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THE IMPACT OF SETS-BASED SCIENCE LEARNING ASSISTED BY IT MEDIA ON SCIENCE LITERACY AND DIGITAL LITERACY

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Abstract
This research aims to analyze the impact of SETS-based science learning assisted by IT-based media in increasing elementary school students' scientific literacy and digital literacy. This research method is an experimental nonequivalent control group design type. The subjects of this research were 50 grade V elementary school students divided into experimental classes and control classes. Data collection techniques in this research used observation sheets, questionnaires and test questions. The data analysis techniques used are descriptive percentages, difference tests (t-test) and increase tests (N-gain). The research results showed that the average mastery of scientific literacy aspects in the experimental class was 94.57% and in the control class it was 61.70%. Meanwhile, mastery of digital literacy aspects in the experimental class was 91.45% and in the control class it was 65.40%. Meanwhile, in the t test, the results of the post test obtained a value of t = 5.476 > t table = 1.998 and (p) count = 0 < 0.05, which means that there is a significant difference in learning achievement scores between the experimental group that used the product developed and the control group. . The results of the N gain test showed that the control group had an increase in the medium criteria (0.46) and the experimental group had an increase in the high criteria (0.74). Based on this, it can be concluded that SETS-based science learning assisted by IT-based media is effective and has a positive impact on elementary school students' mastery of scientific literacy and digital literacy.
Keywords: *Science Learning; SETS; Scientific Literacy; Digital Literacy*

Abstrak
Penelitian ini bertujuan untuk menganalisis dampak pembelajaran sains berbasis SETS berbantuan media berbasis IT dalam meningkatkan literasi sains dan literasi digital siswa sekolah dasar. Metode penelitian ini adalah eksperimen tipe desain nonequivalent control group. Subjek penelitian ini adalah siswa kelas V sekolah Dasar yang berjumlah 50 siswa terbagi dalam kelas eksperimen dan kelas kontrol. Teknik pengumpulan data dalam penelitian ini menggunakan lembar observasi, angket dan soal tes. Teknik analisis data yang digunakan yaitu deskripitf persentase, uji perbedaan (*uji-t*) dan uji peningkatan (*N-gain*). Hasil penelitian menunjukkan rata rata penguasaan aspek literasi sains pada kelas eksperimen adalah 94,57% dan pada kelas kontrol sebesar 61,70%. Sedangkan penguasaaan aspek litrasi digital pada kelas eksperimen adalah sebesar 91,45% dan pada kelas kontrol sebesar 65,40%. Sedangkan pada uji t hasil post test diperoleh nilai t hitung = 5,476 > t tabel = 1,998 dan (p) hitung = 0 < 0,05, yang berarti terdapat perbedaan nilai prestasi belajar yang signifikan antara kelompok eksperimen yang menggunakan produk hasil pengembangan dengan kelompok kontrol. Hasil uji N gain menunjukkan kelompok kontrol memiliki peningkatan dengan kriteria sedang (0,46) dan keolompok eksperimen memiliki peningkatan pada kriteria tinggi (0,74). Berdasarkan hal tersebut maka dapat disimpulkan bahwa pembelajaran sains berbasis SETS berbantuan media berbasis IT efektif dan berdampak positif terhadap penguasaaan literasi sains dan literasi digital siswa sekolah dasar.
Kata Kunci: Pembelajaran Sains; SETS; Literasi Sains; Literasi Digital

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Introduction

The advancement of information technology (IT) in the digital era has had a significant impact on various aspects of life, including education. The use of IT-based media in the learning process has become an urgent need, especially in an effort to improve the quality of education in schools. One of the most important competencies for today's young generation is science literacy and digital literacy. Science literacy includes not only understanding scientific concepts, but also the ability to think critically, solve problems, and apply science in everyday life. On the other hand, digital literacy includes skills in using information technology wisely, effectively and productively (Jackson, C., Mohr-Schroeder, M. J., Bush, S. B., Maiorca, C., Roberts, T., Yost, C., & Fowler, A. 2021; Valladares, L. 2021; Ke, L., Sadler, T. D., Zangori, L., & Friedrichsen, P. J. 2021; Jalaluddin, J. 2024; Franco-Mariscal, A. J., Cano-Iglesias, M. J., España-Ramos, E., & Blanco-López, Á. 2024).

In Indonesia, students' science literacy is still at an alarming level, as shown by the results of the Program for International Student Assessment (PISA) survey. This shows that conventional learning methods that are still widely applied in schools are not able to optimally develop students' abilities in understanding and applying science. On the other hand, the rapid development of technology demands learning that is able to integrate digital literacy in the learning process, especially at the elementary school level. Therefore, an innovative learning approach that is relevant to the needs of the times is needed, one of which is Science, Environment, Technology, and Society (SETS)-based science learning supported by IT-based media.

SETS-based science learning (Science, Environment, Technology, and Society) with the help of information technology-based media has novelty compared to previous similar studies. It integrates the SETS approach with IT-based media, creating a learning experience that is interactive and relevant to students' daily lives, in contrast to previous studies that may only use one of the approaches. Not only does it improve the understanding of science concepts, it also targets the development of students' digital literacy, an essential skill in the modern era. This approach expands learning from merely cognitive to technological mastery. With a focus on primary school students, this research introduces a new perspective, different from previous studies generally conducted at secondary or higher education levels, so as to demonstrate the impact of technology-based learning from an early age. The use of IT-based media to support the SETS model presents a new approach that makes learning more interesting, contextualized, and can meet the learning needs of students with various styles. This study measures the impact on two dimensions of literacy, namely science literacy and digital literacy, providing more comprehensive insights than previous studies that usually only focus on one dimension. Through this innovation, this research is relevant to modern challenges and makes a real contribution to the development of an education system that is more responsive to the technological and skills needs of the 21st century.

The SETS approach is a learning model that integrates four important aspects, namely science, environment, technology, and society. This approach allows students to understand science concepts more contextually by linking them to real problems around them (Alatas, F., & Solehat, D. 2022; Muhtadi, D., & Wulandari, W. 2023). With the help of IT-based media, SETS-based science learning becomes more interesting, interactive, and easily accessible to students. The use of IT media such as videos, simulations, interactive learning applications, and other digital platforms can enrich students' learning experience, increase active engagement, and facilitate the development of their digital literacy.

This study aims to analyze the impact of SETS-based science learning assisted by IT-based media on the acquisition of science literacy and digital literacy of elementary school students. With the combination of a holistic SETS approach and interactive IT-based media, it is expected that students can improve their science understanding while developing their digital skills. The results of this study are expected to contribute significantly to the development of learning models that are in line with the demands of the 21st century, where science and digital literacy are important aspects that must be mastered by every student.

Several previous studies have shown that IT integration in learning can improve students' motivation, engagement and learning outcomes. For example, according to research by Setiawan & Widyantoro (2020), the use of IT-based media in science learning can significantly improve students' conceptual understanding and learning motivation. In addition, research conducted by Rahmawati et al. (2021) also found that students' digital literacy increased through the use of digital media in learning, which had an impact on students' ability to access and critically evaluate information.

Research Methods

This research was conducted in July - October 2024 in the fifth grade of SD Negeri Padokan 2 Kasihan Bantul Yogyakarta. This research method is an experiment with a nonequivalent control group design. The subjects of this study were fifth grade students of SD Negeri Padokan 2 Kasihan Bantul Yogyakarta totaling 50 students divided into two classes, namely class VA as an experiment and class VB as a control class. Data collection techniques, instruments and data analysis techniques can be seen in Table 1.

Table 1. Type of Data, Data Collection Techniques, Instruments and Data Analysis Techniques

Type of Data	Data Collection Techniques	Instruments	Data Analysis Techniques
Science literacy	Observation	Observation Sheet	percentage descriptive
Digital Literacy	Observation	Observation Sheet	percentage descriptive
Respon Siswa	Questionnaire	Questionnaire Sheet	percentage descriptive
Science Learning Outcomes	Test	Test Questions	t-test and N-gain test.

Results and Discussion

Science literacy involves several important aspects and indicators that help students understand, apply and evaluate scientific concepts in everyday life. Based on several science literacy guides such as the Program for International Student Assessment (PISA) and other studies, the main aspects and indicators of science literacy can be seen in Table 2.

Table 2. Aspects and Indicators of Science Literacy

No	Aspects	Indicator
1	Describing Scientific Phenomena	The ability to explain scientific phenomena using correct concepts.
2	Designing a Scientific Inquiry	Skills to formulate scientific questions and plan investigations to obtain relevant data
3	Interpreting Data and Evidence Scientifically	Able to analyze data and draw conclusions based on scientific evidence.
4	Using Evidence to Conclude	Use observations and experiments to support or reject a hypothesis or theory.

Science literacy is essential for understanding global issues such as climate change, health, and technological innovation (Rini, C. P., Hartantri, S. D., & Amaliyah, A. 2021; Utami, S. H. A., Marwoto, P., & Sumarni, W. 2022). This ability allows students to make decisions based on a deep and critical scientific understanding of information in the digital era. The impact of SETS-based science learning assisted by IT-based media on science literacy can be seen in Figure 1.

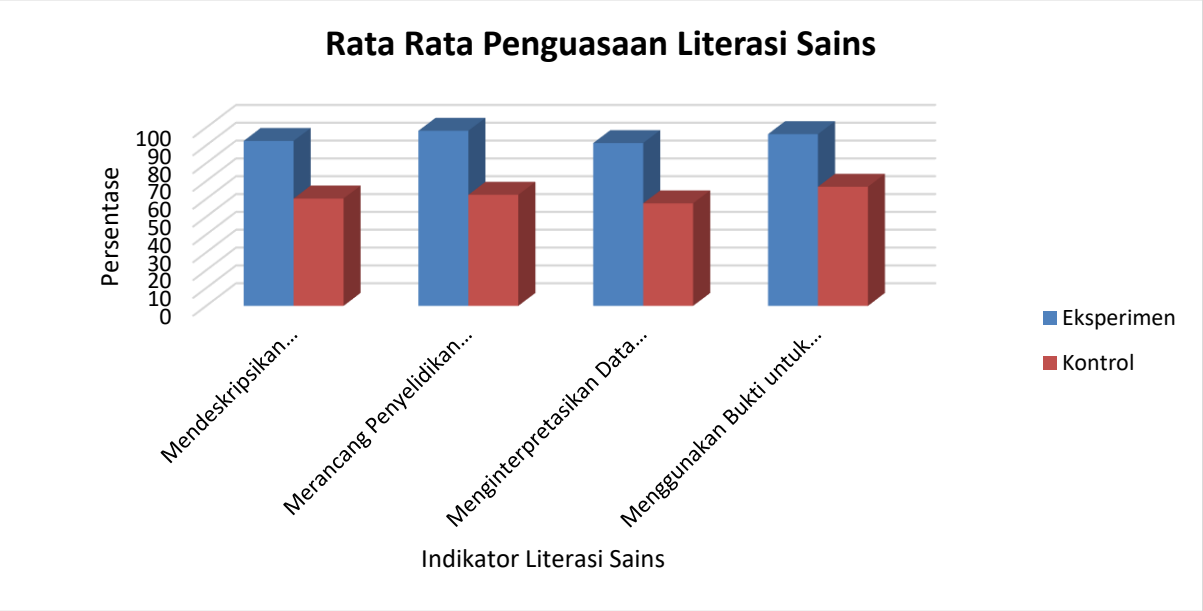

Figure 1. Percentage Chart of Mastery of Science Literacy Indicators

Figure 1 shows that the average mastery of science literacy aspects in the experimental class was 94.57% and in the control class was 61.70%. These results indicate that the experimental class has a higher mastery of science literacy compared to the control class. This difference is due to the implementation of SETS-based science learning assisted by IT-based media. The development of science literacy at the basic education level is useful so that students are ready to face the complexity of the modern world and are able to think critically in processing information in this digital era (PISA (OECD, 2018). In addition to science literacy, digital literacy is also needed as a provision for students to face the massive development of technology and information. Digital literacy is a very important skill in today's digital era, and has several main aspects with indicators that describe the user's competence in accessing, understanding, and using digital information wisely. The aspects and indicators of digital literacy can be seen in Table 3.

Table 3. Aspects and Indicators of Digital Literacy

No	Aspect	Indicator
1	Access to Digital Information	The ability to search and find relevant information using various digital sources, such as search engines, databases and social media.
2	Information Evaluation	Skills to assess the credibility and accuracy of information found online. This includes the ability to distinguish between trustworthy and untrustworthy sources, as well as recognizing information bias.
3	Ethical and Safe Use of Information	Know how to share digital information responsibly, understand privacy, and apply ethics in interacting in digital spaces.
4	Digital Content Creation	The ability to generate and structure digital content such as text, images, videos and other multimedia. It also includes the ability to collaborate and communicate effectively on digital platforms.

5	Understanding Technology and Digital Tools	Technical skills in using digital devices and apps, such as privacy settings, app navigation, and use of specific software
6	Digital Troubleshooting	Ability to resolve technical issues that arise when using digital devices or applications and find independent solutions.
7	Cybersecurity Awareness	An understanding of security risks in the digital world, such as phishing, malware and data protection. This includes the ability to protect personal information and avoid online security threats.

Digital literacy involves not only technical skills, but also a deeper understanding of digital ethics and the critical ability to evaluate information. These aspects are an important basis for users to be able to interact and contribute productively in the digital space. This digital literacy indicator has been adjusted to the level that needs to be mastered by elementary school students. The average level of students' digital literacy can be seen in Figure 2.

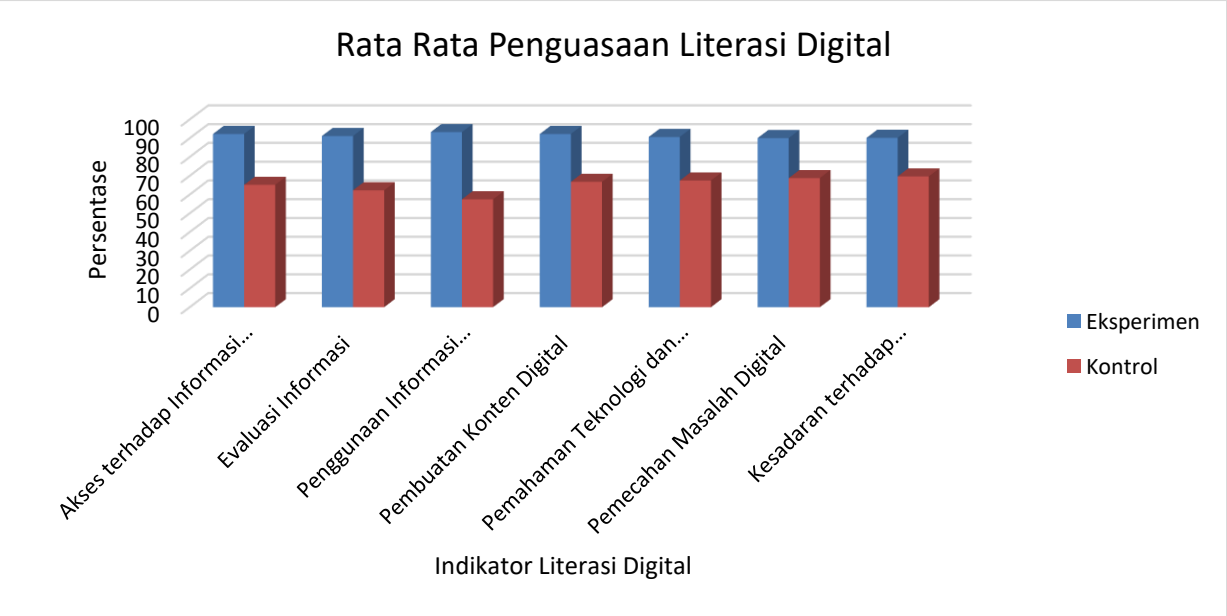

Figure 2. Percentage Chart of Mastery of Digital Literacy Indicators

Figure 2 shows that the average mastery of digital literacy aspects in the experimental class was 91.45% and in the control class was 65.40%. These results indicate that the experimental class has a higher mastery of digital literacy compared to the control class. This difference is due to the implementation of SETS-based science learning assisted by IT-based media.

Furthermore, the measurement and comparison of students' science learning achievement between classes that use SETS-based science learning assisted by IT-based media and classes that use conventional learning. Based on the results of the calculation of pre-test values, it is known that the value of t count = 1.286 < t table = 1.998 which shows there is no difference in student science learning achievement between the control class and the experimental class. While in the t test of post test results, the value of t count = 5.476 > t table = 1.998 and (p) count = 0 < 0.05 which means that HO is rejected, so the conclusion obtained is that there is a significant difference in the value of science learning achievement between the experimental class using SETS-based science learning assisted by IT-based media with the value of science learning achievement of the control class using conventional learning. After it is known that there is a difference in the value of science learning achievement between the experimental class

and the control class, then the N-gain test is carried out to find out which class has a higher increase in science learning achievement. The results of the N-gain test can be seen in Table 4.

Table 4. Test of Increased Student Learning Achievement Value

Group/Class	Pre Test	Post Test	Gain	N gain	Criteria
Experiment / VA	55,85	88,75	32,90	0,74	High
Control / VB	56,75	76,85	20,10	0,46	Medium

Based on Table 4, it is known that there is a difference in increasing the value of science learning achievement between the control class and the experimental class. The control class had an increase with moderate criteria (0.46) and the experimental class had an increase in high criteria (0.74). Based on these results, it is stated that learning in the experimental class using SETS-based science learning assisted by IT-based media is better in increasing the value of students' science learning achievement in elementary school.

This study aims to analyze the impact of SETS-based science learning assisted by IT-based media in improving science literacy and digital literacy of elementary school students. SETS-based science learning successfully improves students' science literacy. After the application of IT media in learning, the results in the experimental class showed a significant increase compared to the control class. Students not only understand basic science concepts such as ecology and environmentally friendly technology, but are also able to apply these concepts in everyday life (Sawitri, A. D., Priyanti, P. W., Wanah, N., & Prayogo, M. S. 2024; Meni, A. 2023). The SETS approach that links science with the environment, technology, and society makes students more interested in learning science because the context is relevant to real life. For example, students more easily understand sustainable technology and its impact on the environment because the material is delivered through IT-based interactive simulations (Hakim, A. R., Sururuddin, M., & Haqiqi, N. 2021; Sopiah, S., Khermarinah, K., & Sari, M. 2024).

In addition to the improvement in science literacy, students also showed improvement in digital literacy. They became more accustomed to using technological devices, such as computers or tablets, in accessing course materials. IT-based media used included interactive e-modules, animated videos and virtual simulations, all of which were designed to facilitate understanding of science materials and maximize student engagement (Hafizah, M. 2024; Aldini, R. R. H., Kusumawan, U., & Santoso, B. 2022; Musyafa, I. F., Budiman, M. S., Marlihayati, R. K., Nuraeni, R., & Septiani, M. 2022; Cibro, I. P. P. S., & Tanjung, E. F. 2024). Research also shows that students who participate in IT-based learning become more skilled in using learning applications, navigating information digitally, as well as working collaboratively in technology-based projects. This suggests that SETS-based learning focuses not only on academic material, but also on developing 21st century skills (Realitawati, R., Ikrom, F. D., Herawan, E., & Kadarsah, D. 2024; Supriatna, N. 2019). IT-based learning media has proven to be very effective in improving student understanding and engagement. Animated videos, for example, successfully capture students' attention and help them understand abstract concepts in a more visual and interactive way. Some studies also show that virtual simulations help students learn more independently, which supports differentiated learning (Avkarinah, Z. I. 2024; Rosa, E., Destian, R., Agustian, A., & Wahyudin, W. 2024; Umkabu, T. 2023; Casfian, F., Fadhillah, F., Septiaranny, J. W., Nugraha, M. A., & Fuadin, A. 2024; Pangalo, E. G. 2020). By using interactive e-modules, students can explore the subject matter anytime and anywhere, giving them the freedom to learn at their own pace. This provides a more personalized and in-depth learning experience, which ultimately improves student learning outcomes (Kusnadi, E., & Azzahra, S. A. 2024).

One of the main reasons why the SETS approach is effective is because of the relevance of the context it brings to science learning. By connecting science to environmental and social issues, learning becomes more interesting and motivating for students. This approach facilitates more in-depth discussions on how technology and science can be used to solve real problems in society. In this study, students are not only required to understand science concepts theoretically, but also asked to think critically and creatively in applying their knowledge in real-life situations. This is in line with previous research which shows that problem-based learning and social context result in a more significant increase in science literacy than conventional approaches (Fitriani, D., Milama, B., & Irwandi, D. 2017; Ramdani, A. 2023; Kurniawati, K., & Hidayah, N. 2021; Vodă, A. I., Cautisanu, C., Grădinaru, C., Tănăsescu, C., & de Moraes, G. H. S. M. 2022).

In addition to science literacy, technology plays an important role in developing students' digital literacy. IT-based media helps students learn to use technological tools effectively to solve problems, conduct research and collaborate with their peers. In this context, technology is not only a tool but also a means to develop essential 21st century skills such as digital literacy, communication and collaboration (Aliyah, S. R., & Sapitri, E. 2024; Nababan, D. A., Patty, J., Sopacua, S. B., & Sianipar, D. 2024). This study also found that student engagement increased when IT media was used, especially through the use of animated videos and interactive simulations. Students tend to be more interested and engaged in the learning process when they use technology that is familiar to their daily world, such as tablets, laptops, or web-based learning applications.

SETS-based science learning (Science, Environment, Technology, Society) supported by information technology (IT)-based media can have a significant impact on improving students' science literacy. This learning model combines science with real contexts such as environmental and technological issues, so that students can see the relevance of science in everyday life. In addition, with the help of digital technology, students can be more involved in the learning process interactively, for example through the use of learning modules or applications that allow independent exploration and deeper discussions on complex topics.

The SETS (Science, Environment, Technology, and Society) approach, applied with IT media support, has proven effective in enhancing students' ability to critically and practically understand scientific concepts. Interactive media, such as digital modules or educational videos, supports students in analyzing issues related to technology and the environment, while also building their critical thinking skills. Students who learn through SETS modules show a greater improvement in concept comprehension and scientific literacy skills compared to those who learn using conventional methods. By leveraging technology, SETS learning also strengthens student engagement in the learning process, allowing them to independently access scientific information and apply it in broader social and environmental contexts. This approach creates a meaningful learning experience, boosts motivation, and helps students connect scientific knowledge to real-world issues, aligning with the goals of scientific literacy expected in the 21st century (Atiaturrahmaniah, A., Bagus, I., Aryana, P., & Suastra, I. W., 2022; Barkah, E. S., Awaludin, D., & Bahtiar, M. I. E. A., 2024).

The SETS (Science, Environment, Technology, Society) approach to science learning, supported by information technology-based media, has a significant impact on improving students' scientific literacy. This model enriches students' understanding by connecting science to real-world contexts, such as environmental and technological issues that are relevant to daily life. Research results indicate that the IT-supported SETS method enhances students' critical

thinking skills, conceptual understanding, and active participation. For instance, recent research in Indonesia shows that this approach is effective in significantly improving scientific literacy skills among elementary school students, thanks to meaningful contextual integration and digital learning tools that support both independent and collaborative exploration (Sujanem, R., Suwindra, I. N. P., & Suswandi, I., 2022).

The SETS (Science, Environment, Technology, Society) approach to science learning, supported by information technology (IT)-based media, has proven effective in enhancing students' digital literacy. The use of IT media in SETS learning not only enriches students' understanding of science but also helps them develop essential digital skills for the modern era. Students become more proficient in accessing digital information, analyzing data, and working collaboratively in digital environments, all of which are essential components in developing digital literacy skills.

The SETS-based learning approach with technology-based media has shown improvements in students' mastery of both scientific and digital literacy. This aligns with research indicating that IT-based learning strengthens students' understanding of content and enhances digital literacy skills, such as information evaluation and effective use of digital tools for research and collaboration (Syahada, H. A. S., & Santoso, G., 2023). For elementary school students, this integration is especially important as they learn to use technology productively, not only as a tool for play but as a means for deep and meaningful learning (Nurlina, N., Maharani, S. D., & Barus, J., 2024; Verrysaputro, E. A., Agysti, A. I., & Putri, D. N., 2024).

Furthermore, the digital literacy developed through this approach equips students with the ability to adapt to rapid technological changes. In an IT-based SETS learning environment, students learn to navigate digital information, understand digital ethics, and apply these skills in contexts relevant to real life, such as environmental issues and technological advancements. Consequently, IT-supported SETS learning provides a strong foundation in digital skills and prepares students to meet future technological demands.

The results of this study have important implications for elementary education. IT-supported SETS-based science learning can serve as an effective model for enhancing students' scientific and digital literacy in the digital age. Additionally, teachers need to be trained to integrate technology more effectively into the learning process to maximize the benefits of technology (Fitri, W. A., & Dilia, M. H. H., 2024). However, it is also important to note that not all schools have adequate technological infrastructure. Therefore, the government and stakeholders must provide support in the form of teacher training and necessary technological resources, especially for schools with limited access to technology.

Research on the effectiveness of SETS (Science, Environment, Technology, Society)-Based Science Learning with IT media support in enhancing elementary students' scientific and digital literacy is notably innovative, particularly in integrating both literacies into a single learning approach. The use of the SETS approach supported by digital technology enables students to develop both scientific and digital literacy skills. Recent studies show that this method helps students understand scientific phenomena and improves critical thinking skills, as well as their ability to access, evaluate, and utilize digital information to solve science-related problems. The IT-based SETS approach uses interactive digital tools, such as e-modules and learning applications, designed to engage students more actively. These media provide real-world context for science learning, allowing students to comprehend the application of scientific concepts in everyday life, ultimately strengthening both their science understanding and digital literacy simultaneously (Marwah, A. S., & Pertiwi, F. N., 2024; Monika, D., Magta, M., & Rose, D. E., 2024; Nengsih, S., Haryanti, Y. D., & Yonanda, D. A., 2024). This approach is highly relevant in the digital era, where digital skills are considered essential for students. In

addition to developing scientific literacy, it also prepares students to navigate future technological changes. Students not only learn scientific concepts but are also trained to use technology wisely and productively, aligning with the demands of 21st-century education. Thus, this research contributes not only to improving the quality of science education but also to enriching students' digital literacy from an early age, which is an essential asset for lifelong learning. This research is especially relevant in responding to the increasing demand for dual literacy in the digital era.

Conclusion

Based on the results of data analysis and discussion, it can be concluded that SETS-based science learning assisted by IT media is effective in increasing the scientific literacy and digital literacy of elementary school students. This can be seen in the average mastery of scientific literacy aspects in the experimental class is 94.57% and in the control class it is 61.70%. Meanwhile, mastery of digital literacy aspects in the experimental class was 91.45% and in the control class it was 65.40%. In the t test, the results of the post test obtained a value of t = 5.476 > t table = 1.998 and (p) count = 0 < 0.05, which means that there is a significant difference in learning achievement scores between the experimental group that used the product developed and the control group. The results of the N gain test showed that the control group had an increase in the medium criteria (0.46) and the experimental group had an increase in the high criteria (0.74). Based on this, it can be concluded that SETS-based science learning assisted by IT-based media is effective and has a positive impact on elementary school students' mastery of scientific literacy and digital literacy. In addition, the SETS approach helps students understand science concepts in contexts that are relevant to real life. Thus, the use of technology in science learning can strengthen scientific literacy and digital literacy and provide students with the skills needed to be successful in the competitive life of the 21st century.

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