# Analysis of the pre-service physics teacher's ability to develop SDGs-oriented multimedia

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**Abstract.** The teacher's ability to develop multimedia is one of the supporting factors in communicating physics learning. Besides that, another requirement for a teacher is to introduce the concept of SDGs to students to prepare generations to achieve sustainable development goals for a better future. Therefore, this study aimed to analyze the abilities of pre-service physics teachers in developing SDGs-oriented multimedia. This study is descriptive research on the pre-service physics teacher who joined multimedia lectures in the Physics Education study program at one of the state universities in Surabaya, Indonesia. Data was collected through interviews and using product assessment sheets, then analyzed descriptively. Based on the results of data analysis, of the six indicators of the ability to develop multimedia, only two indicators were in the high category, namely the ability to edit videos and Accurate presentation of SDG content, and one indicator in a low category was ability to present animations, while the others three in the medium category. Therefore, it can be concluded that pre-service physics teachers' ability to develop SDGs-oriented multimedia is in the medium category.

## 1 Introduction

In the era of globalization and rapid technological developments, education is one of the critical aspects that must be continuously updated to face the challenges of the times. Education is tasked with forming the next generation who are highly competitive, have a deep understanding of global issues, and can contribute to achieving sustainable development goals [1-3]. One of the fields of education that has an essential role in forming a quality generation is physics education. Physics education strategically shapes students' analytical, critical, and creative thinking patterns and helps them understand the natural phenomena around them. In addition, multimedia technology in the learning process has become increasingly relevant, especially to meet the demands of a curriculum oriented toward Sustainable Development Goals (SDGs).

The SDGs are a global framework established by the United Nations (UN) to address various global challenges, including poverty, inequality, and environmental damage [4]. In education, the SDGs aim to improve the quality and accessibility of education for all, ensure

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inclusive and equitable education, and encourage innovation and continuous learning. To meet the demands of the SDGs, physics teachers have a vital role in developing innovative and relevant learning methods and media [5,6]. Using SDGs-based multimedia in physics learning is expected to help increase students' understanding of the relationship between physics and global issues and motivate them to actively participate in achieving sustainable development goals.

However, special abilities are needed for pre-service physics teachers to develop effective SDGs-based multimedia. The ability to integrate physics concepts with SDG issues, identify student needs and characteristics, and master multimedia technology is a critical factor in the development process [7]. Therefore, research on analyzing the abilities of pre-service physics teachers in developing SDGs-based multimedia is very relevant for exploration. In addition, based on the results of the analysis carried out by researchers from several previous research articles in developing learning multimedia, developers often need help with several obstacles, namely the low ability to produce exciting and high-quality multimedia content [8]. Another obstacle is the difficulty in creating engaging content due to a low understanding of the topics discussed and the need for more ability to package them in an exciting and easy-to-understand way [9,10]. From these various problems, it is necessary to carry out a more profound analysis regarding the developer's ability, in this case, pre-service physics teachers. From this problem, they can be used as a priority scale in teaching pre-service physics teachers regarding the development of multimedia physics learning, primarily in developing SDGs-based physics learning multimedia.

Research related to physics learning multimedia has been carried out by previous researchers, including the use of multimedia in physics learning [11,12], development of physics learning multimedia [13-15], review of literature related to learning multimedia [16-18], analysis of the effect of multimedia on physics learning outcomes to improving specific skills [19-21]. From a number of these studies, there has been no research related to the analysis of the ability of teachers or pre-service physics teachers to develop multimedia physics learning. Likewise, the content in the multimedia produced still needs to emphasize the contents of the SDGs. Therefore, this study aimed to evaluate pre-service physics teachers' ability to design SDGs-based multimedia in physics learning. The results of this research certainly provide valuable input for educational institutions in developing better physics teacher training and development programs. They can provide valuable insights for the development of SDGs-based education more broadly.

## 2 Method

The research methods used are descriptive quantitative and qualitative methods [22]. The data collected in a descriptive quantitative manner is used to provide an overview of the actual situation and answer questions related to the status of the research subjects. Meanwhile, qualitative data strengthens and complements quantitative data on the problem under study. The research sample is a study program of physics education students contracting multimedia lectures. Based on the data, students were selected by dividing the categories of high ability (S1), moderate ability (S2), and low ability (S3). The indicators of the ability to develop multimedia can include the following: (1) Graphic Design Skills, namely the ability to use graphic design software such as Adobe Photoshop, Adobe Illustrator, or CorelDRAW to create graphics, logos, and other visual elements in multimedia; (2) Video Editing Capability, namely the ability to edit videos using video editing software such as Adobe Premiere, Final Cut Pro, or Sony Vegas Pro, including cutting, merging, color adjustment, and special effects; (3) Animation skills include creating animations using animation software such as Adobe Animate, Blender, or Maya, including 2D and 3D animation, characters, effects, and object movement; (4) Understanding of Design Concepts,

namely the ability to understand multimedia design principles, such as good layout, effective use of colors, proper typography, and visual consistency, as well as the topic of the content loaded; (5) Creativity and Innovation, namely the ability to produce creative and innovative ideas in developing attractive multimedia that attracts the audience's attention; and (6) Accurate presentation of Sustainability development goals (SDGs) content.

**Table 1.** The level scale of multimedia development ability

| Level of multimedia developing ability | Score |
|---|---|
| High | $75<x\leq100$ |
| Moderate | $60<x\leq75$ |
| Low | $x\leq60$ |

Quantitative data was collected through a product assessment rubric and product dissemination, while qualitative data was collected through observation. Furthermore, the collected data is analyzed using an inductive approach in which conclusions are drawn from minor case investigations in detail to provide a big picture. Furthermore, determining the ability level of clone physics teachers in developing SDGs content-based physics learning multimedia follows Table 1.

## 3 Results and discussion

Developing multimedia learning has many benefits and importance in modern education. Multimedia helps maintain student interest and makes the learning process more enjoyable. Learning materials presented in different ways help facilitate a more profound understanding. With multimedia learning, students can learn independently. Learners can choose the time and place to study according to their preferences. It allows learners to learn at their own pace, increasing the independence of their learning, thereby enabling each learner to learn in the most effective way for them. Therefore, teachers must be able to develop teaching materials in the form of multimedia in learning, likewise with physics teachers. Based on the data analysis results, pre-service physics teachers generally have abilities in the moderate category of developing multimedia learning physics with an average score of 69.95, as shown in Table 2.

**Table 2.** The level of PSPT ability in developing multimedia of each indicator

| Indicators | Score | Level |
|---|---|---|
| Graphic design ability | 67.20 | Moderate |
| Video editing ability | 69.80 | Moderate |
| Ability to present animations | 59.30 | Low |
| Understanding of design concepts | 77.70 | High |
| Creativity and Innovation | 69.40 | Moderate |
| Accurate presentation of SDGs content | 76.30 | High |
| Average | 69.95 | Moderate |

Based on Table 2, the ability of pre-service physics teachers to develop learning multimedia needs to be improved again. It can be seen from all indicators of the ability to

develop multimedia physics learning; only two indicators are in the high category, namely the ability of pre-service physics teachers to understand multimedia design concepts with an average score of 77.70 and the accuracy of pre-service physics teachers in presenting SDGs content with a score of 76.30. And there is one indicator that is in the low category, namely the ability to present animation. In contrast, the other three indicators are in the medium category. The ability of pre-service physics teachers to present SDGs content can be seen in the content of the videos developed; in this case, the prospective teachers raise the theme of environmental pollution, as shown in Figure 1.

In Figure 1, it can be seen that prospective teachers present content related to the environment, which initially presented sources of environmental problems such as excessive use of air conditioners, use of vehicles, forest fires, and industrial disposal. This phenomenon is presented and narrated with good audio. Then, at the end of the video, the prospective physics teacher invites them to prevent global warming by planting trees, saving energy, etc.

Furthermore, if viewed from the participation of the number of teachers related to the ability to develop SDGs-based physics learning multimedia, it was found that only 36.51% of physics teacher candidates could develop physics learning multimedia in the high category, 54.76% in the medium category, and 8.73% in the low category. More details can be seen in Figure 2.


**Fig. 1.** An example of multimedia produced by PSPT.

Based on Figure 2, it can be seen that of the six indicators of the ability to develop SDGs-based and physical learning multimedia, there is only one indicator where the percentage of pre-service physics teachers is in the high category, namely the ability to present SDGs content in the developed multimedia. In the other five indicators, the percentage of the number of teachers is dominated by the medium category for each indicator. It is, of course, due to various factors. Based on the results of observations, the level of mastery and expertise in using graphic design software such as Adobe Photoshop, Illustrator, InDesign, CorelDRAW, or other software still needs to be improved. This results in an imbalance and

disharmony in composing the visual elements of a design, including the arrangement of negative and positive space [23]. In addition, the quality of the video could be better with clear, not blurred or distorted images [24]. This is due to the need for more skills from pre-service physics teachers in editing videos. Edits should be done carefully to ensure visual consistency and quality [25,26]. If the video has a storyline, video editing skills should reflect a clear and logical storyline. Transitions between clips and scenes should be seamless and help build the narrative [27]. The use of transitions and visual effects should be relevant to the style and message of the video.

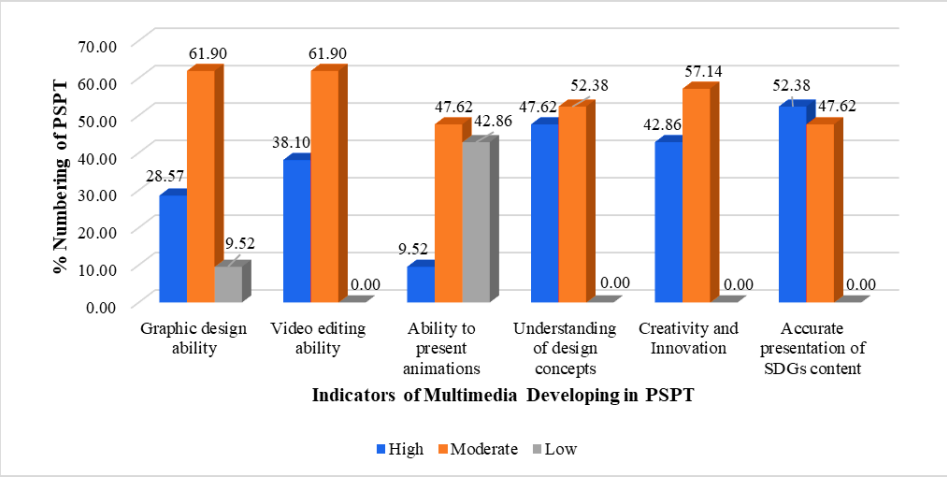


**Fig. 2.** Percentage of PSPT's level of each multimedia developing ability indicator.

Another factor that causes indicators of the ability to develop learning multimedia to be in a low category, especially in the aspect of presenting animation, is that the presentation of animation needs better visual quality with attractive character designs and backgrounds and inaccurate illustrations [28]. There is no visible use of keyframes and in between to ensure natural and authentic movement and an engaging storyline. Besides that, the creativity and innovation of pre-service physics teachers in developing multimedia physics learning still need to cover various aspects that can create attractive, interactive, and compelling content [29,30]. However, the creativity shown by pre-service physics teachers has revealed new, original content, not just copying material from other sources but also presenting information uniquely and excitingly. Using attractive, aesthetic designs and following the target audience will help increase student interest and involvement. Likewise, the content presented has presented lessons that lead to efforts to introduce the SDGs theme.

## 4 Conclusion

Based on the research and discussion, the ability of pre-service physics teachers to develop multimedia physics learning is still in the medium category. However, when viewed from all indicators, only two ability indicators are in the high category, namely (1) the ability of pre-service physics teachers to understand the concept of multimedia design and (2) the accuracy of pre-service physics teachers presenting SDGs content. In contrast, one indicator is in the low category, namely the ability of pre-service physics teachers to present animation in the developed multimedia. The limitations of this research are that the research only uses product data and observations in analyzing the abilities of pre-service physics teachers, and interview data may be needed to dig deeper into the constraints pre-service physics teachers

face while developing multimedia. This research is beneficial as input for tertiary institutions that produce pre-service physics teachers to provide them with the ability to develop multimedia. Furthermore, for future research, it is necessary to develop teaching facilities or materials to improve the ability of pre-service physics teachers to develop learning multimedia.

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