RESEARCH ARTICLE

# Analysis of e-worksheet based on SDG-13 in climate change material

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Abstract: E-worksheets are needed to support learning of SDG-13 material on climate change material, but analysis related to this has not attracted much attention from researchers. The purpose of this study was to determine the needs of students related to digital-based teaching materials that they want to apply in the classroom in biology learning, especially on climate change material to show the phenomenon of global warming with the application of the Merdeka Curriculum. The use of digital-based media is still very suboptimal in utilization, especially in the material of climate change in biology subjects. This quantitative research was conducted using questionnaire techniques, namely giving questionnaires to X-grade students in two schools, namely SMAN in Yogyakarta and SMAN in South Sulawesi Regency, and descriptive techniques were used for analysis tools. The results of student respondents show that 100% want to use electronic worksheets as a learning medium on climate change material. The implication of this research is expected to increase the potential use of digital-based teaching materials and realize the 21st-century era that relies on technology.

Keywords: climate change; digital teaching material; the 21st century

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## Introduction

The 21st century is known as digital era learning; this requires a variety of skills that must be focused on by students. It is currently known that the Indonesian government strongly supports the 21st-century learning. The 21st-century skills or 4Cs include creative thinking, critical thinking and problem-solving, communication, and collaboration (Sukmawati & Fatma, 2019; Ismaimuza, 2013. In today's digital era, education needs to adapt to the development and advancement of technology, and the potential of technology to create new learning spaces needed to facilitate learning activities (Marta, 2019) . The 21st-century teachers must have competence in the use of technology. The teaching profession is expected to reflect changes that can integrate technology, especially to improve student learning experiences and mastery of digital technology (Hsu, 2016). Garcia and Morrell (2013) said that a key feature of the 21st-century learning is the digitization of the teaching and learning process, as technology in the classroom remains a key element that enables teachers to excel in learning. Boholano (2017) said that digital technology fosters student participation and collaboration between teachers, encouraging and guiding students' independent learning. From this explanation according to Yuliana and Atmojo (2021), A key feature of the 21st-century learning is the involvement of technology in the teaching and learning process. Problem-based learning is based on highly innovative learning theories (such as constructivism and experiential learning) by posing problems related to different disciplines to find appropriate solutions. PBL is a way for educators to help learners develop problem-solving skills and face future challenges. Edens (2000) states that problem-based learning equips students with the 21st-century skills. In the 21st century, students are required to develop a variety of skills that are context-specific and appropriate to the challenges of today's life. The biggest problem in life today is global climate change listed in the

SDGs-13 in biology learning, using material on Environmental Change to explain Climate Change, known as Global Warming. Learning biology is not just theories and concepts but must do something, knowing and solving biology-related problems (Ningsih et al., 2023).

Global warming material covers the greenhouse effect and its impact on the earth. Global warming is defined as “an unusually rapid increase in the average temperature of the Earth's surface over the past century, mainly caused by greenhouse gases produced by human activities”. Climate change is defined as “a change in global or regional climate patterns” (Taylor et al., 2018). Global warming is very difficult to understand to students if without analyzing directly, therefore the use of digital teaching materials allows students to access material about global warming easily and effectively, especially in today's digital era. Students can access digital materials from electronic devices such as laptops, tablets, and smartphones, allowing them to learn more flexibly and effectively. One way to learn about climate change using Heat-Cool is to teach complex scientific phenomena in an engaging way, using media that makes people aware of environmental issues. The design of Heat-Cool is to make students aware of the problem of global climate change and warming of the Earth's surface, with practical demonstrations to students, with the help of thermal imaging cameras. The impact of heat on the physical environment and how behavioral changes can have a positive impact. This is achieved through the design, implementation and impact assessment of a new practical tool (Heat-Cool) that addresses the United Nations' call to use science and technology-driven climate change education to achieve sustainable development goals, especially SDG-13 (Bhat et al., 2023).

The use of digital media in educational settings known as digital-based learning is a powerful tool for effective learning and at the same time highly motivates learners in that learning occurs in a fun and engaging way. A further advantage of digital-based learning is immediate feedback (Witzel et al., 2024). Indonesian 21st Century Biology Skills to improve students’ achievement, and develop well-balanced individuals, teachers should apply the use of computers in the learning and teaching process (Pamungkas et al., 2023). Innovation is needed in the design and development of teaching materials, one of which applies information technology through digital teaching materials. Digital teaching materials are an important component in achieving learning objectives (Prastyo et al., 2021). Digital teaching materials can be used as a communication tool between teachers and students in the learning process online and offline learning. The use of digital teaching materials is effective for independent learning, so students can still learn even if they are not accompanied by a teacher (Mella et al., 2022). The initial step in the process of developing digital teaching materials in conducting a needs analysis.

This research focused on students on digital teaching materials in learning. The contribution of this research is as a reference in the development of digital teaching materials based on problem-based learning models to identify the extent to which high school students need digital-based electronic worksheet teaching materials and encourage the 21-st century learning. In addition, this article also examines the integration of SDGs-13 theme on Climate Change in learning the biology of environmental change, so that it can be applied optimally in the classroom.

## Method

This research is quantitative descriptive research. The population and samples in this study were X grade high school students. 132 students, namely 72 X grade students in this case 2 classes from high schools in Yogyakarta City, 60 X grade students in this case 2 classes from high schools in districts in South Sulawesi who were undergoing Biology subjects on the topic of Environmental Change material. This sampling method uses purposive sampling technique, which is a sampling technique by considering certain aspects. Stages in the research used, among others; 1) Identification of problems, 2) Literature study, data collection.

The research data collection technique was obtained from distributing instruments in the form of questionnaires to a predetermined population. Using google form on students. Student questionnaires are used to describe what learning has been used by teachers in the learning process, besides that student questionnaires also describe their needs for digital learning. The results of the questionnaire will be analyzed using the Formula 1 (Sugiyono, 2014):

$$P = \frac{F}{n} \quad (1)$$

Description:
P = Percentage of Student Score
F = Student Score Frequency
n = Number of Students

## Results and Discussion

The research data were obtained through a questionnaire with initial observation indicators of the need for digital teaching material development and indicators of e-worksheet needs as student learning media needs. In developing this questionnaire, researchers also interviewed related to the availability of learning media currently used by teachers, especially Biology subjects. This was done to see if digital-based media had been used during the process of teaching and learning activities and the results of the teacher had not maximized the use of e-worksheet in learning climate change. Based on the results of the interview, the teacher has also implemented learning with discussion, presentation, and problem-based methods, so that students have been trained to be actively involved in learning. However, there are still students who are passive in learning activities (Hasanah, 2022). Through learning media, every student can contribute to learning activities because it can overcome the passive attitude of students to become more active. In addition, observations related to the needs of e-worksheet are carried out to find out how much students are interested in e-worksheet media that will be developed and applied and the results say that 100% of students need electronic digital-based media.

In the research conducted this time, the respondents taken totaled 132 students. Where 72 X grade students come from two classes located in the city of Yogyakarta and 60 X grade students come from two classes located in one of the districts in South Sulawesi. This is done to see the needs of grade X high school students in different locations. Respondents were given a questionnaire as a research instrument in determining the results of the analysis of the needs for developing digital teaching materials and analyzing the needs of e-worksheet as learning media.

The initial question given to respondents on the indicator of the need for the development of digital teaching materials is related to the type of learning media used daily by Biology teachers (Figure 1).

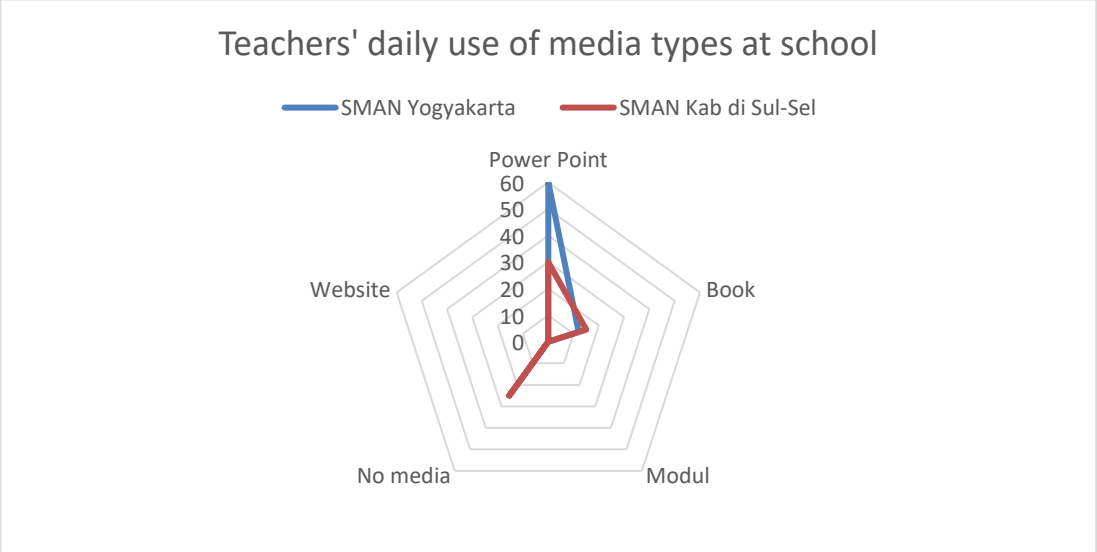


Figure 1. Daily Media Type Usage

Based on the results of the analysis of the use of daily media types used by teachers in Yogyakarta high schools and in regency high schools in South Sulawesi, the results of respondents according to Figure 1 stated as much as 68% of the use of learning media, namely power point being the most types of media used in both schools. Furthermore, the observation continued with several questions according to the level of need for digital teaching materials needed by students can be seen in Table 1.

Table 1. Results of Initial Observation Indicators of the need for Digital Teaching Materials

| No | Question | Alternative Answer | Percentage (%) |
|---|---|---|---|
| 1 | Biology Lessons are interesting lessons for me | Yes | 54% |
| | | No | 46% |
| 2 | I have difficulty learning biology material related to objects of study that are not visualized (depicted) | Yes | 72% |
| | | No | 28% |
| 3 | I need digital teaching materials that can help in understanding the material visually | Yes | 92% |
| | | No | 8% |
| 4 | Teachers use interactive and interesting learning media | Yes | 12% |
| | | No | 88% |
| 5 | Biology learning activities become more interesting with the presence of digital teaching materials | Yes | 100% |
| | | No | 0% |
| 6 | I agree if in biology learning, e-worksheet is utilized and environmental problems are utilized to understand the material | Yes | 100% |
| | | No | 0% |

Based on the results of the initial observation of the need for Digital Teaching Materials presented in Table 1 point one, 54% of respondents stated that biology lessons were interesting lessons for them while 46% of respondents stated that biology lessons were not interesting to them. This is likely due to the impact of teaching materials that are applied are still conventional and not attractive to students according to research from Yanuar and Pius (2023) and strengthened by research from Ayu et al (2022) which states a similar thing that productive learning is achieved when supported by the design and systematic use of media and innovative educational exercises to develop skills. However, there are still many teachers who still use conventional learning models.

Furthermore, based on the results of initial observations of the need for Digital Teaching Materials presented in Table 1 point 2, 72% of respondents stated that they had difficulty learning biology material related to objects of study that were not visualized and 28% stated that they had no difficulty. This is based on the use of digital technology in fact makes it easier for students to understand abstract concepts (Arvanitis et al., 2009). Other studies have shown that teaching material-based learning will improve students' creativity, critical thinking, interest, and learning outcomes, especially in learning biology (Thuneberg et al., 2018; Perignat & Katz-Buonincontro, 2019; Madden et al., 2013; Kurniawati & Nita, 2018; Hakim & Windayana, 2016).

Based on the results of the initial observation of the need for Digital Teaching Materials presented in Table 1, the third point states that students who need digital teaching materials that can help in understanding the material visually are 92% and do not need only 8% of the population. This is because to understand biology learning. Digital-based teaching materials make biology topics easier to understand because they are equipped with images, audio, video, and easy interaction, especially compared to books. Digital-based biology materials with images, audio, video, and interaction help students understand biology concepts more clearly and easily. Because images help students understand biological concepts more clearly and easily. Images can express biological structures, biological processes, and climate change phenomena that are difficult to understand just by reading text. (Widyastuti et al., 2017;Azizah & Alberida, 2021).

Audio can help students understand biology concepts more easily and more clearly. It can be a teacher's voice, a recorded conversation, or nature sounds (Rusmiana Lengu et al., 2022;Widyastuti et al., 2017). Students can understand biological concepts more easily and more easily by watching videos that display biological processes, natural phenomena, and the effects of climate change on living things that are difficult to understand just by reading texts and can develop the interest and motivation of students and students have a better ability to understand the concepts of the lessons taught (Nur & Buraeda, 2023).

Although books can help students understand biology concepts more easily and comprehensibly, they can be ineffective if they are not supplemented with easier interactions, images, videos, and audio. In addition, these books can be less interactive and cannot help students understand biological concepts more clearly.

Based on the results of the initial observation of the need for Digital Teaching Materials presented in Table 1, the fourth to sixth points, 88% of teachers still do not use digital teaching materials in biology learning so the respondents stated 100% agreed if biology learning activities became more interesting with digital teaching materials and also the respondents stated 100% if biology learning utilized digital teaching materials. In this case in line with research conducted by Utami and Atmojo (2021) stated that

the need for digital teaching materials is needed by students to support the success of teaching and learning activities at school.

## Conclusion

Based on the research that has been conducted, it can be seen that 21st-century skills will require educators to always actively develop their abilities so that active learning can be realized. Active learning will run smoothly if supported by the strategies used by educators, one of which is meeting the needs of students for digital-based teaching material technology that is more attractive to students to learn further. Students will feel many conveniences with digital teaching material technology, including access to information, interactivity, affordability, personalization, and improved learning outcomes.

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## Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

## Author Contributions

**N. Fadilah**: Methodology; Analysis; Writing-original draft; Writing – Review and editing. **A. Subiantoro** and **A. T. Pratama**: Writing - review and editing.

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