JPPIPA 9(12) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Analysis of Students Needs for Website-Based Computational Physics Teaching Materials on Linear and Nonlinear Equations

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Received: October 9, 2023
Revised: November 26, 2023
Accepted: December 20, 2023
Published: December 31, 2023

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DOI: 10.29303/jppipa.v9i12.5600

Abstract: This study aims to analyze student needs for teaching materials needed in Computational Physics courses. This research is an quantitative research. The research subjects were physics education students in the 2021 batch of Jambi University who had contracted a computational physics course. The sample consisted of 25 students taken randomly. The research data were obtained from the results of the initial observation questionnaire and the desired teaching material needs analysis questionnaire. From the initial observation questionnaire, it can be concluded that 55.2% of students do not agree if they only use books as teaching materials, so it is necessary to develop teaching materials that are more practical and easy to understand. Based on the needs analysis of the development of teaching materials shows that 85.6% of students strongly agree if a teaching material is developed in the form of website development as teaching material for computational physics course supporters on linear and non-linear equations material.

Keywords: Computational physics; Linear and nonlinear equation; Student's needs; Website

Introduction

Education is a very important aspect of each individual, along with the development of technology, the world of education is required to be able to adapt, but on the one hand technology can be utilized as a forum for means of improving the quality and quality of education. Technology has become an integral aspect of education in the twenty-first century (Ghory & Ghafory, 2021). The development of technology has had a significant impact on education, leading to the need for adaptation in the way materials are delivered and the learning media used (Al-Absy, 2023). The integration of technology into education has brought about various benefits and opportunities. It has improved student feedback, increased engagement, and provided opportunities for innovation in education (Clunie et al., 2018; Cooper, 2019). The world of education is required to be able to make updates both in the way the material is delivered by educators and the learning media used, including using teaching materials. Modern education is one of the adaptations of increasingly sophisticated technological developments, one of which is by utilizing the internet, the ease of access offered by the internet is the main reason for making the internet one of the online learning resources in the current era of modern education. In order to increase accessibility and flexibility, online learning resources can be designed so that students can easily access lecture material in the form of electronic teaching materials that can be integrated with lecture activities (Pratita et al., 2021).

Teaching materials play a crucial role in the learning process as they provide educators with tools to effectively deliver content and engage students (Mushoffa et al., 2020). Teaching materials are all forms of materials in the form of materials or materials used which are used as a tool by educators in implementing the learning process in the classroom. This type of teaching material can include written materials and non-printed resources (Kurniawati, 2015). The selection of teaching materials is important for an educator. The success of delivering material is greatly influenced by the teaching materials used. Teaching materials should also be designed in a way that is aligned with the

How to Cite:
Kurniawan, W., Alrizal, Furqon, M., & Yunita. (2023). Analysis of Students Needs for Website-Based Computational Physics Teaching Materials on Linear and Nonlinear Equations. *Jurnal Penelitian Pendidikan IPA*, *9*(12), 10902–10908. https://doi.org/10.29303/jppipa.v9i12.5600

curriculum and the specific learning objectives. This ensures that the materials are relevant and can effectively support the learning process (Permadi & Adityawati, 2018). Interesting teaching materials will make students feel comfortable in the learning process and of course can help students understand the material so that it can improve learning outcomes. Designing teaching materials requires a thorough and structured approach so that it can be used by educators as a tool that fully supports the learning process (Ardiansyah et al., 2016).

According to Nasruddin et al. (2022), there are two types of teaching materials, namely printed and non-printed categories. Printed teaching materials are classic teaching materials using printed media such as paper, the use of printed media has the advantage that it can be durable and the manufacturing process is simple and only uses a little technology, while non-printed teaching materials are teaching materials delivered through screens or other visual media. The main advantage of digital media lies in its ability to create a variety of attractive colors and shapes. Digital-based teaching materials, there are five key elements that are essential for students and teachers, which include learning guidelines, competencies to be achieved, supporting information sources, practical exercises, and evaluation methods (Farhana et al., 2021) One of the digital teaching materials that can make it easier for students to understand material with a variety of visualizations is in the form of a website. The advantages of website teaching materials is web-based learning allows learning anywhere, while of course it can improve student learning outcomes. So the hope is that learning that is difficult to understand can be resolved by using the website (Januarisman & Ghufron, 2016; Divayana et al., 2016; Setyadi & Qohar, 2017; Sari & Suswanto, 2017; Fauzi & Rosliyah, 2020; Budiyono, 2020; Peprizal & Syah, 2020).

The advantage of using web-based teaching materials is that it does not require a lot of storage space (Purmadi & Surjono, 2016; Pratiwi & Wahyudi, 2021; Fernando et al., 2022). This is in line with research conducted by Pebriantika (2018) the development of web-based teaching materials can make it easier for teachers and help students understand learning materials. The utilization of web technology has great potential that can significantly improve the quality and quality of education, especially in the context of learning (Hidayatulah et al., 2015; Pratama & Buditjahjanto, 2016; Parumbuan, 2016; Rahman, 2016; Firmansyah & Saidah, 2016; Sunwinarti & Suwito, 2016; Jusmardi et al., 2019).

Computational physics is a course at the SI level of the Physics Education study program at Jambi University, this course is related to the combination of physics and computer programming languages. The subject matter in the computational physics course is that students are able to solve physics problems using numerical methods so that it can make it easier to solve physics equations, but in understanding computational physics material it is required to be able to understand programming languages so that the teaching materials used have a major influence on the success of lectures. But in reality the teaching materials used still have weaknesses that need to be reviewed, the weaknesses of teaching materials come from the selection of the type of teaching materials used besides foreign language teaching materials is one of the weaknesses of teaching materials that can hinder students in understanding computational physics material. In terms of visualization, students need teaching materials that are attractive, easily accessible from various devices without minimum computer specifications and of course require teaching materials that can help students learn independently to improve understanding.

The purpose of this research is to find out what kind of teaching materials need to be developed in Computational Physics courses at Jambi University through an questionnaire. It is hoped that the results of this study can provide information about the types of teaching materials that can be used in class or self-study so as to improve students' ability to understand computational physics in the material of linear and non-linear equations.

Method

This research is an quantitative research that implemented survey method, this research was conducted in September 2023 at the Physics Education Study Program, Faculty of Teacher Training and Education, Jambi University. The subjects of this study were physics education students in the 2021 batch of Jambi University who had contracted a computer physics course. The sample used for this study was randomly drawn 25 students. The research procedure begins with the distribution of an questionnaire to find out what obstacles the research subjects are experiencing regarding the completeness of the teaching materials used in computational physics lectures, followed by the needs questionnaire, this is a further effort to deal with the problem and so that researchers can provide appropriate and appropriate solutions to be applied to computational physics lectures.

The data collection instrument in this study consists an initial questionnaire using a Likert scale of 5 using a Likert scale of 5. Analysis technique is data obtained in the form of quantitative data which is then analyzed descriptively and compiled based on categories to make

narrative conclusions. According to Agustina et al. (2017), the following answer scale in the initial observation questionnaire and needs analysis uses a Likert scale.

Table 1. Category of Scale

Scale	Category
5	Strongly Agree
4	Agree
3	Slightly Disagree
2	Disagree
1	Strongly Disagree

To calculate the percentage of student participants' responses, use the equation (1):

$$Y = \frac{\Sigma P}{\Sigma Q} \text{ X } 100\% \quad (1)$$

Y = Percentage of Students' Responses
P = Score
Q= Maximum Score

So that these answers can be translated into answer scale results, an interpretation scale such as Table 2 is needed.

Table 2. Percentage of Total Responses

Percentage (%)	Category
80 – 100	Strongly Agree
60 – 80	Agree
40 – 60	Slightly Disagree
20 – 40	Disagree
0 – 20	Strongly Disagree

Result and Discussion

Result of Survey

The tables provided offer deep insights into student behavior and perceptions related to Computational Physics learning. Analyzing the results of the study presented in Table 3 provides us with the opportunity to discern trends, challenges, and opportunities in the context of Computational Physics education. We can classify the result into some categories below.

Table 3. The Result of Student's Behavior and Perception Related to Computational Physics Learning

Statement	Percentage of Student Answers (%)
I am interested in the Computational Physics course	Strongly Agree (28)
	Agree (64)
	Slightly Agree (8)
	Disagree (0)
	Strongly Disagree (0)
For me, the computational physics course is important for my knowledge in further learning	Strongly Agree (40)
	Agree (60)
	Slightly Agree (0)
	Disagree (0)
	Strongly Disagree (0)
For me, computational physics is a difficult and boring subject	Strongly Agree (0)
	Agree (16)
	Slightly Agree (72)
	Disagree (12)
	Strongly Disagree (0)
I am afraid of missing out on computational physics material	Strongly Agree (16)
	Agree (80)
	Slightly Agree (8)
	Disagree (0)
	Strongly Disagree (0)
I have reference books for computational physics courses	Strongly Agree (16)
	Agree (44)
	Slightly Agree (24)
	Disagree (16)
	Strongly Disagree (0)
I have no computational physics record	Strongly Agree (0)
	Agree (28)
	Slightly Agree (28)
	Disagree (32)
	Strongly Disagree (12)
At home I re-read computational physics material	Strongly Agree (0)
	Agree (28)
	Slightly Agree (60)

Statement	Percentage of Student Answers (%)
	Disagree (12)
	Strongly Disagree (0)
Learning using books alone can clarify computational physics material	Strongly Agree (4)
	Agree (12)
	Slightly Agree (48)
	Disagree (28)
	Strongly Disagree (8)
Learning using the website is more practical and can facilitate understanding of computational physics material	Strongly Agree (16)
	Agree (64)
	Slightly Agree (8)
	Disagree (12)
	Strongly Disagree (0)
I have often used the website in learning computational physics	Strongly Agree (4)
	Agree (64)
	Slightly Agree (28)
	Disagree (4)
	Strongly Disagree (0)
I like learning computational physics	Strongly Agree (20)
	Agree (76)
	Slightly Agree (4)
	Disagree (0)
	Strongly Disagree (0)
I have difficulty understanding computational physics material	Strongly Agree (8)
	Agree (60)
	Slightly Agree (28)
	Disagree (4)
	Strongly Disagree (0)
Linear and non-linear equations are difficult material to understand.	Strongly Agree (16)
	Agree (44)
	Slightly Agree (40)
	Disagree (0)
	Strongly Disagree (0)
I have difficulty in understanding the material of linear and non-linear equations through teaching materials applied by lecturers	Strongly Agree (8)
	Agree (36)
	Slightly Agree (52)
	Disagree (4)
	Strongly Disagree (0)
The learning media used makes me active in the learning process	Strongly Agree (12)
	Agree (60)
	Slightly Agree (28)
	Disagree (0)
	Strongly Disagree (0)
The learning media used makes it easier for me to understand the material of linear and non-linear equations	Strongly Agree (12)
	Agree (68)
	Slightly Agree (20)
	Disagree (0)
	Strongly Disagree (0)
The learning media (MATLAB) used requires too much laptop storage space	Strongly Agree (52)
	Agree (32)
	Slightly Agree (16)
	Disagree (0)
	Strongly Disagree (0)
I have difficulty installing the learning media application (MATLAB) on a laptop	Strongly Agree (44)
	Agree (48)
	Slightly Agree (8)
	Disagree (0)
	Strongly Disagree (0)
I need more interesting learning media to use	Strongly Agree (32)
	Agree (68)

Statement	Percentage of Student Answers (%)
	Slightly Agree (0)
	Disagree (0)
	Strongly Disagree (0)
I like technology-based learning media	Strongly Agree (40)
	Agree (60)
	Slightly Agree (0)
	Disagree (0)
	Strongly Disagree (0)
I feel the need for website-based computational physics learning media that can be used on all devices, e.g. website development.	Strongly Agree (48)
	Agree (48)
	Slightly Agree (4)
	Disagree (0)
	Strongly Disagree (0)
I agree if learning media is developed in the form of teaching material development as a supporter of computational physics courses on linear and non-linear equations.	Strongly Agree (28)
	Agree (72)
	Slightly Agree (0)
	Disagree (0)
	Strongly Disagree (0)

Interest and Perception towards the Course

Statements 1 to 3 from Table 3 center around the students' interest and perception of the Computational Physics course. A combined 92% (28% Strongly Agree + 64% Agree) of students have shown interest in the Computational Physics course. Furthermore, a unanimous 100% believe in the importance of the course for their further learning (Statement 2). However, Statement 3 presents a contrast where 72% of the students slightly agree that the subject is difficult and boring. This indicates that while the course is seen as beneficial, there's a need to make it more engaging and comprehensible.

Approach towards Learning

Statements 4 to 10 offer insights into students' approach towards learning Computational Physics. A large number, 96% (16% Strongly Agree + 80% Agree), are concerned about missing out on course material. This could be related to their belief that the subject is complex (from Statement 3). Furthermore, while 60% use reference books, a significant 64% of students find online resources more practical for understanding the material (Statement 9). This suggests that there is a tilt towards digital methods of learning over traditional ones.

Challenges in Understanding Computational Physics

Statements 11 to 14 provide a glimpse into the challenges students face in understanding the material. While 96% of the students like learning Computational Physics (Statements 11), 96% also admit to facing difficulties in understanding its material (Statement 12). Specifically, linear and non-linear equations emerge as complex topics with 100% of students expressing difficulty in one form or the other (Statements 13 and 14).

Effectiveness of Learning Media

Statements 15 to 20 delve into the effectiveness of the learning media used. A significant 72% (12% Strongly Agree + 60% Agree) feel active during the learning process due to the media, with 80% (12% Strongly Agree + 68% Agree) agreeing that the media simplifies understanding of linear and non-linear equations. However, practical challenges related to the learning media (MATLAB) also emerge. A substantial 84% of students express challenges related to storage space (Statement 17) and installation (Statement 18).

Demand for Enhanced Learning Media

The last two statements, 21 and 22, underline the demand for better and more flexible learning media. A combined 96% (48% Strongly Agree + 48% Agree) feel the need for a website-based Computational Physics learning platform that is device-agnostic. Similarly, 100% support the development of enhanced teaching materials for the subject, emphasizing on linear and non-linear equations (Statement 22).

The data sheds light on the fact that while students recognize the value of Computational Physics, they also find it challenging. While they are making efforts to grasp the material, there is a clear preference for online and digital resources. Practical challenges with existing digital tools like MATLAB suggest the need for more intuitive and accessible learning platforms. Given the unanimous support for enhanced learning materials and platforms, educational institutions and course designers should focus on the development of user-friendly, technology-based learning media.

Conclusion

The results of the student needs analysis questionnaire on the development of teaching materials show that there are still weaknesses in the learning media used previously where the use of matlab makes it difficult for students to install applications on their respective computers because it requires too much storage space on the device. So the solution to the problem is to develop web-based digital teaching materials. The results of the questionnaire stated that students had difficulty understanding computational physics material on linear and non-linear equations so that technology-based teaching materials were needed that were more practical to use, as many as 85.6% of students strongly agreed if a teaching material was developed in the form of website development as teaching material for supporting computational physics courses. From the results of this study, researchers plan to develop a teaching material based on website development as a supporter of computational physics courses on linear and non-linear equations.

Acknowledgments
Based on the data from the needs analysis questionnaire, it can be concluded that teaching materials need to be developed in computational physics courses precisely on the material of linear and non-linear equations at Jambi University in the form of website development. This research is a computational physics module development research to meet the needs of students for computational physics teaching materials so that it can be used as a reference in developing teaching material websites later.

Author Contributions
Conceptualization, Wawan Kurniawan; methodology, Alrizal and M. Furqon; software, Alrizal; validation, Wawan Kurniawan; formal analysis, M. Furqon; investigation, Yunita; resources, Wawan Kurniawan, Alrizal, and M. Furqon; data curation, Alrizal; writing—original draft preparation, M. Furqon; writing—review and editing, Wawan Kurniawan, Alrizal, M. Furqon; visualization, M. Furqon; supervision, Wawan Kurniawan; project administration, M. Furqon. All authors have read and agreed to the published version of the manuscript.

Funding
This research was funded by LPPM Universitas Jambi.

Conflicts of Interest
The authors declare no conflict of interest.

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