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The Effectiveness of Digital Textbooks on Brain-based Learning assisted by Animated Videos and Maze Chase-Wordwall on Science Literacy Skills and Student Learning Outcomes

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ABSTRACT

This study aimed to determine the effectiveness of digital textbooks on Brain-based Learning assisted by animated videos and Maze Chase-Wordwall to improve science literacy and learning outcomes of high school students. The media was developed using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The research method used mixed methods, combining qualitative and quantitative methods. Based on the analysis results, digital textbooks on Brain-based learning assisted by animated videos and Maze Chase-Wordwalls can effectively improve student learning outcomes and science literacy as indicated by the small-scale and large-scale class learning outcomes that obtained a high category with an N-gain value of 0.81. Furthermore, science literacy skills received an average score in the high category with a value of 86.

Efektivitas Penggunaan Buku Ajar Digital Berbasis Brain-based Learning dengan Video Animasi dan Maze Chase-Wordwall Untuk Meningkatkan Literasi Sains dan Hasil Belajar Siswa SMA

ABSTRAK: *Tujuan dari penelitian ini adalah untuk mengetahui keefektifan buku ajar digital berbasis Brain-based Learning yang dilengkapi dengan video animasi dan Maze Chase-Wordwall untuk meningkatkan literasi sains dan hasil belajar siswa SMA. Pengembangan media pada penelitian ini menggunakan model ADDIE (Analysis, Design, Development, Implementation, and Evaluation). Metode penelitian yang digunakan ialah penelitian kombinasi (mixed methods) yaitu gabungan metode kualitatif dan kuantitatif. Berdasarkan hasil penelitian, dapat dinyatakan bahwa buku ajar digital dengan Brain-based Learning menggunakan video animasi dan Maze Chase-Wordwalls secara efektif dapat meningkatkan hasil belajar dan literasi sains siswa yang ditunjukkan dengan kategori hasil belajar kelas skala kecil dan skala besar yang memiliki kategori tinggi dengan memiliki nilai N-gain sebesar 0,81, sedangkan hasil kemampuan literasi sains memperoleh skor rata-rata pada kategori tinggi dengan memiliki nilai sebesar 86.*

INTRODUCTION

21st-century education expects learners and teachers to improve their creative, innovative, and problem-solving skills. Several skills must be possessed, including independent learning, ethics and responsibility, communication, thinking skills, teamwork and flexibility, digital skills, and literacy skills. One of the skills to face the challenges of the 21st century is science literacy (Lestari, 2020).

Indonesian students' ability to understand biology material is ranked 40 out of 42 countries. Therefore, students' abilities are low (Salsabella & Juanengsih, 2021). One of the causes is students' low understanding of essential concepts contained in the material. The influence of misconceptions has an impact on low student learning outcomes. Also, low learning outcomes are followed by the low science literacy of students in Indonesia compared to other countries, where Indonesia is ranked 64 out of 65 countries (Hadisaputra et al., 2019). This problem can be overcome by giving students an understanding of the material with the concepts learned and connected to everyday life. A person who has science and technology literacy skills is a person who can solve problems using science concepts obtained in the learning process (Bagasta et al., 2018).

The learning process is the main key in students' learning activities because they can get various learning experiences by applying learning models and methods. Also, the availability of teaching materials helps in the learning process (Setiyadi & Gani, 2017). The availability of teaching materials also plays a role in assisting students to understand learning outcomes. However, the learning process often has problems, such as low student learning outcomes. The cause of low student learning outcomes is due to the lack of teacher innovation when conducting classroom learning, starting from selecting strategies, learning models, and teaching materials. Learning in the classroom starts with selecting strategies, learning models, and teaching materials (Ramdiah & Adawiyah, 2018).

Efforts to improve learning outcomes and various measures have been made to enhance students' science literacy through models, learning methods, and student worksheets. Besides, efforts to improve science literacy are influenced by teaching materials (Pursitasari et al., 2019). Educators must innovate to achieve maximum learning outcomes. One of the innovations is to develop teaching materials (Ulfa & Firdausi, 2020).

The development of teaching materials is significant for educators so that the learning process is more effective and efficient and does not deviate from the competencies to be achieved (Amaliah et al., 2022). Teaching materials are essential to be developed by educators to improve the quality of the learning process (Adnan et al., 2021). Teaching materials are an indispensable component of learning. Teaching materials consist of two words, namely teaching and materials. It has directions and images that make it easier for students to read and understand the material contained in the book (Duda et al., 2022).

One of the teaching materials to support the success of the learning process is a textbook. Textbooks can be used as a reference in thinking to find an answer to a problem and help the learning process. A good textbook is developed following the needs based on geographical, ethnographic, and developmental factors (Saswulan, 2020).

The development of the times brings significant changes, especially in the character of individuals. We call it living in the age of generation Z. Generation Z was born in a world that is globally connected to the internet. Miftakhuddin argues his life is always inseparable from technology (Miftakhuddin, 2020). Along with the emergence of new generations, such as technology literacy in the digital era, teachers must integrate technology utilized for learning. Current learning has led to paperless or not using paper materials, and

almost all utilize digital technology and the internet. Thus, teachers are expected to develop abilities or competencies in developing textbooks into digital textbooks (Mascita, 2021).

Digital books can be seen from a broader perspective. Digital books are one of the phenomena of the digital revolution. It impacts education since all learning, such as digital classrooms and books, becomes completely digital. The characteristics of digital books are the use of hypertext and hypermedia, a presentation that will lead from one text to another or move to another website. It is connected to other information sources and multimedia (audio, images, and video) (Ivić, 2019).

Digital learning media must also be networked and interactive, requiring devices with unique skills. Knowing the relationship between literacy and learning outcomes in learning activities (Pangrazio et al., 2020) is important. Therefore, this research creates a different digital textbook by combining two media that help improve students' science literacy and learning outcomes. These two media help to maximize the improvement of two variables, namely science literacy and student learning outcomes. This digital textbook uses animated video media and Maze Chase-Wordwall. Textbook teaching materials that tend to only contain general material are less attractive to students, so innovations are needed to develop student knowledge (N. B. Haka et al., 2020).

Textbooks equipped with animated videos can make it easier for students to understand, especially biological material, so it has a good impact on science literacy. This statement is reinforced by Riyanto et al. (2020) that animated video media can help students to convey information through a combination of text, graphics, sound, video, and animation so that the learning process becomes innovative and fun and improves students' science literacy skills. Also, this digital textbook is equipped with a game, Maze Chase-Wordwall. Games in digital textbooks can help improve student learning outcomes. This claim is reinforced by the statement by Liao et al (2019: 5) that game features in teaching can help students to learn as a learning tool. The game encourages students to learn actively and can improve learning outcomes and make the learning environment fun and meaningful.

Digital textbooks can help students to access the material anywhere and anytime. Also, textbooks are arranged practically and can be stored in the media through a PC or Android device. Subjects that can take advantage of digital textbooks are biology subjects because their use can have a good impact on improving the quality of learning and helping to represent real visuals.

Digital books still have many shortcomings, such as access to open digital textbooks. Students often find access difficulties when opening the digital textbook, either from the application or the link presented (Almekhlafi, 2021). The other shortcomings are the effect of the screen on eye fatigue because continuous access to digital books using cell phones will cause abnormalities in the senses (Batubara et al., 2022).

Based on the need analysis questionnaire distributed to 63 high school students majoring in MIPA, the students had difficulty understanding biology lessons, especially in digestive system material, because it has a broad subject matter. Many scientific names and concepts are difficult to understand. Furthermore, the needs analysis distributed to five high school biology teachers also stated that students' difficulty learning the digestive system is in the role of function and where chemical digestion occurs. Besides, some students lack concentration.

This statement is reinforced by Ulfa & Rozalina (2019), who claimed that the digestive system material has many concepts and scientific names. It is one of the materials that is considered important because it is widely applied in everyday life. In overcoming these problems, the need for teaching materials that can interpret

concepts and help understand in material to support students' understanding of digestive system material was needed, one of which is a digital textbook based on Brain-based learning.

The textbook was prepared in a digital form based on Brain-based learning. Brain-based learning creates learning with an orientation toward efforts to empower the brain's potential (Das, 2018). Brain performance that can help stimulate the performance of the right and left brain requires a medium that contains the features of digital textbooks. One of these media is animated videos and Maze Chase-Wordwall. This claim is reinforced by Hatibie (2019), that animated videos can provide varied stimuli to the brain so that the brain can function optimally. Maze Chase-Wordwall is a maze-shaped game where players are instructed to run and choose the right answer while avoiding enemy pursuit.

Based on the background and problem identification, this research aimed to determine the effectiveness of digital textbooks on Brain-based learning assisted by animated videos and Maze Chase-Wordwall to improve high school students' science literacy and learning outcomes.

METHOD

This research employed Research and Development (R&D) to produce a certain product. The research method used was mixed methods, which is a combination of qualitative and quantitative methods. The media was developed using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) developed by Dick and Carey. The product was developed at the Faculty of Teacher Training and Education, University of Jember. The digital textbook on Brain-based Learning, assisted by animated videos and Maze Chase-Wordwall, was tried out at SMAN 3 Jember. The trial was conducted in the 2022/2023 academic year. The small-scale trial was conducted with a total of 9 students, while the large-scale trial was conducted with a total of 34 students. The pilot test of the developed textbooks was implemented in a small-scale class first for two meetings. Furthermore, the textbook was revised according to the shortcomings of the small-scale class trial. The revised textbook was tried out at a large-scale class for three meetings.

The data collection techniques were pretests, posttests, and description questions. Pretest questions were administered at the beginning of learning to determine students' initial understanding of the material. Furthermore, posttest questions to assess student success were administered after applying learning activities using a digital textbook on Brain-based learning assisted by animated videos and Maze Chase-Wordwall. The analysis of product effectiveness on learning outcomes was done through pretest and posttest scores adapted to the digestive system material. The formula used to compare the increase in competence before and after learning was the g-factor (N-Gain) (Hake, 2002). The N-Gain formula is written as follows.

$$N\text{-}Gain = \frac{S_{Posttest} - S_{pre\text{-}test}}{100 - S_{pre\text{-}test}}$$

The N-Gain g-factor criteria are as follows.

Table 1. N-Gain g-factor Criteria

G-Value	Category
g≥0,7	High
0,3≤g≤0,7	Medium
g<	Low

The data to determine science literacy was obtained using description questions based on indicators of science literacy: making clear statements through representations, explaining the potential implications of scientific knowledge for society, identifying problems discussed in a scientific study, explaining how to explore a scientific problem, drawing conclusions based on appropriate data, and identifying assumptions based on scientific data. The formula for analyzing data to determine science literacy skills is as follows.

$$\text{Value}=\frac{\textit{Obtained Score}}{\textit{Maximum Score}}\text{x } 100\%$$

The results of the calculation of the value of science literacy skills can be grouped into the following categories:

Table 2. Science Literacy Categories

Percentage	Category
86-100	Very High
76-85	High
60-75	Fair
55-59	Low
≤ 54	Very Low

RESULTS AND DISCUSSION

The results of this study were obtained through learning outcomes and students' science literacy skills. Learning outcomes were obtained from pretest and posttest scores, while science literacy skills were obtained from measurements based on description questions distributed to students with science literacy indicators. Table 3 presents the learning outcomes of the pretest and posttest scores in the small-scale class.

Table 3. Learning Outcomes in Small-Scale Classes

Meetings	Learning Outcomes	Number of Students	Average ± SD	N-Gain Value	N-Gain Category
1	*Pretest*	9	44,44 ± 13,33	0,84	High
	Posttest	9	91,11 ± 7,82		
2	*Pretest*	9	61,11 ± 19,65	0,92	High
	Posttest	9	96,67 ± 7,07		

Table 3 displays the learning outcomes as pretest and posttest scores in the small-scale class trial. The values obtained came from each meeting. Meeting 1 obtained an N-Gain value of 0.84, included in a high category. Meeting 2 obtained an N-Gain value of 0.91, included in a high category. Also, there are measurements of science literacy skills shown in Table 4.

Table 4. The Scientific Literacy Ability in Small-Scale Classes

No.	Indicator	Average±SD
1.	Make a clear statement through representation	83 ± 0,5
2.	Explain the potential implications of scientific knowledge for society	97 ± 0,33
3.	Identify the problems discussed in a scientific research	92 ± 0,5
4.	Explain how to explore a scientific problem	92 ± 0,5
5.	Draw conclusions based on the data properly	97 ± 0,33
6.	Identify assumptions based on scientific data	97 ± 0,33
Average Scientific Literacy Ability		93 ± 3,46
Category		Very High

Based on Table 4, the average value of science literacy skills in the small-scale class with nine students is 93 in the excellent category. Also, the effectiveness of digital textbooks was measured in a large-scale class. This large-scale class was conducted in three meetings with 34 students.

Table 5. Learning Outcomes in Large-Scale Classes

Meetings	Learning Outcomes	Number of Students	Average ± SD	N-Gain Value	N-Gain Category
1	*Pretest*	34	42,06 ± 17,19	0,59	Medium
	Posttest	34	76,47 ± 19,52		
2	*Pretest*	34	59,71 ± 16,96	0,68	Medium
	Posttest	34	87,06 ± 11,69		
3	*Pretest*	34	62,94 ± 24,44	0,81	High
	Posttest	34	92,94 ± 9,7		

Table 5 depicts the learning outcomes in the form of pretest and posttest scores in the large-scale class test. Meeting 1 obtained an N-Gain value of 0.59, included in the medium category. Meeting 2 obtained an N-Gain value of 0.68, included in the medium category. Meeting 3 obtained an N-Gain value of 0.81, included in the high category. The average values were increasing, as seen from the average value obtained at meeting 3. Also, there are measurements of science literacy skills in large-scale class tests shown in Table 6.

Table 6. Results of Scientific Literacy Ability in Large-Scale Classes

No.	Indicator	Average ± SD Meetings 1	Average ± SD Meetings 2
1.	Make a clear statement through representation	87 ± 0,55	87 ± 0,48
2.	Explain the potential implications of scientific knowledge for society	87 ± 0,5	85 ± 0,59
3.	Identify the problems discussed in a scientific research	85 ± 0,59	84 ± 0,48
4.	Explain how to explore a scientific problem	78 ± 0,8	80 ± 1,08
5.	Draw conclusions based on the data properly	90 ± 0,54	93 ± 0,44
6.	Identify assumptions based on scientific data	90 ± 0,49	88 ± 0,98
Average Scientific Literacy Ability		86± 7,43	
Category		Excellent	

Based on Table 6, the science literacy skills in the large-scale class with 34 students obtained an average of 86 with an excellent category. The learning outcomes and results of science literacy skills show that the digital textbooks on Brain-based learning on digestive system material assisted by animated videos and Maze Chase-Wordwall had a good impact on improving learning outcomes and science literacy skills in real applications in large-scale classes.

A textbook development product is said to be effective if makes it easy to use. The textbook can be used by both teachers and students (Devirita et al., 2021). The characteristics can see the effectiveness of a development product of a positive response from students to the learning program using the development product. Then there is a positive impact on the achievement of learning outcomes (Akker et al., 2013). Effectiveness can be seen through indicators from two components: teachers and students. From the teacher component, the effectiveness of the developed book will increase their ability to make learning innovations, especially teaching materials and learning models. From students, the effectiveness of the developed book will increase critical and logical in addressing problems, be more open to receiving input and criticism, and understand the use of information and communication technology in supporting the quality of learning (Huda, 2021). This statement agrees with Novitasari et al. (2022), learning that facilitates students so that they can train to find problem solutions and ideas through the results of discussions.

The existence of Brain-based Learning-based digital textbooks with animated videos and Maze Chase-Wordwall assists this improvement in learning outcomes and science literacy skills. According to (Alperi, 2019), digital books can help students learn more interestingly. Also, digital books are superior to facilitating student learning in the millennial era, which is very close to computers and the internet. This digital textbook is prepared using the Brain-based Learning approach. According to Handayani (2021), students' brain abilities will develop and optimize their potential if Brain-based Learning is pursued. The Brain-based Learning approach will make students more active, making learning meaningful.

The utilization of animated videos in which there is a display combining audio and visuals can make learning more meaningful because in sending information, there are interactive activities that can make students learn the material. Also, animated videos can support science literacy, giving students more meaningful knowledge (Wulandari, 2019). In agreement with Agprianti et al. (2022), media that contain images and videos that contain illustrations or facts are easy for students to learn and remember. Brain-based Learning-based digital textbooks are not only equipped with animated videos to help improve learning outcomes, namely equipped with Maze Chase-Wordwall. Maze Chase-Wordwall is a website-based educational game with quizzes like a maze chase. Applying the Maze Chase-WordwalI game can see the development of student's abilities and train students' emotions much better. Also, it can sharpen the insights and brain abilities of anyone who plays it, so this game can do a learning exercise (Khoriyah & Muhid, 2022). Active and meaningful learning can positively impact students' brain work. This is in line with (Haka et al., 2022). Students can produce and develop better knowledge and innovation because it is assisted by technology.

The human brain is one of the most vital and complex human organs. The brain can develop five primary learning systems: emotional, social, cognitive, physical, and reflective. If these five systems can be understood, the learning process will be more effective, and feel greater joy (Handayani et al., 2022). Emotions can play an optimal role in an atmosphere that matches the concept of education, namely that the learning process must be fun, provide meaningful and relevant experiences, involve multi-sensory aspects of humans, and provide unique and challenging experiences (Chairunnisa et al., 2020).

Memory for recording incoming information or stimuli is processed through a combination of senses, namely visually through the eyes, hearing through the ears, and touching through the skin (Musdalifah, 2019). The memory system is known as the paradigm model of Atkinson and Shiffrin. The concept developed by Atkinson and Shiffrin's memory involves a sequence of sensory memory stages, short-term memory, and long-term memory. Various information comes from sensory memory, namely from sound and visualization. The sensory input enters the sensory storage. Nur & Nurhidayah (2021) argue that through the attention process, the information moves to short-term memory, which remains for approximately 30 seconds. Memory short-term memory can be transferred to long-term memory if repetition occurs. When information enters long-term memory storage, it may be retained for life.

CONCLUSIONS AND SUGGESTIONS

Based on the results of research and discussion, the digital textbook on Brain-based learning assisted by animated videos and Maze Chase-Wordwall can effectively improve student learning outcomes and science literacy as shown in the small-scale class learning outcome value of 0.91, and the large-scale class learning outcome value of 0.81, both within the excellent categories. Furthermore, the results of science literacy skills obtained an average value of 93 in the small-scale class and an average of 86 in the large-scale, both the high categories.

REFERENCES

Adnan, Mulbar, U., Sugiarti, & Bahri, A. (2021). Biology Science Literacy of Junior High School Students in South Sulawesi, Indonesia. *Journal of Physics: Conference Series*, *1752*(1). https://doi.org/10.1088/1742-6596/1752/1/012084

Agprianti, N., Agusminarti, A., & Sholihat, N. (2022). Development of Printed Module of Plants Structure Materials and Its Technology-Based Utilization

on The Eighth-Grade Cross Puzzles at Smp Negeri 35 Pekanbaru. *Biosfer : Jurnal Tadris Biologi*, *13*(2), 231–238.

Akker. (2013). *Educational Design Research Part A: An Introduction*. Kluwer Academic Publisher.

Almekhlafi, A. G. (2021). The effect of E-books on Preservice student teachers' achievement and perceptions in the United Arab Emirates. *Education and Information Technologies*, *26*(1), 1001–1021. https://doi.org/10.1007/s10639-020-10298-x

Alperi, M. (2019). Role of Sigil Digital Learning Materials in Preparing the Students' Learning Independence. *Teknodik*, *23*(2088–3978), 99–110.

Amaliah, A., Adnan, & Azis, A. A. (2022). Pengembangan E-book Berbasis Studi Kasus Pada Materi Perubahan Lingkungan Kelas X SMA. *BIOSFER : Jurnal Biologi Dan Pendidikan Biologi*, *1*(7 No 1). https://doi.org/10.23969/biosfer.v7i1.5630

Bagasta, A. R., Rahmawati, D., M, D. M. F. Y., Wahyuni, I. P., & Biologi, P. P. (2018). Profil Kemampuan Literasi Sains Peserta Didik di Salah Satu SMA Negeri Kota Sragen. *PEDAGOGIA : Jurnal Pendidikan. 7*(2), 121–129.

Batubara, H. H., Sumantri, M. S., & Marini, A. (2022). Developing an Android-Based E-Textbook to Improve Learning Media Course Outcomes. *International Journal of Interactive Mobile Technologies*, *16*(17), 4–18. https://doi.org/10.3991/ijim.v16i17.33137

Chairunnisa, F., & Maryuningsih, Y.(2020). The Application of Excretion System E-Module to Improve Science Literacy Skills. *Biosfer: Jurnal Tadris Biologi*, *13*(1), 57–66. https://doi.org/10.24042/biosfer.v13i2.13381

Das, S. W. H. (2018). The Character Education of Early Childhood: Brain-based Teaching Approach. i*nternational Conference on Education, Sports, Arts and Management Engineering (ICESAME 2018)231*(Amca), 25–28. https://doi.org/10.2991/amca-18.2018.8

Devirita, F., Neviyarni, N., & Daharnis, D. (2021). Pengembangan Buku Ajar Berbasis Problem Based Learning di Sekolah Dasar. *Jurnal Basicedu*, *5*(2), 469–478. https://doi.org/10.31004/basicedu.v5i2.680

Duda, H. J., Wahyuni, F. R. E., Setyawan, A. E., Supiandi, M. I., & Bustami, Y. (2022). Development of project based biotechnology teaching books. *Biosfer : Jurnal Tadris Biologi*, *15*(2), 178–191. https://doi.org/10.21009/biosferjpb.18003

Elementary, J. (2020). Pengembangan Bahan Ajar Matematika Berwawasan Lingkungan untuk Meningkatkan Hasil Belajar materi KPK dan FPB. *Jurnal Elementary: Kajian Teori dan Hasil Penelitian Pendidikan Sekolah Dasar*. *3*(1), 21–25.

Hadisaputra, S., Gunawan, G., & Yustiqvar, M. (2019). Effects of green chemistry based interactive multimedia on the students' learning outcomes and scientific literacy. *Journal of Advanced Research in Dynamical and Control Systems*, *11*(7), 664–674.

Haka, N. B., Anggoro, B. S., Hamid, A., Novitasari, A., Handoko, A., & Puspita, L. (2020). The Development of Biology Module Based on Local Wisdom of West Lampung: Study of Ecosystem Material. *Journal of Physics: Conference Series*, *1467*(1). https://doi.org/10.1088/1742-6596/1467/1/012013

Haka, N. B., Sari, L. K., Supriyadi, Handoko, A., Hidayah, N., & Masya, H. (2022). Model Pembelajaran RICOSRE Berbantuan Podcast Terhadap Peningkatan Keterampilan Komunikasi dan Berpikir Analisis pada Mata Pelajaran Biologi Kelas XI. *J-HyTEL: Journal of Hypermedia & Technology-Enhanced Learning*, *1*(1), 15–22. https://doi.org/10.58536/j-hytel.v1i1.23

Hake. (2002). *Assessment of student learning in introductory science courses. PKAL Roundtable on the future: Assessment in the service of student learning, Duke University*. 1–3.

Handayani, I. S., Zaini, M., Dharmono, D., & Wulandari, E. (2022). An Analysis of Biology Students' Creative Thinking ability in Ethnobotany Course. *Biosfer: Jurnal Tadris Biologi*, *13*(1), 13–20. https://doi.org/10.24042/biosfer.v13i1.10931

Handayani, Y. (2021). The Effect of Brain-based Learning Model on Student Physics Learning Outcomes. *Kasuari : Physics Education Journal (KPEJ) Universitas Papua. 4*(2), 110–117.

Hatibie, Y. (2019). Pembelajaran Bahasa Inggris Berbasis Teknologi Komunikasi dan Informasi Melalui Penerapan Multimedia Pembelajaran. *SemanTech (Seminar Nasional Teknologi Sains dan Humaniora).* 1(1). 395–400.

Huda. (2021). *Menulis Buku Digital Modern.* Bitread : Publishing

Ivić, I. (2019). Printed and digital media: Printed and digital textbooks. *Center for Educational Policy Studies Journal*, *9*(3), 25–49. https://doi.org/10.26529/cepsj.694

Khoriyah, R., & Muhid, A. (2022). Inovasi Teknologi Pembelajaran dengan Menggunakan Aplikasi Wordwall Website pada Mata Pelajaran PAI di Masa Penerapan Pembelajaran Jarak Jauh: Tinjauan Pustaka. *Tarbiyah Wa Ta'lim: Jurnal Penelitian Pendidikan Dan Pembelajaran*, *9*(3), 192–205. https://doi.org/10.21093/twt.v9i3.4862

Lestari, H. (2020). Literasi Sains Siswa Melalui Penerapan Model Pembelajaran Blended Learning Dengan Blog. *NATURALISTIC : Jurnal Kajian Penelitian Pendidikan dan Pembelajaran. 4*(2), 597–604.

Liao, C. W., Chen, C. H., & Shih, S. J. (2019). The interactivity of video and collaboration for learning achievement, intrinsic motivation, cognitive load, and behavior patterns in a digital game-based learning environment. *Computers and Education*, *133*, 43–55. https://doi.org/10.1016/j.compedu.2019.01.013

Mascita. (2021). *Mendesain Bahan Ajar Cetak dan Digital*. Media Sains Indonesia.

Miftakhuddin, M. (2020). Pengembangan Model Pendidikan Agama Membentuk Karakter Empati pada Generasi Z. *Jurnal Pendidikan Agama Islam*. *17*(1), 1–16.

Novitasari, A., Widiasari, B., Haka, N. B., Hidayah, N., & Handoko, A. (2022). The Effect of Google Classroom Assisted STEM Approach on Students ' Creative Thinking Skills*. ASSIMILATION : Indonesian Journal of Biology Education. 5*(2), 71–79.

Nur, R. A., & Nurhidayah, N. (2021). An Implementation of Rotating Trio Exchange (RTE) Assisted by Coup Card toward Biology Learning Outcome. *Biosfer: Jurnal Tadris Biologi*, *12*(2), 123–129. https://doi.org/10.24042/biosfer.v12i2.9913

Pangrazio, L., Godhe, A. L., & Ledesma, A. G. L. (2020). What is digital literacy? A

comparative review of publications across three language contexts. *E-Learning and Digital Media*, *17*(6), 442–459. https://doi.org/10.1177/2042753020946291

Pursitasari, I. D., Suhardi, E., Ardianto, D., & Arif, A. (2019). Pengembangan Bahan Ajar Bermuatan Konteks Kelautan Untuk Meningkatkan Literasi Sains Siswa. *Jurnal IPA & Pembelajaran IPA*, *3*(2), 88–105. https://doi.org/10.24815/jipi.v3i2.14847

Ramdiah, S., & Adawiyah, R. (2018). Pengaruh Model Pembelajaran Reading Questioning and Answering(Rqa) Terhadap Hasil Belajar Kognitif Biologi Siswa Kemampuan Akademik Rendah. *Simbiosa*, *7*(1), 1. https://doi.org/10.33373/sim-bio.v7i1.1255

Riyanto, Amin, M., Suwono, H., & Lestari, U. (2020). The new face of digital books in genetic learning: A preliminary development study for students' critical thinking. *International Journal of Emerging Technologies in Learning*, *15*(10), 175–190. https://doi.org/10.3991/ijet.v15i10.14321

Salsabella, S., & Juanengsih, N. (2021). Analysis of cognitive level biology exercise questions in science text books based on TIMSS frame work. *Journal of Physics: Conference Series*, *1836*(1). https://doi.org/10.1088/1742-6596/1836/1/012063

Setiyadi, M. W., & Gani, H. A. (2017). Pengembangan Modul Pembelajaran Biologi Berbasis Pendekatan Saintifik Untuk Meningkatkan Hasil Belajar Siswa. *Journal of Education Science and Technology*. *3*, 102–112.

Ulfa, K., & Rozalina, L. (2019). Bioilmi Vol. 5 No. 1 Edisi Juni Tahun 2019 10 Pengembangan media pembelajaran monopoli pada materi sistem pencernaan di SMP Khalida Ulfa. *Jurnal Bioilmi*, *5*(1), 10–22.

Wulandari, M. P. (2019). Keefektifan Penggunaan Media Video Animasi IPA SD Berbasis Literasi Sains Terhadap Hasil Belajar Siswa Kelas IV. *Jurnal Matematika*, *1*(2), 263–278.