RESEARCH ARTICLE

The effectiveness of scientific approach-based worksheets on angiosperm classification to improve students' scientific literacy skills

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Abstract

Background: The scientific literacy skills of students in Indonesia are still relatively low due to teacher-centered learning and a lack of student scientific activity. In Angiosperm classification, learning is dominated by memorization, therefore requiring active teaching materials. **Objectives:** This study aims to determine the effect of using scientific approach-based worksheets on students' scientific literacy skills. **Method:** The study used a quantitative approach with a quasi-experimental method and a Non-Equivalent Control Group Design. The sample was obtained through cluster random sampling, involving 69 students, divided into experimental class (n = 34) and a control class (n = 35). Instruments used were a scientific literacy test, observation sheets, and student response questionnaires. Data were analyzed using the N-Gain test, the Mann-Whitney test, and the effect size. **Result:** The results showed that the N-Gain value for the experimental class was 0.63 (medium), while the control class was 0.07 (low). The Mann-Whitney test obtained a significance value of 0.001 (<0.05) with an effect size of 0.40 (medium), indicating a significant effect of using scientific approach-based worksheets on students' scientific literacy skills. **Conclusion:** Therefore, scientific approach-based worksheets can serve as an alternative teaching material to improve students' scientific literacy through active and contextual learning.

Keyword: angiosperm classification; scientific literacy; scientific worksheet

Introduction

Scientific literacy is defined as the ability of every individual to understand and use scientific knowledge to solve problems related to science and technology in everyday life (Rudolph, 2023). The Organisation for Economic Co-operation and Development (OECD) defines scientific literacy as the ability of students to use scientific knowledge to identify problems. This ability is important for students because it can provide a foundation for improving critical thinking skills and actively addressing scientific issues related to the surrounding environment (Virtič, 2022). However, the scientific literacy skills of students in Indonesia remain a challenge, as evidenced by the 2022 PISA (Program for International Student Assessment), which ranked Indonesia 67th out of 81 countries, with an average score of 383, below the international average of 485. Furthermore, various studies have shown that the level of scientific literacy of students in Indonesia remains relatively low. Research conducted at the junior high school level by Suaib et al. (2025), found an average of 12.46%, categorized as very low. Meanwhile, at the high school level by Sutrisna (2021), showed that scientific literacy skills reached 45% and were categorized as low, due to weak understanding and limitations in designing and evaluating scientific analysis. The results of previous studies indicate that students still have difficulty understanding scientific problems, reading data, and drawing conclusions based on evidence.

The low level of scientific literacy is influenced by various factors, including teacher-centered instruction, limited learning resources, low learning motivation, and limited student involvement in scientific activities (Čipková et al., 2019). This situation reflects real-life conditions. Interviews with science teachers at a junior high school in Purwakarta Regency revealed that learning is still dominated by conventional methods, including lectures, and the use of teaching materials that do not optimize students' scientific activities. The lecture-based learning process results in passive and boring student engagement. As a result, students are not used to developing critical thinking and scientific reasoning, which contributes to poor learning outcomes (Fauziah et al., 2024; Noor, 2021). This situation affects low student involvement in activities that develop scientific literacy skills (Sholahuddin et al., 2022). According to Čipková et al. (2019), the weakness in students' scientific literacy lies in their grasp of scientific content, caused by their inability to apply textual knowledge to real-world phenomena. Students who are actively involved tend to demonstrate greater interest and involvement, leading to higher learning outcomes (Maamin et al., 2021).

Improving scientific literacy requires the active involvement of students through learning materials relevant to their daily lives, such as the classification of living things. This topic provides foundational knowledge and reinforces conceptual understanding by examining organisms based on their morphological characteristics. Consequently, the classification of living things holds significant potential for fostering and assessing students' scientific literacy skills specifically in explaining phenomena scientifically, evaluating and designing scientific inquiries, and interpreting data and evidence scientifically (Andayani & Agustina, 2025). However, in reality, many students still have difficulty recognizing the characteristics and classifying plants (Karakaya et al., 2022). Students continue to face difficulties because learning relies heavily on textbooks and lecture methods (Dang, 2026). Learning becomes more effective if it involves observing plants in students' environments (Rico et al., 2026). A form of contextual learning that can be applied in science education is the use of learning media that present real-life examples. Utilizing biodiversity in students' environments has been shown to be effective as a resource for developing learning tools and media (Leksono et al., 2023). In this context, Angiosperms represent an ideal subject as they are the most readily accessible plants, accounting for approximately 90% of all plant species (Schachat & Cariglino, 2023). The integration of local plants into the school environment is presented through visual learning media. However, optimal use of the surrounding environment in learning cannot be achieved without media and methods that guide students in making focused observations. Research by Gebremeskel et al. (2025), found that active student involvement in independently building understanding can improve conceptual understanding and problem-solving skills.

The scientific approach is a learning approach that involves students actively acquiring knowledge through systematic stages. In science education, this approach can offer real-world experiences that help students understand concepts through the scientific process. Applying the scientific approach in the learning process aims to accustom students to develop critical thinking in assessing and constructing a phenomenon (Osborne & Allchin, 2025). At the secondary school, students are expected to be actively involved in observing, asking questions, collecting data, and drawing conclusions based on evidence, rather than just passively memorizing steps (Pols et al., 2022). Furthermore, Bossér (2024) stated that scientific literacy skills will be formed functionally if students are given space to be active. A number of previous studies have shown that improvements in scientific literacy can be effectively achieved through the application of the scientific approach and active learning (Oktafiani et al., 2024; Megarahayu et al., 2023). In addition, the use of student worksheets has shown effective in supporting students' scientific literacy skills Saija et al. (2022), especially when specifically designed based on the scientific approach (Nuriyani & Sari, 2024). However, existing scientific literacy studies have yet to the classification of Angiosperms. On the other hand, research on the scientific approach and environmental exploration in the 'Classification of Living Things' topic generally still focuses solely on improving cognitive learning outcomes (Sulastri et al., 2024). Although some studies have measured scientific literacy in classification topics, they remain limited to the use of the Problem-Based Learning model (Andayani & Agustina, 2025). Therefore, this study aims to fill this gap by investigating the impact of scientifically-oriented student worksheets incorporating visual representations of local Angiosperms on students' scientific literacy skills.

To address this research gap, this study aims to analyze the effect of using scientific approach-based worksheets on the topic of Angiosperm classification on students' scientific literacy skills. The novelty of this study lies in integrating images of Angiosperms sourced from the school's surrounding environment into the scientific learning stages of the worksheets, thereby making the learning process more contextual as students can connect classification concepts with plants encountered in their daily lives.

Method

Research design

This study uses a quantitative, quasi-experimental design. This study was conducted from April 27 to May 7, 2026, at a junior high school in Purwakarta district. The research design used was a Non-equivalent Control Group Design (Table 1). In this design, there are two groups: the experimental group, which received learning using scientific approach-based worksheet, and the control group, which used conventional learning.

The study was conducted over three learning sessions, each lasting 2 × 30 minutes. Prior to the intervention, both groups completed a pretest to assess their initial scientific literacy skills. During the study, the experimental group learned using scientific approach-based worksheets, which involved observing, questioning, collecting information, associating, and communicating. In contrast, the control group received conventional, teacher-centered instruction through textbook-based learning, lectures, question-and-answer activities, and practice exercises, without the use of scientific approach-based worksheets. After the learning sessions, both groups completed a posttest to evaluate changes in their scientific literacy skills.

Table 1. Non-equivalent control group design research

No	Group	Pre-test	Treatment	Post-test
1	Experimental	O_1	X	O_2
2	Control	O_3	-	O_4

Population and sample

The study population consisted of all seventh-grade students for the 2025/2026 school year, comprising 246 students from six classes (VII A–VII F), as in Table 2. Cluster random sampling was used to select the sample. The sample consisted of two entire classes, totaling 69 students.

Table 2. Classification of research samples

No	Class	Number of students	Group
1	VII-A	34	Experimental Class
2	VII-C	35	Control Class

Data collection technique

Data were collected using three instruments: observation sheets, written tests, and questionnaires. Observation sheets were used to monitor the implementation of the learning process in both the experimental and control classes. Written tests were administered before and after the intervention to assess students' scientific literacy skills, while questionnaires were distributed to collect students' responses following the learning process.

The scientific approach-based worksheets used in the experimental class were validated by subject matter experts and media experts to ensure the validity of their content, presentation, language, and visual design.

The development of the test instruments was based on the OECD PISA Science Literacy Framework to ensure alignment with science literacy indicators.The instrument was developed under the supervision of two academic advisors and underwent several revisions before being pilot-tested using 25 multiple-choice items. The trial test data were analyzed to assess validity, reliability, item difficulty, and discrimination. Based on the analysis, 20 items that met the established psychometric criteria were selected for use in the study (Table 3). The instrument’s reliability was calculated using Cronbach’s Alpha, which produced a value 0.82 indicating high consistency. The test design for each indicator is detailed in Table 3.

Table 3. Design of scientific literacy indicator test

No	Scientific literacy indicator	Number of items	Items number
1	Explaining phenomena scientifically	8	1, 2, 3, 4, 5, 6, 7, 8
2	Interpreting data and evidence scientifically	7	9, 10, 11, 12, 13, 14, 15
3	Evaluating and designing scientific investigations	5	16, 17, 18, 19, 20

Procedure

This study was conducted in four main stages: preparation, sample selection, implementation, and data analysis. The preparation stage involved the development and refinement of teaching materials and research instruments. The cluster random sampling technique was applied in the research sample selection process. From all six available seventh-grade classes (Classes VII A–VII F), two classes were selected by drawing class names at random, resulting in Class VII A as the experimental group and Class VII C as the control group.

Both groups took a pretest before the intervention to measure their initial science literacy skills. The pretest results showed that the experimental and control groups had similar initial abilities. Subsequently, the experimental group engaged in learning using scientific approach-based worksheets, whereas the control group received conventional instruction. Following the learning process, a posttest was administered to measure changes in students' scientific literacy skills. The collected data were then analyzed to examine the effect of the scientific approach-based worksheets on students' scientific literacy skills.

Data analysis technique

The scientific literacy data were analyzed statistically using the N-Gain test to measure the increase in students' abilities between the pretest and posttest. Additionally, normality and homogeneity tests were conducted as prerequisites for hypothesis testing using the Independent Samples T-Test, if the data were not normally distributed, the Mann-Whitney test was used in SPSS. Furthermore, the effect size was calculated based on the Z value from the Mann-Whitney test results to assess the magnitude of the influence of using scientific approach-based worksheet on students' scientific literacy

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Results and Discussion

Observation sheet for teacher and student learning implementation

Learning on the topic of angiosperm classification was conducted over three sessions in each of two classes (experimental and control), as shown in Table 4. Based on observation sheets, the implementation of learning activities in both classes was categorized as very good. In the experimental class, all planned learning activities in the first session were fully implemented (100%). The implementation rate decreased slightly during the second and third sessions. In the control class, the implementation of student activities remained stable at 92.5%, whereas the implementation of teacher activities reached 100% by the third session.

The slight decrease in the implementation rate observed in the experimental class may be attributed to the increasing complexity of the learning activities during the second and third sessions. At these stages, students were required to analyze similarities and differences among plant organs and construct a simple dichotomous key. These activities demanded independent reasoning and higher-order thinking, requiring more time to complete within the allocated class period. In contrast, the implementation of teacher activities in the control class remained consistently high because learning was primarily conducted through teacher-centered instruction. Under this approach, the teacher played a dominant role in explaining the material and facilitating students' learning activities. Conversely, students in the experimental class were encouraged to actively construct their understanding while completing each phase of the Scientific Approach, making the learning process more dependent on students' participation and adaptation to scientific inquiry activities (Fry et al., 2026).

Table 4. Learning implementation observation sheet results

No	Class		Meeting			Average	Interpretation
			1	2	3		
1	Experimental	Teacher	100%	96.43%	96.43%	97.62%	Excellent
		Student	100%	96.43%	93.57%	96.6%	Excellent
2	Control	Teacher	92.5%	92.5%	100%	95%	Excellent
		Student	92.5%	92.5%	92.5%	92.5%	Excellent

Improving scientific literacy skills

Table 5 presents a comparison of the N-Gain scores for scientific literacy for the experimental and control classes. The experimental class obtained an N-Gain score of 0.63, which falls within the moderate category, whereas the control class obtained an N-Gain score of 0.07, which is categorized as low. The results indicate that the students' gains in scientific literacy skills was greater in the experimental class than in the control class.

Table 5. Results of N-Gain analysis in experimental and control classes

No	Class	Pretest average	Posttest average	N-Gain	Category
1	Experimental	60.14	83.67	0.63	Medium
2	Control	61	68.28	0.07	Low

Students in the experimental class showed higher gains in scientific literacy skills observed in the experimental class may be attributed to the learning activities incorporated into the scientific approach-based worksheets. The worksheets were designed based on the 5M learning stages, which systematically engaged students in observing, questioning, collecting information, associating evidence, and communicating their findings. These activities provided opportunities for students to develop the core competencies of scientific literacy during classroom learning.

At the observation stage, students observed images of angiosperm organs and morphological characteristics presented in the worksheets. The images represented plant species commonly found in the school environment, allowing students to connect abstract concepts of plant classification with familiar examples. This activity supported students in identifying scientific phenomena within everyday contexts. During the questioning and data collection stages, students formulated questions and determined appropriate procedures for observing plant morphology from the images provided in the worksheets. These activities encouraged students to evaluate and design simple scientific investigations by deciding what information should be collected and how the observations should be conducted.

During the association stage, students analyzed the morphological characteristics shown in the images by comparing plant features and constructing a simple dichotomous key. This process required students to organize and interpret observational evidence before drawing conclusions, thereby strengthening their ability to interpret scientific evidence and data. The learning process concluded with the communicating stage, where students presented the results of their group discussions and justified their conclusions using the evidence obtained from their observations. Such learning experiences actively engaged students in constructing knowledge, reflecting the principles of constructivist learning (Suwono et al., 2023).

These results are in line with earlier studies indicating that structured inquiry-based learning supports the development of scientific literacy and science process skills (Eymur & Pınar, 2024; Ramlawati et al., 2025). These research findings align with Kang (2022), reported that guided inquiry effectively promotes scientific literacy among secondary school students. These findings suggest that engaging students in systematic learning activities encourages them to develop scientific reasoning through active participation rather than passive knowledge acquisition. Scientific literacy not only understanding scientific concepts but also using evidence to support conclusions (Kumar et al., 2024).

The inclusion of plant images in the worksheets helped reinforce students' learning. By observing images of plant organs and morphological characteristics, students were able to visualize classification concepts that are often difficult to understand through verbal explanations alone (Souza et al., 2026; Wen et al., 2020). Because the images represented plant species commonly found in the school environment, students could relate classroom learning to familiar contexts, making the learning experience more meaningful (Hanifha et al., 2023; Sjöström, 2025). Similar benefits have also been reported when visual representations of plant organs are used to facilitate students' understanding of plant classification (Pany et al., 2025; Suprapto et al., 2024).

In contrast, the relatively limited improvement observed in the control class may be associated with the use of teacher-centered instruction, which provided fewer opportunities for students to participate actively in inquiry and develop their own understanding based on evidence. To further examine the contribution of the scientific approach-based worksheets, improvements in each scientific literacy indicator were analyzed separately. The results of this analysis are presented in Figure 1.

Figure 1 shows that the improvement in scientific literacy varied across the three competency indicators in the experimental class. Among the three indicators, explaining scientific phenomena showed the highest N-Gain (0.72), which falls into the high category. This finding may be associated with the observation and communication activities incorporated into the scientific approach-based worksheets. Students observed images of angiosperm species commonly found in the school environment and used their observations to explain plant morphological characteristics. Relating classification concepts to familiar examples helped students connect scientific knowledge with everyday contexts, making learning more meaningful (Pahrudin et al., 2020). This contextual learning experience also enabled students to integrate classification concepts with evidence obtained from their observations rather than relying solely on memorization (Hemtasin et al., 2026).

The indicator of evaluating and designing scientific investigations showed a moderate improvement, with an N-Gain score of 0.61. This result may reflect the contribution of structured inquiry activities embedded in the worksheets, particularly when students formulated questions, planned observation procedures, and determined the information needed to investigate plant morphology. Such activities encouraged students to think systematically throughout the investigation process and supported the scientific literacy development and scientific thinking skills (Wen et al., 2020). Previous studies have describe similar results, such as Nwoke et al. (2026), who found that inquiry-based learning actively engages students in scientific investigations. Procedural skills developed through these activities are also considered essential for evaluating and designing scientific investigations (Istyadji & Sauqina, 2023).

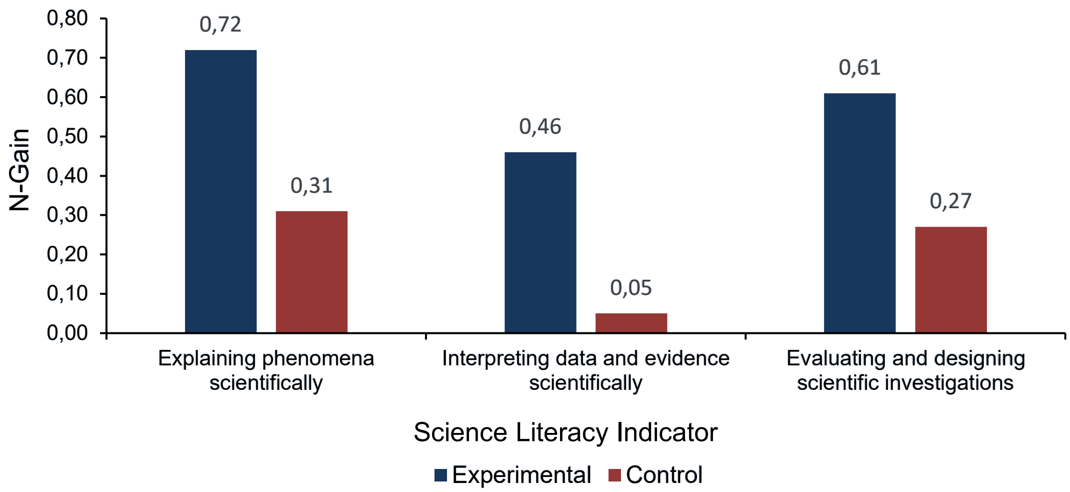

Figure 1. Scientific literacy improvement

Among the three indicators, interpreting data and evidence scientifically showed the smallest improvement, with an N-Gain value of 0.46, although it was still classified as moderate. This finding suggests that students still experienced difficulty interpreting observational evidence before drawing scientific conclusions. Data interpretation requires higher-order thinking because students must analyze evidence, identify relationships among observations, and justify their conclusions using scientific reasoning. One possible explanation is that many students were still unfamiliar with independently interpreting scientific data, as previous learning experiences had been dominated by memorization rather than analytical activities (Pujawan et al., 2022; Tytler et al., 2025). These challenges became particularly apparent when students constructed dichotomous keys, where some tended to reach conclusions before carefully analyzing the observed characteristics. Similar difficulties have also been reported by (Teig et al., 2020) and Pozuelo-Muñoz et al. (2025).
In addition, the limited classroom time and students' unfamiliarity with constructing dichotomous keys reduced their opportunities to practice interpreting observational data. As data interpretation is a skill that develops through repeated practice, the limited practice opportunities may have contributed to the relatively lower improvement in this indicator.

Scientific literacy skills

The Mann–Whitney U test results are presented in Table 6, test comparing the improvement in scientific literacy between the experimental and control classes. The Mann–Whitney U test yielded a significance value of $p = 0.001$ ($p < 0.05$), indicating the two groups differed significantly. Students taught with the scientific approach-based worksheets demonstrated greater gains in scientific literacy than those in the conventional learning group. In addition, the calculated effect size ($r = 0.40$) indicates a moderate practical impact of the intervention on students' scientific literacy skills.

Table 6. Recapitulation of statistical test results

Mann-Whitney Hypothesis Test	
Data Analysis	Experimental and Control class post-tests
Significance Value	0.001
Level of Significance	(Sig<0.05)
Conclusion	**H0 rejected H1 accepted**
Effect Size Test	
Mann-Whitney	316.000
Z	3.376
N	69
Effect Size	**0.40**
	Medium

The scientific approach-based worksheets produced a moderate effect on students' scientific literacy may be explained from the perspective of constructivist learning theory. The worksheets combined images of angiosperm species commonly found in the school environment with structured learning guidance that encouraged students to observe, analyze, and communicate their findings. These features functioned as learning scaffolds, enabling students to construct their understanding of plant classification independently rather than relying solely on teacher explanations (Ge et al., 2017). By presenting classification concepts through familiar examples, the worksheets reduced the abstract nature of the topic and allowed students to focus on scientific reasoning and meaningful concept construction (Fortus et al., 2022; Pujawan et al., 2022; Uminski et al., 2024). Using contextual examples from the surrounding environment further supported students in connecting scientific concepts with their everyday experiences (Cammies et al., 2024; Georgiou & Kyza, 2023).

An effect size of r = 0.40 observed in this study is consistent with previous studies highlighting the role of inquiry-based learning in improving scientific literacy. Teig et al. (2020), reported that inquiry-based scientific reasoning and problem-solving strategies produced a moderate effect on students' scientific literacy. Likewise, Santi et al. (2024) found that problem-solving-based worksheets improved students' critical thinking skills by actively engaging them in knowledge construction. Overall, the available evidence indicates that structured learning activities encouraging active participation can produce meaningful improvements in higher-order learning outcomes.

Although the intervention produced a significant effect, the effect size remained within the moderate category. One possible explanation is that learning plant classification, particularly constructing dichotomous keys, requires students to apply higher-order reasoning while interpreting morphological evidence. In addition, the limited duration of the intervention reduced opportunities for repeated practice and feedback. Similar observations were reported by Chotimah et al. (2023), who found that achieving a larger instructional effect requires sufficient time for inquiry activities, visual exploration, and repeated practice. Therefore, extending the duration of the intervention and providing more opportunities to practice scientific reasoning may further enhance students' scientific literacy. As noted by Anđić et al. (2018), mastery of taxonomic analysis and determinative key reasoning demands frequent, repeated practice to ensure the optimal development of students' cognitive schemas. The limited time allocation in this study prevented science process skills from being fully internalized.

Student responses to learning using scientific approach-based worksheets

Based on the research results in Table 7, the average student response to the use of scientific approach-based worksheets was 80.6%, categorized as good. These results indicate that scientific approach-based worksheets received a positive response from students throughout the learning process.

Table 7. Student response questionnaire results

No	Indicators	Average percentage	Criteria
1	Media and display	80.28%	Good
2	Material and Language	79.57%	Fair
3	Scientific Approach	81.5%	Good
4	Scientific Literacy	81.07%	Good
	Average	**80.6%**	**Good**

The media and display indicator achieved 80.28%, classified as good. The questionnaire results showed that students found the worksheets attractive, engaging, and easy to read due to their clear font size and layout. Furthermore, the plant images included in the worksheets helped students understand the material more easily. The attractive presentation of the worksheets increases students' enthusiasm and reduces boredom during learning. This aligns with Ge et al. (2017), explanation that the use of images can help attract students' attention and make the process of understanding learning materials easier. Meanwhile, the material and language indicators obtained a percentage of 79.57%, which is considered sufficient. Overall, the instructions for the table and explanation activities in the Student Worksheet are clear enough to help students carry out the learning activities. However, some students still found it difficult to understand scientific terms and Latin names in the angiosperm plant material. According to Prosser and Bismarck (2023), students' difficulty understanding scientific terms generally occurs because they are not accustomed to using them in everyday life. Therefore, the presentation of terms and the choice of language in teaching materials need to be carefully tailored to the students' level of understanding so that the material remains easy to understand (Virtič, 2022).

The scientific approach indicator achieved the highest percentage, at 81.50%, with a good score. This result indicates that students found the scientific steps in the student worksheet helpful. Through these steps, students not only listened to the teacher's explanation but also actively participated in the learning process. This scientific approach-based worksheet is effective in helping students become more active in discovering concepts and understanding phenomena in their surroundings, thus making the learning process more focused and easier to understand (Wen et al., 2020). The scientific literacy indicator achieved a percentage of 81.07%, with good criteria. These results indicate that the activities in the Worksheet help students understand scientific concepts through problems encountered in their environment. The use of in science learning can help students connect scientific concepts to real-life situations, thereby improving scientific literacy skills and learning interest. Overall, the results of the questionnaire response analysis indicate that the developed scientific approach-based worksheet is able to create a more active and student-centered learning environment. Learning activities that directly involve students have been shown to make the learning process more meaningful and engaging (Cammies et al., 2024). In addition to improving scientific literacy, scientific approach-based learning also provides opportunities for students to take a more active role in the learning process. Guerrero and Olave (2022) stated that student agency allows students to have control over their learning process through involvement in expressing opinions, making decisions, and exploring knowledge independently.

Conclusion

The results of this study indicate that the use of scientific approach-based worksheets on angiosperm classification significantly contributes to improving students' scientific literacy. Integrating real-world phenomena from the school environment as visual representations within the worksheets encourages students to transition from rote memorization to active learning driven by scientific reasoning. An important contribution of this study is showing that abstract biological concepts requiring higher-order thinking skills can be effectively comprehended through structured instruction.

Overall, the results indicate that scientific approach-based worksheets can serve as an effective instructional resource for promoting scientific literacy through active and contextual learning experiences. Although the intervention produced a moderate effect size, the results demonstrate that this approach has the potential to improve students' scientific literacy. The moderate effect may, in part, be explained by the relatively short duration of the intervention, which limited opportunities for students to repeatedly apply and consolidate the scientific reasoning skills developed during the learning process. Future studies could examine the effectiveness of these worksheets over a longer implementation period, apply them to other biology topics, and explore their integration with interactive digital learning media to further enhance students' scientific literacy.

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Conflicts of Interest

The author certifies that there are no potential conflicts of interest regarding the publication of this manuscript.

CRediT authorship contribution statement

S. N. J. Alfinita: Conceptualization, investigation, writing – original draft of the manuscript. **E. Paujiah:** Data analysis review, supervision, writing – review & editing**. M. Solikha:** Instrument review, supervision, writing – review & editing. **S. R. Amelia:** Material expert validator, writing – review & editing, and instrument review.

Declaration of the use of AI

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The author used artificial intelligence (AI) tools only to assist with grammar checking, language editing, and improving the clarity of English translations. All aspects of the research, including the study design, data analysis, interpretation of the findings, and conclusions, were completed independently by the author.

Data availability statement

The authors confirm that the primary data supporting the findings of this study are available within the article. Additional raw data are available from the corresponding author, S. N. J. Alfinita, upon reasonable request

Ethical Statement

This study was conducted in accordance with institutional ethical guidelines for research involving student participants. Data collection began after official permission had been obtained from the school administration. The confidentiality and anonymity of all participants were maintained throughout the study.

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