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The Effectiveness of Website-Based Learning Media in Improving Students' Science Literacy Skills in Grade X Biology Material

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Abstract: *Science literacy is a critical 21st-century competency that remains low among Indonesian students. This study aims to test the effectiveness of website-based learning media in improving science literacy skills in 10th-grade biology. The method used was a quasi-experimental study with a nonequivalent control group design involving two classes: an experimental class and a control class. The research instruments consisted of pretest and posttest assessments of science literacy skills. Statistical analysis results indicate a significant improvement in students' science literacy skills, evidenced by an increase in the average score from 74.9% on the pretest to 86.5% on the posttest. Meanwhile, the control class also experienced an increase from 71.5% to 79.9%. In addition, the implementation of learning in the experimental class was classified as high. Thus, website-based learning media are effective in improving students' science literacy.*

Keywords: *Biology learning, learning media, science literacy, websites*

1. INTRODUCTION

In the 21st century, everyone must have basic skills, namely literacy skills. One of the demands of the current era is the achievement of a scientifically literate society (Sumanik et al., 2021). The ability to master science literacy is urgently needed in today's world to face various challenges in the future (Siregar et al., 2020). Science literacy can be defined as a person's ability to understand science, communicate science, and apply scientific knowledge to solve problems, thereby improving attitudes and sensitivity towards the surrounding environment (Irsan, 2021). Science literacy is one of the most important skills to be considered so that students can apply science appropriately (Fuadi et al., 2020).

Low science literacy among Indonesian students is generally caused by a learning process that does not focus on developing science literacy skills. Several other contributing factors are school infrastructure conditions, the qualifications of human resources in schools, and school management and the curriculum implemented. In addition, the choice of teaching methods and models by teachers also plays a role, coupled with the quality of teaching materials used (Sutrisna, 2021). Furthermore, the causes of low science literacy among students are: 1) difficulty in understanding complex scientific problems, 2) lack of awareness of the environment, 3) lack of creativity and innovation, 4) lack of critical thinking skills, and 5) low academic achievement (Dianti et al., 2023).

Biology education is part of natural sciences. Biology is also related to systematically discovering and understanding nature, so biology is not only about mastering and collecting knowledge in the form of facts, concepts, and principles, but also a process of discovery (Harefa et al., 2022). This is important for students to develop because biology learning is complex, involving foreign terms and abstract concepts (Rahmayumita & Hidayati, 2023). The challenges

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in learning biology are: 1) differences in student abilities; 2) students who are less active in learning; and 3) too many students in one class, too many characters, so that learning time is very limited (Urba et al., 2024). In addition, misconceptions are also common in learning biology (Hajiriah et al., 2019).

The rapid development of information technology in today's era of globalization has had an undeniable impact on the world of education (Budiman., 2017). The era of the Fourth Industrial Revolution is one that the world is currently experiencing. Human life has always been closely related to technology and information. Educational institutions must take advantage of the opportunities and challenges offered by the 4.0 era, starting from adapting to various changes and educating students in the fields of pedagogy, digital literacy, technological literacy, humanities literacy, strengthening character education, and life skills (Nuraeni et al., 2022). The utilization of technology and information in education can be done through the application of Audio-Visual Aid (AVA) learning media, the use of computer systems in classroom learning, and the utilization of the internet network that can support the implementation of more effective education and learning (Cholik, 2017).

Based on the results of observations conducted with the aim of determining students' science literacy skills, this initial observation used an instrument sheet containing questions, and it turned out that many students still scored below the minimum passing grade of 70 set by the school. It was found that there were still a number of students who were in the low group. This observation was conducted indirectly using a tool containing several behavioral indicators that were observed and filled out by biology teachers. The findings of the observation also showed that teachers had not yet utilized website-based media in the teaching and learning process, and that students were very enthusiastic and interested in using website-based learning media.

Website learning media or 21st century e-learning is now very popular because of its flexibility and effectiveness in delivering learning materials via the internet (Azmi et al., 2020). Learning via the internet provides opportunities for the educational process to take place in various locations and at various times. Students can learn based on their individual characteristics and stages of development, because internet-based learning facilitates a personalized approach (Kuswanto, 2021). The use of website-based learning media has generated positive responses from students, indicating that students have a positive attitude toward the use of website-based media and have experienced improvements in the learning process (Islanda & Darmawan, 2023).

The above reality requires educators to provide collaborative learning content to truly prepare students for the realities of the 21st century. This 21st century learning content is known as 4C (Communication, Collaboration, Critical Thinking and Problem Solving, and Creativity and Innovation) (Prayogi & Estetika, 2019). The human resources needed in the 21st century is high-quality, reliable, and globally competitive in terms of thinking, expertise, and skills (Kasse & Atmojo, 2022). In today's era of digitalization, it is necessary to use electronic media to facilitate educators and students in the learning process. Website-based learning media is an alternative that can be used in learning, as its flexibility and effectiveness make it very suitable for use by educators and students. Web-based learning can create more flexible learning, more abundant content, and a learning environment with a large class reach (Abdurrokhim et al., 2022). In line with this, (Sidabutar et al., 2023) states that utilizing web-based learning can increase student engagement through various communication channels, increased autonomy, and flexibility in terms of time, location, educators, and learning resources. Using websites can help students improve their science literacy skills and facilitate interaction and collaboration between students and educators globally through various features and information sources that support the learning process (Lestari, 2020).

In line with the study conducted by Fasya et al. (2023), which found that website-supported teaching and learning processes can develop and enhance science literacy skills. Additionally, the study conducted by (Anindita et al. (2023), found that there is an improvement in science literacy skills using website-based mobile learning platforms. This study is novelty in that it integrates web-based learning materials with the flipped classroom approach, specifically aimed at improving students' science literacy in biology

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instruction. This study emphasizes science literacy as a higher-order competency.

2. RESEARCH METHOD

The research method used in this field trial was a quasi-experimental design, specifically a Nonequivalent Control Group Design (Table 1). In this design, research subjects were not randomly selected for the experimental and control groups. Two groups were selected purposively or based on specific criteria and then given a pretest to determine the initial conditions of the groups to be tested (Pakaya et al., 2023).

In this study, the experimental group used website-based learning media with a flipped classroom model (X1), while the control group used media and learning models commonly used in schools (PowerPoint media). The control group did not receive any special treatment and was treated as usual. During the field trial, pre-tests and post-tests were conducted to obtain data and information on science literacy skills.

Table 1. Nonequivalent Control Group Design

Group	Pretest	Treatment	Posttest
Experiment	O_1	X_1	O_2
Control	O_3	-	O_4

(Pakaya et al., 2023)

3. RESULTS AND DISCUSSION

Advances in information and communication technology today provide many conveniences and possibilities in designing and developing educational systems, particularly the concept and model of online learning, or what many refer to as E-Learning (Pujiastutik, 2019). Media is considered important given the demands of today's technological era, and teachers should be able to choose learning media that is appropriate for the times (Ambarwati, 2019). Website-based learning media is an alternative that can be used in today's technological advances.

Website-based learning media are flexible and effective in delivering material. Learning material can be enriched with various learning resources and can be quickly updated by administrators, in this case educators (Sinta et al., 2020).

The results of implementing website-based learning media on students' science literacy skills were obtained from data analysis using pretest and posttest scores. The results of the descriptive statistical analysis included a normality test to determine whether the data were normally distributed (Table 2), followed by the sample size, total score, minimum score, maximum score, and standard deviation (Table 3 and Figure 1). Next, an analysis was conducted using the n-gain score to determine the improvement in students' science literacy skills in both the experimental and control classes (Figure 2).

Table 2. Results of the Normality Test for the Experimental and Control Classes in Science Literacy

Class	Pretest	Posttest	Description
Experiment	0.083	0.094	The data follows a normal distribution
Control	0.133	0.160	

Table 3. Comparison of Science Literacy Data

Types of Analysis	Experiment Class		Control Class	
	Pretest	Posttest	Pretest	Posttest
Sample size	36	36	36	36
Total value	2697	3113	2574	2877
Minimum value	61	71	58	65
Maximum value	87	97	87	94
Standard deviation	6,73	5,86	7,38	7,56

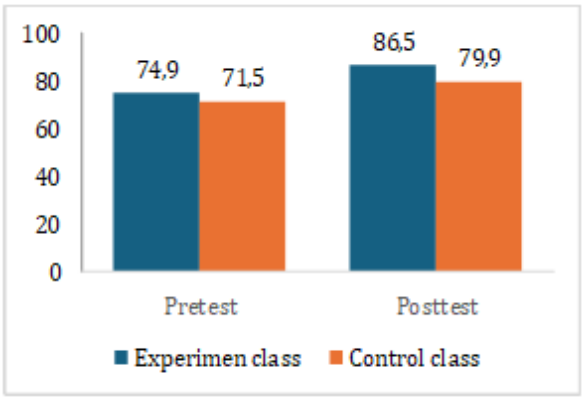


Figure 1. Comparison Chart of Average Science Literacy Variable Data in the Experimental Class and Control Class

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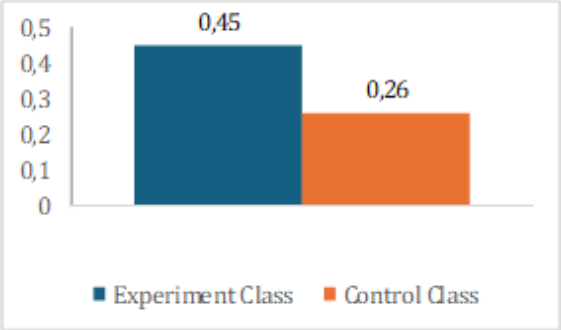


Figure 2. Graph showing the improvement in students' science literacy based on N-Gain scores

The results of the study revealed that there was an increase in the science literacy skills of students in both classes, with a higher increase in the experimental class (medium criteria) compared to the control class (low criteria). Data analysis also showed that the total posttest scores, posttest averages, and n-gain scores in the experimental class were higher than those in the control class, indicating that the use of website-based learning media had an effect on improving students' science literacy skills. Research conducted by (Dini & Ekohariadi, 2024) states that website-based learning media can improve student competency achievement and that this media can serve as a supporting tool in the learning process, both directly and indirectly. Science literacy skills and student competency achievement are closely related, because science literacy is built on scientific knowledge, skills, and attitudes, all of which are components of science education. Once students reach a level of proficiency in understanding concepts, applying academic procedures, and presenting positive examples of their work, they also develop their ability to analyze data, solve contextual problems, and make arguments based on facts all of which are indicators of science literacy. As a result, as students' proficiency increases, so does their ability to understand complex and timely issues.

Table 4. Implementation of Learning in the Experimental Class and Control Class

Class	Meeting	Activity	Total	Percentage
Experiment	1	10	11	91%
	2	11	11	100%
Control	1	9	11	82%
	2	10	11	91%

According to Table 4, the level of instructional implementation in the experimental class falls into a very high category and has consistently improved with each session. Meanwhile, the control class also showed improvement, but its level of implementation remained below that of the experimental class. This indicates that the use of web-based instructional media can support more optimal instructional implementation compared to conventional instruction.

The learning implementation data above has been used in previous journal publications to examine the effect of website-based learning media, specifically on student learning outcomes. Therefore, the same data is used in this journal article to examine the effectiveness of website-based learning media, specifically on students' science literacy skills. Based on Table 3 above, the learning implementation results are very effective in learning.

4. CONCLUSION

Based on the results of the study, it was concluded that the use of website-based learning media was effective in improving students' science literacy skills in 10th grade biology. This was evident from the significant increase in science literacy scores in the experimental group compared to the control group, both in terms of post-test average scores and n-gain scores. In addition, the implementation of learning in the experimental class showed a high level of consistency, which supported a more active and meaningful learning process. Science literacy skills are closely related to student competency achievement, where mastery of knowledge, scientific process skills, and scientific attitudes are the basis for forming the ability to understand, apply, and respond to scientific issues critically and reflectively. Therefore, the use of website-based learning media can be an alternative solution in 21st-century education that encourages the integration of technology, literacy, and competency.

5. REFERENCES

Abdurrokhim, A., Kuswandi, D., & Ulfa, S. (2022). Pengembangan Pembelajaran Berbasis Web Dengan Pendekatan Guided Discovery Berbantuan Hypermedia Untuk

p-ISSN 1907-3089, e-ISSN 2615-5869
Vol 18, No. 2, 2026, pp 184 - 189
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DOI: https://doi.org/10.25134/quagga.v18i2.507

Siswa Smp. Jktp: Jurnal Kajian Teknologi Pendidikan, 5(2), 121–131. https://Doi.Org/10.17977/Um038v5i22022p121

Ambarwati, M. (2019). Efektivitas media pembelajaran berbasis web game untuk meningkatkan kemampuan pemecahan masalah pada pembelajaran matematika SD. *Mimbar Pgsd Undiksha*, *7*(2). https://doi.org/10.23887/jjpgsd.v7i2.17472

Anindita, R., Hayati, M. N., & Widiyanto, B. (2023). Pengaruh Penggunaan Mobile Learning Berbasis Website Terhadap Kemampuan Literasi Sains Materi Sistem Tata Surya. In Pancasakti Science Education Journal Psej (Vol. 8, Number 1). http://Scienceedujournal.Org/Index.Php/Psej

Azmi, R. A., Rukun, K., & Maksum, H. (2020). Analisis kebutuhan pengembangan media pembelajaran berbasis web mata pelajaran administrasi infrastruktur jaringan. *Jurnal Ilmiah Pendidikan dan Pembelajaran*, *4*(2), 303-314. https://doi.org/10.23887/jipp.v4i2.25840

Budiman, H. (2017). Peran teknologi informasi dan komunikasi dalam pendidikan. *Al-Tadzkiyyah: Jurnal Pendidikan Islam*, *8*(1), 31-43. https://doi.org/10.24042/atjpi.v8i1.2095

Cholik, C. A. (2017). A, Cholik, Abdul, Cecep Pemanfaatan Teknologi Informasi Dan Komunikasi Untuk Meningkatkan Pendidikan Di Indonesia. *Syntax Literate; Jurnal Ilmiah Indonesia*, *2*(6), 21-30. https://doi.org/10.36418/syntaxliterate.v2i6.130

Dianti, S. A. T., Pamelasari, S. D., & Hardianti, R. D. (2023, July). Penerapan pembelajaran berbasis proyek dengan pendekatan stem terhadap peningkatan kemampuan literasi sains siswa. In *Proceeding Seminar Nasional IPA*.

Dini, N. L. M., & Ekohariadi, E. (2024). Pengembangan media pembelajaran berbasis website dengan model pembelajaran problem based learning untuk meningkatkan kompetensi percabangan dan perulangan di SMK Negeri 2 Mojokerto. *IT-Edu: Jurnal Information Technology and Education*, *9*(1), 8-16.

Fasya, N. K., Sjaifuddin, S., & Kurniasih, S. (2023). Pengembangan website pembelajaran berbasis literasi sains pada topik global warming siswa kelas vii smp. *Jurnal Pendidikan Mipa*, *13*(2), 367-374. https://doi.org/10.37630/jpm.v13i2.951

Fuadi, H., Robbia, A. Z., Jamaluddin, J., & Jufri, A. W. (2020). Analisis Faktor Penyebab Rendahnya Kemampuan Literasi Sains Peserta Didik. Jurnal Ilmiah Profesi Pendidikan, 5(2), 108–116. https://Doi.Org/10.29303/Jipp.V5i2.122

Hajiriah, T. L., Mursali, S., & Dharmawibawa, I. D. (2019). Analisis miskonsepsi siswa dalam menyelesaikan soal miskonsepsi pada mata pelajaran biologi. *Bioscientist: Jurnal Ilmiah Biologi*, *7*(2), 97-104. https://doi.org/10.33394/bioscientist.v7i2.2356

Harefa, M., Lase, N. K., & Zega, N. A. (2022). Deskripsi minat dan motivasi belajar siswa pada pembelajaran biologi. *Educativo: Jurnal Pendidikan*, *1*(2), 381-389. https://doi.org/10.56248/educativo.v1i1.65

Irsan, I. (2021). Implemensi Literasi Sains Dalam Pembelajaran Ipa Di Sekolah Dasar. Jurnal Basicedu, 5(6), 5631–5639. https://Doi.Org/10.31004/Basicedu.V5i6.1682

Islanda, E., & Darmawan, D. (2023). Pengembangan Google Sites sebagai media pembelajaran untuk meningkatkan prestasi belajar siswa. *Jurnal Teknodik*, 27(1), 51–62. https://doi.org/10.32550/teknodik.vi.991

Kasse, F., & Atmojo, I. R. W. (2022). Analisis kecakapan Abad 21 melalui literasi sains pada siswa Sekolah Dasar. *Jurnal Education and Development*, *10*(1), 124-128. https://doi.org/10.37081/ed.v10i1.3322

Kuswanto, J. (2021). Pengembangan media pembelajaran berbasis web pada mata kuliah rekayasa perangkat lunak. *Jurnal Ilmiah Edutic: Pendidikan dan Informatika*, *8*(1), 11-18. https://doi.org/10.21107/edutic.v8i1.10470

Lestari, H., & Siskandar, R. (2020). Literasi sains siswa melalui penerapan model pembelajaran blended learning dengan blog. *NATURALISTIC: Jurnal Kajian*

p-ISSN 1907-3089, e-ISSN 2615-5869
Vol 18, No. 2, 2026, pp 184 - 189
Available online https://journal.fkip.uniku.ac.id/quagga
DOI: https://doi.org/10.25134/quagga.v18i2.507

Penelitian Pendidikan Dan Pembelajaran, *4*(2b), 597.

Nuraeni, R., Pattiasina, P. J., & Ulfah, A. (2022). Peran Literasi Teknologi Dalam Dunia Pendidikan. Al-Madrasah: Jurnal Pendidikan Madrasah Ibtidaiyah, 6(3), 659. https://Doi.Org/10.35931/Am.V6i3.1045

Pakaya, W. C., Sutadji, E., Dina, L. N. A. B., Rahma, F. I., Mashfufah, A., & Ayu, I. R. (2023). *Metode penelitian pendidikan*. Nawa Litera Publishing.

Pujiastutik, H. (2019). Efektivitas penggunaan media pembelajaran e-learning berbasis web pada mata kuliah Belajar Pembelajaran I terhadap hasil belajar mahasiswa. *Jurnal Teladan: Jurnal Ilmu Pendidikan Dan Pembelajaran*, *4*(1), 25-36.

Rahmayumita, R., & Hidayati, N. (2023). Kurikulum Merdeka: Tantangan dan implementasinya pada pembelajaran Biologi. *Biology and Education Journal*, *3*(1), 1-9. https://doi.org/10.25299/baej.2023.12758

Sinta, T., Elga, B., Dewi, K., Dan, *, & Sumarni, W. (2020). Chemistry In Education Efektivitas Penggunaan Media E-Learning Berbasis Website Terhadap Hasil Belajar Kognitif Peserta Didik. Cie, 9(2). http://Journal.Unnes.Ac.Id/Sju/Index.Php/Chemined

Siregar, T. R. A., Iskandar, W., & Rokhimawan, M. A. (2020). Literasi sains melalui pendekatan saintifik pada pembelajaran ipa sd/mi di abad 21. *MODELING: Jurnal Program Studi PGMI*, *7*(2), 243-257. https://doi.org/10.69896/modeling.v7i2.582

Sumanik, N. B., Nurvitasari, E., & Siregar, L. F. (2021). Analisis profil kemampuan literasi sains mahasiswa calon guru pendidikan kimia. *Quantum: Jurnal Inovasi Pendidikan Sains*, *12*(1), 22.

Sustrisna, N. (2021). Analisis kemampuan literasi sains peserta didik SMA di Kota Sungai Penuh. *Jurnal Inovasi Penelitian*, 1(12), 2683–2690.

Urba, M., Haria, Y., Prameswary, I., Suryanda, A., & Rini, D. S. (2024). Tantangan dan Strategi Pembelajaran Biologi di SMAN dalam Pelaksanaan Kurikulum Merdeka. *DIAJAR: Jurnal Pendidikan dan Pembelajaran*, *3*(1), 80-85. https://doi.org/10.54259/diajar.v3i1.2236