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Scientific encyclopedic media: Its influence on learning outcomes and critical thinking skills

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Abstract: A scientific encyclopedia is a learning resource that provides factual information, engaging illustrations, simple case studies, and reflective questions that guide students to explore, analyze, and communicate their findings using scientific methods. This study aims to measure the effect of media on learning outcomes and critical thinking skills of fifth-grade elementary school students in science. This study used a quantitative approach, employing both associative and descriptive quantitative strategies. The sample consisted of students in class VA (experimental) and VB (control) at Lubuklinggau Elementary School. Scientific encyclopedia media was applied to the experimental class, and image media was applied to the control class. In data collection, multiple-choice written tests were used to measure learning outcomes, and essay questions were used to measure critical thinking skills (pretest and posttest). Data analysis and processing included determining question scores, conducting descriptive analyses, analyzing prerequisite tests, and performing inferential analyses. The research design used was a pure experimental design with two groups. The results of this study indicate that scientific encyclopedia media significantly influence learning outcomes and critical thinking skills in social studies (learning outcomes and critical thinking skills in the experimental class were greater than those in the control class). These findings contribute to the existing literature on scientific encyclopedia media and their impact on student learning outcomes and critical thinking skills in social studies.
Keywords: critical thinking, encyclopedia, learning outcome, media, scientific

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Introduction

Classroom learning will not be optimal without the support of relevant learning media. At the elementary school level, students are generally in the concrete operational stage of cognitive development; therefore, teachers often use teaching aids to help students understand abstract concepts by presenting them in concrete and tangible forms (Boggan et al., 2010). At this stage, students begin to think logically, but they still require visual media and direct experiences to understand abstract concepts more effectively. Such support is intended to improve students' understanding and learning achievement (Siller & Ahmad, 2024). This stage of cognitive development is characterized by logical thinking, deduction, reversibility, cause-and-effect relationships, classification, transitivity, and the decline of egocentrism (Börnert-Ringleb & Wilbert, 2018; Miller, 2010).

Meaningful understanding of learning materials requires instructional support that helps students illustrate concepts and connect them to meaningful learning experiences (Mayer, 2024). Therefore, the learning process at this stage should be designed to be engaging, applicable, and contextual so that students can develop meaningful knowledge and critical thinking skills (Satria et al., 2025). Critical thinking is the ability to analyze information logically, objectively, and systematically to make decisions or solve problems. It involves clear, rational thinking (Lau, 2011) and the ability to analyze and evaluate information (Baker, 2020). Ennis (2011) states that critical thinking involves identifying problems, evaluating evidence, drawing rational conclusions, and constructing arguments based on logic. Critical

thinking is also considered a professional characteristic, and teachers agree that it is a basic skill that needs to be developed in students (Galindo-Domínguez et al., 2025).

One of the learning challenges teachers face concerns students' critical thinking skills. Field observations indicate that students are not yet actively involved in the learning process; they tend to take notes and listen without demonstrating curiosity or asking questions. Students' interest in reading learning resources is also low, and the limited availability of supplementary reference books exacerbates this condition. The use of encyclopedias is expected to train and guide students to think critically in decision-making. Such efforts can enhance students' knowledge through mental activities associated with thinking (McPeck, 2016). Students' critical thinking skills have not yet developed optimally, as shown when they are given problems that require reasoning or problem-solving; most students still struggle to analyze information and provide logical justification.

Learning media that address these needs may combine several components, including text, images, animations, audio, and video (Agung et al., 2018). One potential medium is an encyclopedia, which contains factual information, attractive illustrations, simple case studies, and reflective questions that guide students to explore, analyze, and communicate their findings. By connecting cognitive aspects to their real-life applications, encyclopedias can serve as effective learning tools for developing critical thinking, conceptual understanding, and reflective inquiry (Maryani & Dewanti, 2025). These findings are consistent with previous studies showing that the use of learning media can increase students' motivation, critical thinking skills, and scientific reasoning (Sutiani et al., 2021; Zulyusri et al., 2023).

The implementation of the scientific approach in the classroom cannot run optimally without the support of relevant learning media. Therefore, learning media innovation is needed to facilitate all stages of the scientific approach. Innovation in packaging the learning process more effectively is an important part of meaningful learning because it encourages students to develop 21st-century skills, which have become an urgent priority in education (Daryanes et al., 2023). In this context, a scientific encyclopedia can serve as a learning resource because it contains factual information, engaging illustrations, simple case studies, and reflective questions that guide students in exploring, analyzing, and communicating their findings through the scientific learning process.

These problems indicate that the learning methods and media used have not optimized students' cognitive potential, especially in developing conceptual understanding and critical thinking skills. The scientific approach requires students to engage in five main stages: observing, questioning, experimenting or collecting data, reasoning, and communicating (Satria, 2017). When applied appropriately, this approach not only improves students' conceptual understanding but also develops their critical and creative thinking skills.

Considering the field findings and previous studies, this study investigates the effect of using scientific encyclopedia learning media on the learning outcomes and critical thinking skills of fifth-grade elementary school students. This research is expected to contribute to learning innovation at the elementary school level, particularly in improving the quality of science learning that is more contextual, meaningful, and supportive of students' reasoning skills from an early age. The learning media used in this study is an encyclopedia integrated with the scientific approach to examine its effect on students' critical thinking skills. The implementation of a scientific encyclopedia is expected to enhance students' cognitive abilities and foster critical thinking among students.

Methods

This study uses an associative strategy that aims to determine the relationship between two or more variables. The analysis method in this study uses a descriptive quantitative approach, which involves describing or depicting the object being studied using sample or population data, without the intent to draw generalizable conclusions (Cheston et al., 2016).

The population for this study comprises fifth-grade students at Kota Lubuklinggau Elementary School for the 2025/2026 academic year, with two classes totaling 48 students. The sample for this study was selected by random sampling to determine the control and experimental classes; specifically, Class VB was selected as the experimental class and Class VA as the control class.

The instrument used in this study was a test consisting of 15 multiple-choice questions to measure learning outcomes and 10 questions to measure critical thinking skills, both using social studies material on types of Indonesian cultural heritage. The study hypotheses were:

H_0 = The average score of the experimental class was less than or equal to that of the control class.
H_a = The average score of the experimental class was higher than that of the control class.

The data collection methods used were tests (pretest and posttest) and documentation. Data analysis included validity and reliability testing to ensure the test items were suitable for use. The testing was conducted on sixth-grade students. The test was used to measure students' cognitive levels from the use of scientific encyclopedia media The testing criteria were as follows t_{count} less than or equal to t_{table} ($t_{count} \leq t_{table}$) so H_o accepted and H_a rejected, to a significant extent α= 0,05 dk = $n_1 + n_2 - 2$ dan jika $t_{hitung} > t_{tabel}$ so H_0 rejected and H_a accepted.

Results and Discussion

Results

Learning Outcome

This study was conducted with students in Class VA as the control class and Class VB as the experimental class. The research was conducted directly by the researcher, according to the school's schedule, and was accompanied by the homeroom teacher at Lubuklinggau Elementary School. In the control class, the research began with a pretest to determine students' prior knowledge before learning the topic of Types of Indonesian Cultural Heritage through image-based instruction, and ended with a posttest. The same procedure was applied in the experimental class; however, the learning process in this class was conducted using a scientific encyclopedia.

The results of the data analysis on the indicator of identifying cultural heritage, the history of cultural heritage, and acculturation through the history of cultural heritage in students' local region showed an improvement in learning outcomes. In the experimental class, the average pretest score was 52.22, while the average posttest score increased to 83.33. Meanwhile, in the control class, the average pretest score was 48.53, and the average posttest score increased to 75.83.

Pretest

The initial abilities of students before being taught using scientific encyclopedia media were obtained from pretests. These pretests were conducted to assess students' initial abilities before instruction. The pretest used in this study consisted of 15 multiple-choice questions.

The highest and lowest pretest scores among students in the experimental and control classes were similar. The average pretest score in the experimental class was 52.22, with a standard deviation of 15.06, while the average score in the control class was 48.53, with a standard deviation of 11.14. This shows that the initial abilities of students in the experimental and control classes differed, but the difference was not significant. Thus, the average pretest score of students in the control class was lower than that of students in the experimental class, but this difference was not sufficient to determine whether the pretest score difference between the two classes was significant.

In addition, hypothesis testing was performed using the t-test, with homogeneity and normality tests calculated beforehand. The results of the normality test for the pretest scores in Class VA as the experiment χ^2_{count} as large as 2.57 and χ^2_{count} Class VB, the control group, was 6.34. The value at the 5% significance level was 11.07, indicating that the variances of the experimental and control classes were homogeneous and normally distributed.

This indicates that the status of the experimental and control class variations is homogeneous and normally distributed, with the F-count value of 1.83 being smaller than the F-table value of 1.88 at a 5% significance level. This means that the status of the variation in the experimental and control classes is due to homogeneous variation. After the normality and homogeneity tests were conducted, the next hypothesis test was performed based on the t-test results. It was found that the values of the experimental class and control class were homogeneous, with a t_{count} of 0.69 < t_{table} of 1.68. For t_{count}, the value is in

the area of rejection of H₀ and acceptance of Ha. This means that there is no significant difference between the initial abilities of students in the experimental class and the control class.

Posttest

Students' final proficiency in mastering the subject matter results from their learning during the learning process. Final proficiency is assessed through a posttest administered after the learning process. The final test is intended to determine the learning outcomes of students in the experimental class, whose learning uses Scientific Encyclopedia Media (Class V B), compared to the learning outcomes of students in the control class, who use Picture Media (Class V A). The test questions in this final test are 15 multiple-choice questions, with 1 point for each correct answer and 0 for each incorrect answer.

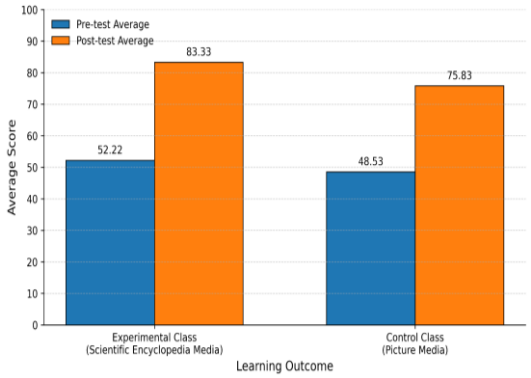

Figure 1. Improvement Learning Outcome in Pre- and Posttest Scores

Compared with students' initial abilities, their learning outcomes improved after instruction. The average score of the control class on the initial test was 48.53, while the average score on the final test was 75.83, meaning that the average score of the control class increased by 27.3. The average score of the experimental class on the initial test was 52.22, while the average score on the final test was 83.33, meaning that the average score of the experimental class increased by 31.11.

In addition, hypothesis testing was performed using the t-test, with calculations of homogeneity and normality. The results of the normality test calculations for the posttest scores in Class VA as the control group χ^2_{count} as large as 8.32 and χ^2_{count} Class VB as an experiment was 8.89. The value at the 5% significance level was 11.07, indicating that the variances of the experimental and control classes were homogeneous and normally distributed.

This indicates that the variation in the experimental and control classes is homogeneous and normally distributed, with an Fcount value of 1.67, which is smaller than the Ftable value of 1.88 at a 5% significance level. This means that the status of variation in the experimental class and control class comes from homogeneous variation. After the normality and homogeneity tests were conducted, the next hypothesis test was performed based on the t-test calculation results. It was found that the experimental and control class values were homogeneous, with a t-count of 3.68 > t-$_{table}$ of 1.678. For t_{count}, the value is in the area of rejection of H₀ and acceptance of H_a. This means that the average score of the experimental class is higher than that of the control class, and that using scientific encyclopedia media affects students' learning outcomes in social studies on the topic of types of Indonesian cultural heritage.

The increase in average scores in the experimental class was greater than in the control class. This was because learning in the experimental class used scientific encyclopedia media, while learning in the control class used image media. Using scientific encyclopedia media made students more enthusiastic, active, and creative in their learning, leading to higher student learning outcomes as reflected in the scores they achieved.

Critical Thinking

Students' learning abilities to think can be developed by improving critical thinking skills so that students can be more active in understanding, analyzing, and evaluating other people's opinions with confidence, able to work together with other students so that they can assess whether a problem is right or wrong based on scientific truth and knowledge. Learning in the 21st century involves critical

thinking and problem solving, communication, collaboration, as well as creativity and innovation.Based on the pretest and posttest data obtained, students' critical thinking skills were analyzed using specific indicators. These indicators provide a detailed assessment of the improvement in students' critical thinking skills before and after using scientific encyclopedia media. This comparison highlights the effectiveness of using scientific encyclopedia media in developing students' critical thinking skills, demonstrating measurable growth.

The research on the control class began with an initial test to assess prior knowledge, followed by learning materials on the topic of Types of Indonesian Cultural Heritage using images, and concluded with a final test. Furthermore, the research in the experimental class was treated the same as that in the control class, but what distinguished the research was that learning in the experimental class was carried out using scientific encyclopedia media. The results of the research data processing that has been carried out are explained as follows.

Table 1. Experimental Class Percentage of Pretest and Posttest Critical Thinking

No.	Critical Thinking Indicator	Pretest Average	Criteria	Posttest Average	Criteria
1	Elementary clarification	44.50	Low	75.50	High
2	Basic support	48.50	Low	80.50	High
3	Inference	52.00	Low	76.50	High
4	Advance clarification	58.50	Low	78.50	High
5	Strategy and tactic	54.50	Low	74.50	High

Critical thinking skills were measured through essay questions. For the Basic Clarification indicator, the pretest average was 44.50 (Low), which increased to 75.50 (High) on the posttest. For the Basic Support indicator, the pretest average was 48.50 (Low), which increased to 76.50 (High) on the posttest. For the Inference indicator, the pretest average was 52.00 (Low), which increased to 76.50 (High) on the posttest. For the Advance Clarification indicator, the pretest average was 58.50 (Low), which increased to 78.50 (High) on the posttest. Finally, for the Strategy and Tactics indicator, the pretest average was 54.50 (Low), which increased to 74.50 (High) on the posttest. As shown in Table 1, the posttest results indicate that the Basic Support indicator had the highest average, while the Elementary Clarification indicator had the lowest.

Students' critical thinking skills were also evaluated based on the average pretest and posttest scores. The pretest results showed an average score of 51.6. Based on this data, it can be concluded that the critical thinking skills of students in class IVA (experimental class) in social studies learning can be classified as “low” with an average score of $43.75 < x \leq 62.5$.

The final test results showed an average score of 77.1 for student learning outcomes. Based on these results, it can be concluded that the critical thinking skills of students in class IVA (experimental class) in social studies were categorized as ‘high’, with an average score of $71.5 < x \leq 81.25$, that meet the criteria for achieving learning objectives. A comparison of pretest and posttest scores shows an increase, with a score difference of 25.5. These results indicate that scientific encyclopedia media is effective in improving students' critical thinking skills.

Table 2. Control Class Percentage of Pretest and Posttest Critical Thinking

No.	Critical Thinking Indicator	Pretest Average	Criteria	Posttest Average	Criteria
1	Elementary clarification	54.50	Low	68.50	Medium
2	Basic support	45.50	Low	66.50	Medium
3	Inference	44.25	Low	67.50	Medium
4	Advance clarification	53.50	Low	70.80	Medium
5	Strategy and tactic	48.50	Low	68.50	Medium

Critical thinking is measured through essay exam questions. For the Basic Clarification indicator, the pretest average was 54.50 (Low), which increased to 68.50 (Moderate) on the posttest. For the Basic Support indicator, the pretest average was 45.50 (Low), which increased to 66.50 (Moderate) on the posttest. For the Inference indicator, the pretest average was 44.25 (Low), which increased to 67.50 (Moderate) on the posttest. The pretest average for the Advance Clarification indicator was 55.50

(Low), which increased to 70.80 (High) on the posttest. Finally, for the Strategy and Tactics indicator, the pretest average was 48.50 (Low), which increased to 68.50 (Moderate) on the posttest. As shown in Table 2, the advanced clarification indicator had the highest average, while the basic support indicator had the lowest.

Students' critical thinking skills were also evaluated based on the average pretest and posttest scores. The pretest results showed an average score of 49.25. Based on this data, it can be concluded that the critical thinking skills of students in class VB (control class) in social studies learning can be classified as 'low' with an average score of $43.75 < x \leq 62.5$.

The final test results showed an average student learning score of 68.36. Based on these results, it can be concluded that the critical thinking skills of students in class VA (experimental class) in social studies can be categorized as 'moderate', with an average score of $62.5 < x < 71.5$, which is the average score that meets the criteria for achieving learning objectives. A comparison of pretest and posttest scores shows an increase, with a score difference of 19.11.

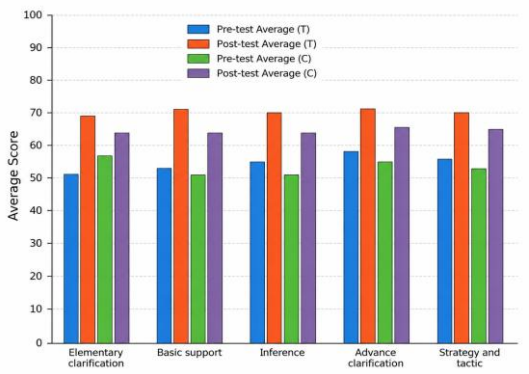

Figure 2. Comparison of Improvement in Pre- and Posttest Scores in Critical Thinking Skills

The learning outcomes and critical thinking skills of the experimental class were greater than those of the control class. The testing criteria were as follows: t_{count} less than or equal to t_{table} ($t_{count} \leq t_{table}$) so H_o accepted and H_a rejected, to a significant extent $\alpha = 0.05$ dk = $n_1 + n_2 - 2$ and if $t_{count} > t_{table}$, so H_0 rejected and H_a accepted.

Discussion

The Effect of Implementing Scientific Encyclopedia Media on Learning Outcomes.

The questions used for the initial and final tests in the experimental and control classes were 15. The population in this study consisted of all fifth-grade students at Lubuklinggau Elementary School, divided into two classes, which were used as the research sample. The two classes were then randomly selected to serve as the control and experimental groups. Class VA was selected as the experimental class using scientific encyclopedia media, and Class VB was selected as the control class using image-based media.

The analysis of the final test data showed a difference in learning outcomes between the control class and the experimental class. This was due to the different learning treatments given. The control class, which used picture media, obtained an average of 75.83 with a standard deviation of 11.50, while the experimental class, which was taught using scientific encyclopedia media, obtained an average of 83.33 with a standard deviation of 9.12. Thus, the experimental class's average final test score was higher than that of the control class.

Analysis using the t-test can be obtained t_{count} 3.68. dk = 47 an α 0.05. value t_{table} = 1.678. So it can be concluded t_{count} 3.68 > t_{table} = 1.678, because $t_{count} > t_{table}$ Therefore, Ha was accepted and Ho was rejected. Thus, there is an effect of using scientific encyclopedia media on the learning outcomes and critical thinking skills of fifth-grade students at Lubuklinggau Elementary School. This is evidenced by the average final test score of the control class using images, which was 72.50. Meanwhile, the average final test score of the experimental class using the scientific encyclopedia media model was 83.33 with a KKTP score of 70.

Table 3. Comparison of pretest and post test results on learning outcomes

Class	t_{count}	dk	t_{table}	Conclusion
Pretest	0.69	47	1.678	$t_{count} < t_{table}$ H_o accepted
Posttest	3.68	47	1.678	$t_{hitung} > t_{tabel}$ H_o rejected

The diversity of student learning outcomes, or differences in student learning outcomes, can be seen in the standard deviation for grade V. This shows that the class has diverse student scores or abilities. The results of the learning achievement test show that the learning outcomes of fifth-grade students taught with scientific encyclopedia media are better than those of students taught with image-based media. Research conducted by the author and previous researchers also shows that scientific encyclopedia media is more effective for science learning activities, especially in the subject of Indonesian Cultural Heritage, as it has been proven to improve student learning outcomes. This is because scientific encyclopedia media tend to attract students' attention more, as they involve students in teaching and learning activities, with educators acting only as facilitators.

Through this scientific encyclopedia, students' academic mastery of learning materials can improve and ultimately enhance their learning outcomes. Although images have also been proven to increase engagement and understanding by concretizing concepts (Yolanda et al., 2022). However, encyclopedic media contain a much more complex set of information, using a variety of texts, images, and other media such as video integration to form a complete understanding of a concept (Lingard et al., 2017). A well-organized encyclopedia can facilitate deeper learning by offering connected learning experiences that greatly help students understand concepts (Inns et al., 2019; Pellegrini et al., 2018). In addition, the interaction generated by using encyclopedias, compared with images, can help students understand the material (Johnson, 2010).

Using visual media makes learning teacher-centered, and students do not obtain much information from the images, so it is not suitable for lower grades. It can keep students active but they do not obtain much information. Visual media can make abstract concepts about the natural and social environment concrete for students (Pope & Light, 2025). However, this requires teachers to be more active in explaining the material verbally so students can master it. Visual media is suitable for lower elementary school students, especially for learning natural and social sciences (Lindebaum, 2024).

This study was well planned and various efforts were made to achieve good results. However, there were several uncontrollable factors that hindered this study, namely that there were still three students who were less active in learning activities using scientific encyclopedia media, and the students' understanding was also less than that of other students due to the internal impact of these students not liking and quickly giving up when encountering difficulties. While the teacher did not understand the students' intentions and objectives, or why they did not like the lesson. The researcher needed more time to prepare for classroom implementation, given limited time, and it took a long time to prepare the scientific encyclopedia media. This aligns with Miguel-Alonso et al. (2024), who describe the relationship between the theory and the various factors identified as important issues in the study. The problems encountered are low student learning outcomes and low student participation in class, resulting in learning outcomes that are not as expected.

Therefore, the solution to overcome the above obstacles is to improve understanding of the material before implementing the scientific encyclopedia media and to provide clear, in-depth explanations of the material to be studied. Use various teaching methods, such as group discussions or presentations, to ensure that all students understand the basic concepts. Manage time efficiently by planning each stage of the scientific encyclopedia media activity to ensure students have enough time to complete tasks without rushing, so they can understand and digest the information properly.

The Effect of Implementing Scientific Encyclopedia Media on Critical Thinking Skills

The critical thinking skills of students in the experimental and control classes differed in their learning outcomes. The experimental class used scientific encyclopedia media, while the control class used image media.

Table 4. Comparison of critical thinking scores of the experimental and control class

	Critical thinking score of the experimental class	Score critical thinking of the control class
Pre test	51.6	49.25
Post test	77.1	68.36
Difference	25.5	19.11

The pretest results in the experimental class showed an average score of 51.60, which was categorized as low. After the implementation of scientific encyclopedia learning media, the posttest results showed an average score of 77.10, which was categorized as high. The comparison between the pretest and posttest scores indicates an increase of 25.50 points. These results suggest that scientific encyclopedia learning media can improve students' critical thinking skills. Meanwhile, the control class obtained an average pretest score of 49.25, which was categorized as low. The posttest results in the control class showed an average score of 68.36, which was categorized as moderate. The comparison between the pretest and posttest scores in the control class indicates an increase of 19.11 points.

In the experimental class, the most significant improvement occurred in the basic support indicator, which achieved the highest average score. In the control class, the most significant improvement occurred in the advanced clarification indicator, while the basic support indicator obtained the lowest average score. This improvement is closely related to teachers' role in guiding students to think in a structured manner. Arvanitakis et al. (2025) state that structured thinking can help students develop knowledge and improve their ability to understand learning materials effectively. Meanwhile, the elementary clarification indicator obtained the lowest average score. This finding is supported by Sofyan et al. (2024), who explain that students' ability to provide simple explanations is influenced by their capacity to understand questions and construct answers grounded in their own arguments.

The difference in learning outcomes between the experimental and control classes can be attributed to the use of scientific encyclopedia learning media. During the learning process in the experimental class, students appeared more interested, motivated, and better able to understand the concepts. Zaniyati and Rohmani (2024) state that learning through a scientific approach encourages a student-centered learning process. Similarly, Adi (2017) explains that learning supported by real problems and concrete objects can produce deeper meaning in natural and social science learning. In addition, Syarifuddin (2018) emphasizes that such learning experiences can improve students' critical thinking skills.

Scientific encyclopedia learning media has proven useful for helping students understand social studies concepts by presenting materials closely related to scientific understanding (Monita & Ikhsan, 2020). Previous studies also support these findings, showing that encyclopedia-based learning media can improve students' learning outcomes, literacy skills, and critical thinking skills (Erviana & Asmara, 2019; Maryani & Rupilu, 2025). Therefore, scientific encyclopedia learning media is considered appropriate for improving students' critical thinking skills because it creates a learning environment in which students are at the center of learning and are encouraged to actively solve problems.

Students need learning resources that are interesting, motivating, and effective. Encyclopedias can serve as learning resources, providing organized information in the form of books that offer concise explanations of various fields of knowledge (Andini et al., 2022). In this study, the use of scientific encyclopedia learning media also integrated local wisdom materials, particularly those related to South Sumatra. This is in line with the finding that students are more enthusiastic when learning media that are relevant to their daily lives. Local wisdom refers to the intelligence, values, or characteristics of a particular community (Nur, 2017), acquired through that community's experiences and not necessarily shared by other communities (Fajarini, 2014).

The challenge of improving critical thinking skills among elementary school students requires teachers to have a deep understanding of critical thinking concepts and effective teaching strategies (Schunk & Zimmerman, 2012). In addition, classes with a high teacher-student ratio may limit intensive interaction and feedback, although critical thinking development requires continuous guidance. Limited access to technology can also become an obstacle in supporting the development of students' critical thinking skills. Therefore, a more holistic approach is needed to develop evaluation methods that are relevant to students' critical thinking development. Students from low socioeconomic backgrounds may also face limited access to additional learning experiences outside the classroom, which can affect the

development of their critical thinking skills. Developing critical thinking is a time-oriented process that requires continuous commitment from all stakeholders, including teachers, parents, and schools (Kusuma et al., 2024).

The use of scientific encyclopedia learning media constitutes an innovative pedagogical approach to improve learning outcomes and cultivate students' critical thinking skills. The integration of this medium with cultural heritage materials supports a learning process that is contextual, meaningful, and aligned with 21st-century skills. An encyclopedia can function as a learning medium that facilitates deeper understanding of Indonesia's cultural heritage (Nurharini & Ratnaningrum, 2026). The findings of this study demonstrate that scientific encyclopedia learning media can improve students' learning outcomes and critical thinking skills while also contributing to their knowledge of Indonesian cultural preservation. Therefore, this medium has considerable potential for adoption and further development in elementary social studies instruction, particularly for promoting 21st-century skills within the context of Indonesia's rich cultural heritage.

Conclusion

A study on the effects of scientific encyclopedia media in social studies classes for fifth-grade students found improvements in learning outcomes and critical thinking skills. The improvement in learning outcomes in the experimental class was greater than that in the control class. The results of this study indicate that the scientific encyclopedia media used can serve as a reference for delivering learning that critically incorporates cultural heritage—one of the eight dimensions of the graduate profile in the Merdeka Curriculum and part of 21st-century skills—and can be recommended as an educational medium. Recommendations based on these findings are: (1) for teachers, the scientific encyclopedia media can be used as an innovative learning medium in social studies instruction; (2) for students, the use of this medium is expected to improve learning outcomes and critical thinking regarding cultural heritage; and (3) for future researchers, this study can serve as a reference for developing similar learning media on different topics and for other skills to achieve more significant learning outcomes.

References

Adi, Y. K. (2017). A content analysis of thematic-integrative, scientific approach, and authentic assessment in the second grade of elementary school textbook theme 6. *Jurnal Prima Edukasia*, *5*(2), 211–224. DOI: https://doi.org/10.21831/jpe.v5i2.9393

Agung, A., Nurfaida, N., & Nasrullah, M. (2018). Idea-Phyrlab development (physical learning media based on virtual laboratory on ideal gas equation). *Proceedings of the 2017 International Conference on Education and Technology (2017 ICEduTech)*. DOI: https://doi.org/10.2991/icedutech-17.2018.9

Andini, S., Anjarini, T., & Khaq, M. (2022). Ensiklopedia digital berbasis HOTS terintegrasi karakter pada materi IPA kelas 5 SD. *Jurnal Educatio FKIP UNMA*, *8*(2), 605–614. DOI: https://doi.org/10.31949/educatio.v8i2.2258

Arvanitakis, I., Palaigeorgiou, G., & Bratitsis, T. (2025). A card-based design tool for supporting design thinking in elementary students. *International Journal of Technology and Design Education*, *35*(2), 461–481. DOI: https://doi.org/10.1007/s10798-024-09916-3

Baker, G. S. (2020). *Critical thinking: A profound handbook to improve your memory and logical skills, level up your decision making and problem solving!* Independently Published.

Boggan, M., Harper, S., & Whitmire, A. S. (2010). Using manipulatives to teach elementary mathematics. *Journal of Instructional Pedagogies*, *3*(1), 1–6. https://files.eric.ed.gov/fulltext/EJ1096945.pdf

Börnert-Ringleb, M., & Wilbert, J. (2018). The association of strategy use and concrete-operational

thinking in primary school. *Frontiers in Education*, *3*, Article 38. DOI: https://doi.org/10.3389/feduc.2018.00038

Cheston, R., Hancock, J., & White, P. (2016). A cross-sectional investigation of public attitudes toward dementia in Bristol and South Gloucestershire using the approaches to dementia questionnaire. *International Psychogeriatrics*, *28*(10), 1717–1724. DOI: https://doi.org/10.1017/S1041610216000843

Daryanes, F., Darmadi, D., Fikri, K., Sayuti, I., Rusandi, M. A., & Situmorang, D. D. B. (2023). The development of articulate storyline interactive learning media based on case methods to train student's problem-solving ability. *Heliyon*, *9*(4), e15082. DOI: https://doi.org/10.1016/j.heliyon.2023.e15082

Ennis, R. H. (2011). *The nature of critical thinking: An outline of critical thinking dispositions and abilities* (Last revised). University of Illinois.

Erviana, V. Y., & Asmara, A. P. (2019). STEM-integrated encyclopaedia as the enrichment for elementary school students. *Jurnal Prima Edukasia*, *7*(2), 114–127. DOI: https://doi.org/10.21831/jpe.v7i2.26594

Fajarini, U. (2014). Peranan kearifan lokal dalam pendidikan karakter. *Sosio-Didaktika: Social Science Education Journal*, *1*(2), 123–130. DOI: https://doi.org/10.15408/sd.v1i2.1225

Galindo-Domínguez, H., Bezanilla, M. J., & Campo, L. (2025). Relationship between social media use and critical thinking in university students. *Education and Information Technologies*, *30*(5), 6641–6665. DOI: https://doi.org/10.1007/s10639-024-12953-z

Inns, A. J., Lake, C., Pellegrini, M., & Slavin, R. (2019). *A quantitative synthesis of research on programs for struggling readers in elementary schools*. Best Evidence Encyclopedia (BEE), Center for Research and Reform in Education.

Johnson, W. G. (2010). No encyclopedia left unopened: Researching No Child Left Behind (NCLB) in the reference shelves. *The Reference Librarian*, *51*(2), 135–147. DOI: https://doi.org/10.1080/02763870903579778

Kusuma, E., Handayani, A., & Rakhmawati, D. (2024). Pentingnya pengembangan kemampuan berpikir kritis pada siswa sekolah dasar: Sebuah tinjauan literatur. *Wawasan Pendidikan*, *4*(2), 369–379. DOI: https://doi.org/10.26877/jwp.v4i2.17971

Lau, J. Y. F. (2011). *An introduction to critical thinking and creativity: Think more, think better*. John Wiley & Sons, Inc.

Lindebaum, D. (2024). Management learning and education as "big picture" social science. *Academy of Management Learning & Education*, *23*(1), 1–7. DOI: https://doi.org/10.5465/amle.2023.0173

Lingard, B., Sellar, S., & Lewis, S. (2017). Accountabilities in schools and school systems. In *Oxford Research Encyclopedia of Education*. Oxford University Press. DOI: https://doi.org/10.1093/acrefore/9780190264093.013.74

Maryani, I., & Dewanti, A. (2025). The effectiveness of a digital encyclopedia in enhancing scientific literacy. *International Journal of Learning Reformation in Elementary Education*, *4*(2), 73–81. DOI: https://doi.org/10.56741/ijlree.v4i02.888

Maryani, I., & Rupilu, A. C. (2025). Boosting scientific literacy and learning motivation in elementary students through a contextual plant encyclopedia. *Biosfer: Jurnal Pendidikan Biologi*, *18*(1), 232–242. DOI: https://doi.org/10.21009/biosferjpb.50376

Mayer, R. E. (2024). The past, present, and future of the cognitive theory of multimedia learning.

Educational Psychology Review, *36*(1), Article 8. DOI: https://doi.org/10.1007/s10648-023-09842-1

McPeck, J. E. (2016). *Critical thinking and education* (1st ed.). Routledge. DOI: https://doi.org/10.4324/9781315463698

Miguel-Alonso, I., Checa, D., Guillen-Sanz, H., & Bustillo, A. (2024). Evaluation of the novelty effect in immersive Virtual Reality learning experiences. *Virtual Reality*, *28*(1), Article 27. DOI: https://doi.org/10.1007/s10055-023-00926-5

Miller, P. H. (2010). Piaget's theory. In *The Wiley-Blackwell Handbook of Childhood Cognitive Development* (pp. 649–672). Wiley. DOI: https://doi.org/10.1002/9781444325485.ch25

Monita, F. A., & Ikhsan, J. (2020). Development Virtual Reality IPA (VR-IPA) learning media for science learning. *Journal of Physics: Conference Series*, *1440*(1), Article 012103. DOI: https://doi.org/10.1088/1742-6596/1440/1/012103

Nur, A. (2017). Pengembangan perangkat pembelajaran collaborative learning berbasis kearifan lokal untuk meningkatkan karakter nasionalisme dan kreatif. *Jurnal Prima Edukasia*, *5*(1), 1–10. DOI: https://doi.org/10.21831/jpe.v5i1.8288

Nurharini, A., & Ratnaningrum, I. (2026). Digital encyclopedia of Semarangan dance style: Strategies for improving critical thinking skills in local culture. *Jurnal Prima Edukasia*, *14*(1), 113–124. DOI: https://doi.org/10.21831/jpe.v14i1.94667

Pellegrini, M., Lake, C., Inns, A., & Slavin, R. E. (2018). *Effective programs in elementary mathematics: A best-evidence synthesis*. Best Evidence Encyclopedia (BEE), Center for Research and Reform in Education.

Pope, L., & Light, J. (2025). Comparison of learning text vs. picture symbol AAC representations for young children on the autism spectrum. *Augmentative and Alternative Communication*, 1–13. DOI: https://doi.org/10.1080/07434618.2025.2458868

Satria, T. G. (2017). Improving listening skills through a scientific approach in fourth grade students in West Jakarta. *Jurnal PGSD*, *10*(2), 114–120. DOI: https://doi.org/10.33369/pgsd.10.2.114-120

Satria, T. G., Sapriya, S., Sa'ud, U. S., Riyana, C., Hajani, T. J., & Erander, S. (2025). The influence of project based learning model on learning outcome and student's critical thinking. *Jurnal Prima Edukasia*, *13*(1), 146–158. DOI: https://doi.org/10.21831/jpe.v13i1.72446

Schunk, D. H., & Zimmerman, B. J. (2012). Self-regulation and learning. In *Handbook of Psychology, Second Edition* (3rd ed.). Wiley. DOI: https://doi.org/10.1002/9781118133880.hop207003

Siller, H. S., & Ahmad, S. (2024). The effect of concrete and virtual manipulative blended instruction on mathematical achievement for elementary school students. *Canadian Journal of Science, Mathematics and Technology Education*, *24*(2), 229–266. DOI: https://doi.org/10.1007/s42330-024-00336-y

Sofyan, F. A., Sartono, E. K. E., Badaruddin, K., Fauzi, M., Syarnubi, Oviyanti, F., Soraya, N., & Sukirman. (2024). Analysis of Higher-Order Thinking Skill (HOTS) of Madrasah Ibtidaiyah students in solving open-ended mathematics problems. *AIP Conference Proceedings*, *3041*(1), Article 060026. DOI: https://doi.org/10.1063/5.0201104

Sutiani, A., Situmorang, M., & Silalahi, A. (2021). Implementation of an inquiry learning model with science literacy to improve student critical thinking skills. *International Journal of Instruction*, *14*(2), 117–138. DOI: https://doi.org/10.29333/iji.2021.1428a

Syarifuddin, S. (2018). The effect of using the scientific approach through concept understanding and

critical thinking in science. *Jurnal Prima Edukasia*, *6*(1), 21–31. DOI: https://doi.org/10.21831/jpe.v6i1.15312

Yolanda, S., Winarni, R., & Yulisetiani, S. (2022). The new way improve learners' speaking skills: Picture and picture learning media based on articulate storyline. *Journal of Education Technology*, *6*(1), 173–181. DOI: https://doi.org/10.23887/jet.v6i1.41452

Zaniyati, M., & Rohmani, R. (2024). Analysis of the effectiveness of pop-up book media on science learning in elementary schools. *IJORER: International Journal of Recent Educational Research*, *5*(4), 919–934. DOI: https://doi.org/10.46245/ijorer.v5i4.641

Zulyusri, Z., Elfira, I., Lufri, L., & Santosa, T. A. (2023). Literature study: Utilization of the PjBL model in science education to improve creativity and critical thinking skills. *Jurnal Penelitian Pendidikan IPA*, *9*(1), 133–143. DOI: https://doi.org/10.29303/jppipa.v9i1.2555