Teacher anxiety levels in multimedia use in physics lessons.

2. Research Method

The research method used in this study is a mixed method consisting of quantitative and qualitative data. The study was conducted in several high schools in Lampung with subjects of research on physics subjects. Data collection techniques were collected using questionnaire instruments, interviews and observations. Data analysis techniques were carried out quantitatively with percentage techniques on the questionnaire, the results of interviews and observations were analyzed qualitatively.

Questionnaire sheets were given to 90 Teachers to find out the perceptions of Teachers and anxiety towards physics learning media. Interviews were conducted to 4 Teachers to find out the forms of learning media that are often used in physics learning. Observations were made in 3 schools to see the availability of facilities to support the learning process.

Table 1. Interpretation of Teacher Perceptions of Learning Media

Interval %	Positive statement	Negative statement
$75 < x \leq 100$	Strongly Agree	Disagree
$50 < x \leq 75$	Agree	Quite agree
$25 < x \leq 50$	Quite agree	Agree
$0 < x \leq 25$	Disagree	Strongly agree

Table 2. Teacher Anxiety Towards Using of Learning Media

Score	Statement
5	Extremely anxious
4	Very anxious
3	Quite anxious
2	Not anxious
1	Very not anxious

Interviews were conducted to 4 Teachers to find out the learning media that are often used in physics learning from several high schools.

Table 3. List of Respondents to Teacher Interviews

Respondent	Graduate	Teaching Experience
ZU	S-2 Physics Education	27 years
SI	S-2 Physics Education	16 years
NG	S-1 Physics Education	15 years
KE	S-1 Physics Education	10 years

3. Result and Discussion

The results of research on Teachers' perceptions and anxieties about the use of multimedia in physics learning are written in the following table.

Table 4. The Teacher Questionnaire Results on the Use of Physics Learning Media

No	Statement	%	Category
1.	I use media in physics learning	95,5%	Strongly agree
2.	I use print media in physics learning	96,6%	Strongly agree
3.	I use video learning media in physics learning	70,5%	Agree
4.	I use power point media in physics learning	75%	Strongly agree
5.	I use software/applications in physics learning	45,5%	Quite agree
6.	I make my own learning media	61,4%	Agree
7.	The media that I use is integrated STEM (Science, Technology, Engineering, and Mathematics)	28,4%	Quite agree
8.	I don't need media that makes physics learning more interesting	80,7%	Disagree
9.	I once created a professional 3D pageflip multimedia	10,2%	Disagree
10.	Learning media that is used can improve students' security	88,5%	Strongly agree
11.	I don't need multimedia (a combination of text, images, audio, video) in the learning process	83%	Disagree

Table 4 shows that Teachers often use print media rather than using non-print media such as audio, video, power points or software/applications in the learning process. Teachers have not made their own learning media both printed and non-printed so as the media used is also not yet integrated with STEM (Science, Technology, Engineering, and Mathematics). Teachers need multimedia which is a combination of text, images, audio and video in the process of learning physics that can improve students' understanding.

Table 5. Teacher Questionnaire Results towards Anxiety in the Use of Learning Media

No	Statement	Extremely Anxious	Very Anxious	Quite Anxious	Not Anxious	Very Not Anxious
1.	I am worried that I cannot use multimedia properly in learning	26,1%	13,6%	39,8%	17%	3,4%
2.	I am worried that the media I use is not in accordance with the indicators and learning purpose	18,2%	25%	40,9%	14,8%	1,1%
3.	Unable to make learning media that makes it easy for students to understand physics makes me stress/burden	21,6%	26,1%	35,2%	14,8%	2,3%
4.	I feel anxious about preparing the media that will be used before teaching	5,7%	21,6%	44,3%	23,9%	4,5%
5.	Only using print media (books modules/LKPD) makes me feel stress/burden in teaching physics to students	19,3%	8%	44,3%	25%	3,4%
6.	I am worried when I have to determine the media needed for each topic of physics	10,2%	11,4%	44,3%	29,5%	4,5%
7.	I feel anxious that students cannot understand the contents of the media that I use	20,5%	27,3%	43,2%	8%	1,1%
8.	I feel worried because I'm not sure whether the media I use is enough or not	15,9%	22,7%	45,5%	13,6%	2,3%
9.	I feel nervous because I can't understand the media that I use clearly	10,3%	23%	34,5%	26,4%	5,7%
10.	I feel anxious when I have to use media that is integrated with digital technology	10,2%	12,5%	28,4%	40,9%	8%

Based on Table 5, Teachers have a high level of anxiety towards the use of multimedia in physics learning. This anxiety occurs because Teachers are lack of readiness in presenting multimedia to be used on each topic in teaching physics. Teachers have high anxiety because they feel uncertain about the media they use whether they have fulfilled the learning purpose or not. This shows that Teachers have a big concern when teaching physics just using one form of print media. This shows that Teachers have realized that physics learning is not enough to only use print media, but the implementation of the improvements cannot be done. Seeing the anxiety about the use of multimedia shows that teachers need scaffolding in the use of technology for physics learning. In line with previous research which stated the importance of giving scaffolding to teachers and providing broader access to the use of ICT that can help Teachers to help difficulties in learning physics students.[26], [27].

Based on the results of the interview, Teachers used printed learning media such as textbooks obtained from school (NG), student worksheets, modules (ZU). The use of non-print media is only in the form of power points, and occasionally uses applications such as phet simulation (SI). The use of computer or digital-based media is very limited because Teachers do not have their own non-printed learning media.

Teachers also encourage students to search for learning material independently through the internet, but not to present it directly in class (NG). The use of such media is recognized by Teachers as still not meeting the needs of learning media that are integrated with technology (SI, ZU). So,

Teachers expect the availability of multimedia that is able to visualize the material in the learning process that is easily understood by students (SI, ZU, NG, KE). Teachers also have not implemented the STEM approach in an integrated manner (NG, KE, ZU). Teachers actually already know about the existence of the STEM approach, but have not known in depth what and how the STEM approach is, so teachers have not implemented it in the learning process (SI). This shows the lack of readiness of teachers to apply the STEM approach to learning. Some physics topics that are difficult for students to understand are electricity (KE), electromagnetic waves, optics, kinetic theory of gases (SI, ZU, NG).
In this research weanalyzedprinted media that is often used, it isbooks on physics subjects that is used in school. The book used in the school is a book entitled Physics (Specialization in Mathematics and Natural Sciences) published by IntanPariwara. This book contains a summary of learning material, sample questions and practice questions. The material presented is only in the form of a summary of concepts and does not present many phenomena in everyday life that are integrated in the book. The book used emphasizes more on independent practice questions at the end of each material, midterm tests, end of semester tests and online homework. This book is also not equipped with simple practical activities as science engineering that students should be able to do on every material presented.

Based on the results of questionnaires, interviews and observations that have been made, the use of multimedia as a source of learning physics by teachers is still very lack. Teachers tend to use one form of print media such as textbooks that are in school. This shows the lack of readiness of Teachers in preparing varied learning media. This is in accordance with previous research which states that Teachers need a media design that can be used to communicate with students so that the transfer of information can be done clearly [28].

Based on the observations, the availability of personal computers and LCD at high school in Bandar Lampung is sufficient. Some schools have even facilitated LCDthat are installed and ready to use in classrooms. This shows that the availability of technology should be used to create varied learning multimedia. Based on the description above, it is necessary to develop multimedia learning in future research. Multimedia learning is very good for improving the learning process by providing opportunities for students to develop skills, identify problems, organize, analyze, evaluate, and communicate information [29]. The form of multimedia that can be developed in the form of flip book or flip module is the development of e-book.

Based on the results of questionnaires and interviews, multimedia that is expected that according to the perceptions of teachers is able to: (1) present the material clearly, in detail and in depth in each sub-material according to the learning indicators (IA, NG); (2) easy to use by students with or without the help of Teachers (KE); (3) language that is easily understood by students (NG); (4) presenting images, animations, videos that are able to clarify the lesson (ZU, NG, KE, SI). So in future research, multimedia needs to be developed that are expected to be able to support STEM learning and learner independence.

4. Conclusion

Based on the results of the study, Teachers have not implemented the STEM approach to learning. Teachers tend to use print media in learning and have not created their own learning media so that the media used is also not integrated with STEM. Teachers have great concerns when only teaching physics using one form of print media. These results indicate that teachers have realized that physics learning is not enough to only use print media, but the implementation of the improvements cannot be done. Seeing STEM learning that integrates all four disciplines, multimedia is needed that is able to facilitate

classroom learning. Multimedia that is expected according to the perceptions of teachers is able to present material clearly, in detail and depth in each sub-material in accordance with learning indicators, easy to use by students with or without the help of teachers, language that is easily understood by students, presents images, animations, videos that are capable to clarify the material presented. So in future research, it is necessary to develop multimedia that is expected to be able to support STEM learning and student learning independence.

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Acknowledgments
Thank you to the supervisor Dr. Abdurrahman, M.Si who has involved the author in the master thesis research funded by the research grant DRPM of the Ministry of Research, Technology, and Higher Education of the Republic Indonesia with Contract Number: 065/SP2H/LT/DRPM/2019