International Journal of Current Educational Research
Homepage: https://www.journal.iel-education.org/index.php/ijocer
Email: ijocer@iel-education.org
p-ISSN: 2961-8517; e-ISSN: 2961-8509

IJOCER, Vol. 2, No. 2, December 2023

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Science Teaching Materials Based on Field Trips with Local Wisdom to Improve Elementary School Students' Critical Thinking

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DOI: https://doi.org/10.53621/ijocer.v2i2.240

Sections Info

Article history:
Submitted: June 18, 2023
Final Revised: August 8, 2023
Accepted: August 10, 2023
Published: October 03, 2023

Keywords:
Critical Thinking;
Education;
Field Trips;
Local Wisdom;
Teaching Materials.

ABSTRACT

Objective: Education is the most essential thing in the life of a human being. Components supporting its implementation are needed to realize the quality of education. Cultivating critical thinking character education is urgently required in the era of globalization. Field trip teaching materials with local wisdom can be an attractive alternative. This study aims to develop science teaching materials based on field trips with local wisdom to improve elementary school students in critical thinking skills. **Method:** This research method uses research and development, Borg and Gall. Data collection techniques used unstructured interviews, observation, assessment tests, and non-tes. At the same time, data analysis uses quantitative data and descriptive elaboration. **Results:** The study showed the validity of teaching materials in this research with a percentage gain of 82.00% if converted to a valid category. In comparison, the practicality of implementing lesson plans obtained a percentage of 94.00%, and student activity obtained a percentage of 95.00% with an outstanding category. The effectiveness of science teaching materials showed pretest results with an average of 66.30, while the post-test data was 87.22. **Novelty:** This research shows a significant increase in the critical thinking skills of elementary school students through learning science teaching materials based on field trips with local wisdom. The update of this research is to implement field trip activities into teaching materials so that learning in cultivating critical thinking is exciting for students.

INTRODUCTION

Education is the most essential thing in human life. Humans, science, and the future are always related. Therefore, the essence of education is to humanize humans because facing contemporary problems and life's challenges requires a competent generation (Ramli, 2015). The education process starts within the family and then proceeds to the level of formal education organized by the school (Khaironi, 2018). The quality of education is also an interesting issue to be discussed by various parties. The curriculum is the root of reforming education (Suparya, 2021). The government seeks to improve the quality of education by improving the curriculum from time to time (Juwanti et al., 2020). Good quality education will grow the nation's next generation of quality. Government Regulation Number 32 of 2013 concerning national education standards states that the educational process in educational units is carried out in an interactive, inspiring, fun, and challenging manner, motivating students to participate actively and providing sufficient space for initiative, creativity, and independence according to talent, motivation, and the physical and psychological development of students.

The results of the PISA 2018 Assessment and Analytical Framework (2019) show that the average reading ability of Indonesian students is 80 points lower than the average compared to ASEAN students. Indonesian students' average reading, math, and science ability is 2 points, 52 points, and 37 points lower than the ASEAN average. The low critical thinking ability can be seen through learning based only on memorization

ability (Almadiah et al., 2022). The primary factor in determining the best performance results in critical thinking is mentality, not age (Fabio et al., 2023; Saldıray & Meydan, 2023). Critical thinking skills can be cultivated from an early age (Changwong et al., 2018; Shao et al., 2022). The ability to think critically can be a provision in the era of globalization because various kinds of positive and negative information can be selected by children (Qori'ah et al., 2022; Yantik et al., 2022). Critical thinking makes students more rational and mature in making decisions, so believing something before proving the truth is not easy. Critical thinking skills are essential because they help students reason about problems, find root causes, and develop solutions or alternatives (Moghadam et al., 2023; Phillips, 2023).

One way to improve the quality of education is to create teaching materials that encourage students to think critically, actively, creatively, and innovatively (Asrina, 2020). Teaching materials provide direction for a directed learning process. The teacher needs the learning process to guide all activities given and taught to children. Teaching materials can be in the form of text, information, and tools that contain attitudes, knowledge, and skills arranged systematically and present the complete competencies that will be mastered by children and used in the learning process. The suitability of teaching materials to the child's condition can make it easier to understand learning material can broaden children's horizons, and provide memorable experiences so that children can interpret a lesson and not just memorize it (Behnamnia et al., 2022 Bunting et al., 2021; Lillard, 2023; Liverpool et al., 2021; Peñarrubia-Lozano et al., 2021; Ravanis, 2021; Surur, 2021). In this case, the teacher does not merely teach but must be able to develop teaching materials for their students.

An adequate learning environment will build students' understanding of scientific phenomena. Local wisdom that understands traditional knowledge as a savior of the environment has been studied by many experts (Saphira, 2022). Utilization of local wisdom can improve student learning outcomes (Sari et al., 2022). Developing a learning model based on local wisdom is the uniqueness of a nation. The result of Soi & Aiman's (2020) Effect of Using Local Wisdom-Based Teaching Materials on the Concept Mastery of Class V Students in Elementary Schools can increase student understanding and shape the character of students who think critically and are responsive to the Indonesian environment and culture. One of the materials in elementary school that plays an important role and is considered quite tricky is learning Natural Sciences (Astiti, 2021; Wahyuni, 2015). To make science learning more attractive to students, science learning in the classroom must be connected to students' daily experiences and environment. Subject matter adapted to the residence's circumstances will make it easier for students to understand it, especially for elementary school-age students whose way of thinking is still in the concrete operational stage. Local wisdom-based learning must be implemented in schools because education has a strategic role in the introduction and transmission of culture (Amin et al., 2022; Bulkani et al., 2022; Purwaningsih & Katoningsih, 2023; Syamsi & Tahar, 2021; Tohri et al., 2022; Triastari et al., 2021). The first step is elementary school, where students learn the basics before moving on to more advanced subjects. Using this teaching material as a reference for learning science based on local wisdom is expected to equip students with local wisdom values and efforts to conserve nature.

RESEARCH METHOD

This study used research and development research methods from Borg and Gall. The development model is the basis for developing a product and the effectiveness between the suitability of the selected approach and the final product. The stages of this research consisted of 10 stages, as shown in Figure 1. This research was conducted at Kertajaya Elementary School Surabaya with three research participants, validators, and 54 fifth-grade students at Kertajaya Elementary School Surabaya.

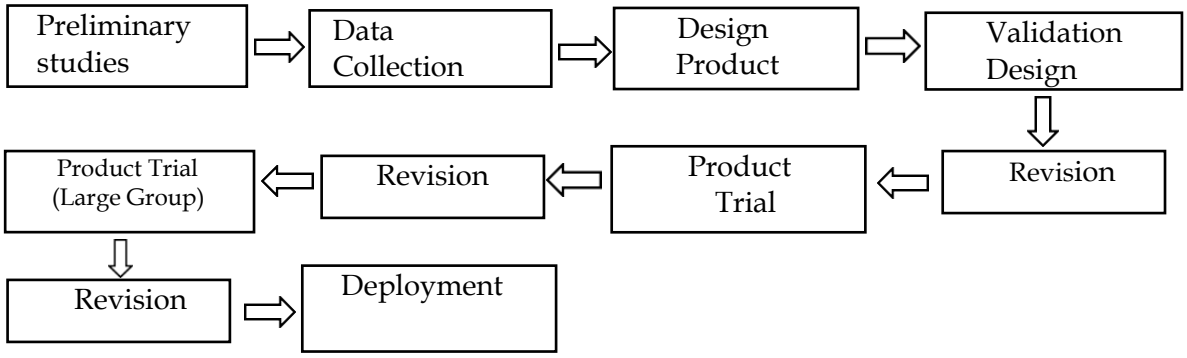


Figure 1. Research satges.

The instruments used in this study were teaching material validation sheets, student activity observation sheets, and students' critical thinking tests. The teaching material validation sheet consists of 15 statements containing components of the correctness of the concept, suitability of content/material, and readability components. The student activity observation sheet consists of the following. Students' critical thinking tests consist of 2 types of formative tests: pretest and post-test. Students' critical thinking tests consist of 5 indicators, namely a) skills in giving simple explanations, b) building basic skills, c) concluding, d) providing further explanation, and e) developing strategies and tactics (A'yun et al., 2020; Dasilva et al., 2019; Dewi et al., 2019; Purnamasari et al., 2020; Sagala & Andriani, 2019; Setiana et al., 2021). Each instrument has been tested for the validity and reliability of the instrument.

Data collection techniques using unstructured interviews, observation, tests, and non-tests. At the same time, the data analysis is in the form of quantitative and qualitative data. Quantitative data in expert validation results were analyzed using product validity categories. Meanwhile, quantitative data in the form of learning outcomes were analyzed using the paired separated variance t-test. This is done to assess the effectiveness of developing field trip-based teaching materials with the developed local wisdom. In contrast, the qualitative data is in the form of observations or preliminary studies in the form of suggestions or input from the validators on the design of teaching materials based on field trips with local wisdom (Panis et al., 2020; Purnomo et al., 2019; Supartini et al., 2020; Syawaludin et al., 2019). This qualitative data is analyzed by organizing, synthesizing, presenting, and making conclusions.

RESULTS AND DISCUSSION

Results

Design Product

Initial product planning (draft) is made using preliminary and literature studies' findings. At this stage of the planning process, the first thing that needs to be done is to

compare the skills students already have with the skills they need to master to do their job correctly. Then, create a test design or evaluation tool relevant to the learning objectives.

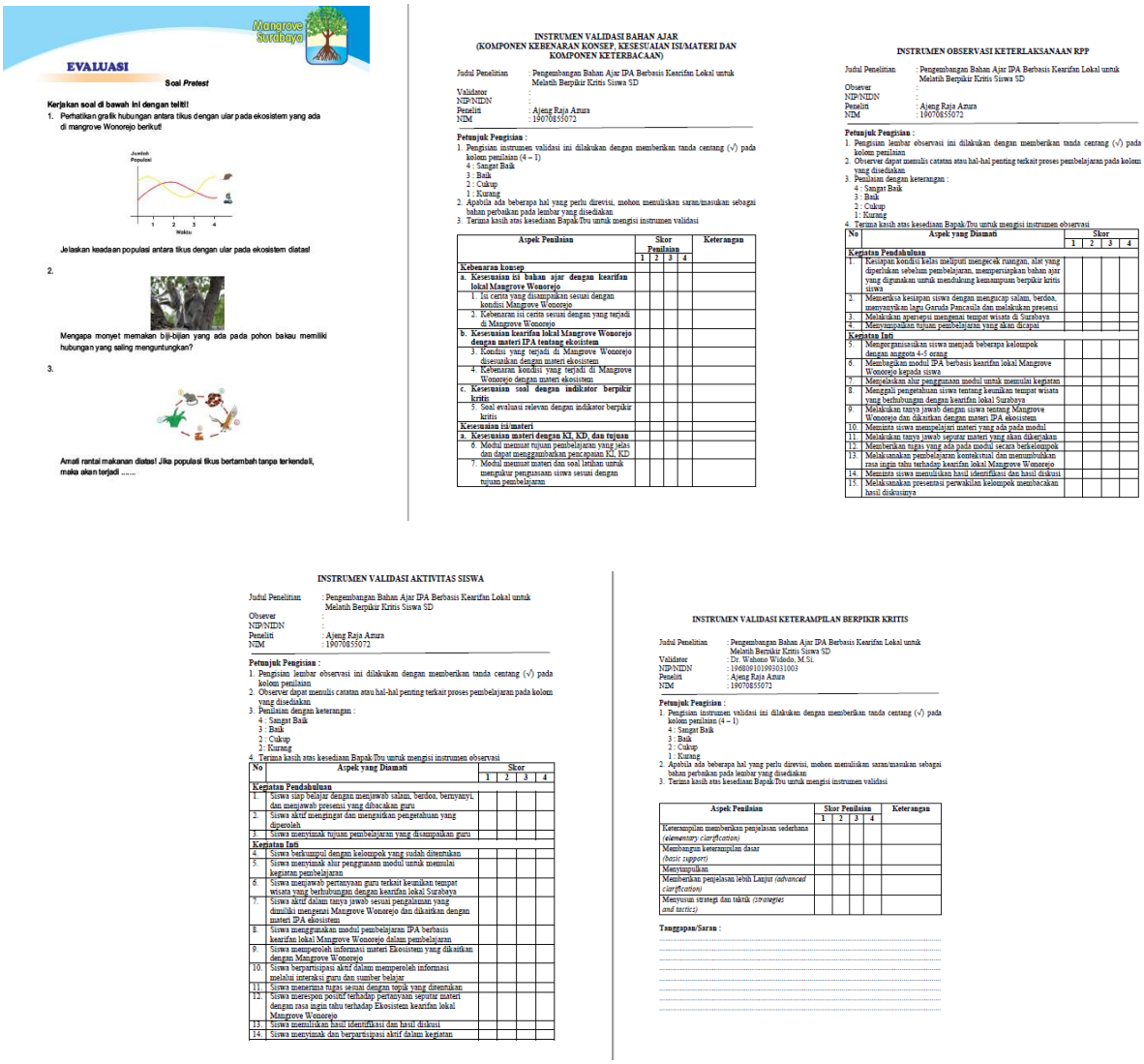


Figure 2. Initial product planning.

Initial Product Development

The initial product with the theme "educational module" was produced as a result of the development of a module for teaching, namely "Local Wisdom-Based Science Module to improve students' critical thinking." The module contains Titles, Glossaries, Core Competencies and Basic Competencies, Ecosystem Learning Materials related to the local wisdom of the Wonorejo Mangrove, Evaluation, answer keys, and practice questions that hone critical thinking skills.

Figure 3. Initial product development.

Product Validation

In this research stage, validation was carried out on three components, namely the correctness of the concept, the material/content component, and the readability component, using a Likert scale of 1-4 by filling in a checklist. In addition, validation is carried out on other supporting instruments, namely learning devices.

Table 1. Teaching materials.

No.	Aspects	Score	Validity Level
1	Concept truth	89.00	Valid
2	Appropriate content/material	83.00	Valid
3	Readability component	85.00	Valid
	Average	**82.00%**	**Valid**

The validity results are converted to 81.00%-100.00% with a very valid category. Thus, science teaching materials based on local wisdom regarding concept correctness, material/content components, and readability are very valid.

Table 2. Critical thinking.

No.	Aspects	Score	
		Validator I	Validator II
1	Elementary clarification	4.00	4.00
2	Basic support	3.00	3.00
3	Conclusion	4.00	4.00
4	Advanced clarification	4.00	4.00
5	Strategies and tactics	4.00	4.00
	Total	**19.00**	**19.00**
	Average	**95.00%**	

Data validation of critical thinking skills is processed to obtain the percentage of validity. Based on the results of the validity of critical thinking skills, 95.00% was obtained. The validity results are conserved in the range of 81.00%-100.00% with a very valid category.

Table 3. Learning media.

No.	Aspect	Score	
		Valid I	Valid II
1	Equipment	4.00	4.00
2	Language	3.00	3.00
3	Syllabus	19.00	19.00
4	Lesson plan	35.00	26.00
5	Teaching materials	4.00	4.00
6	Student Worksheets	8.00	7.00
7	Learning Resources	11.00	11.00
8	Evaluation	8.00	7.00
	Total	92.00	89.00
	Average	94.00%	

The results of the learning device validation are processed to obtain the percentage of validity. Based on the results of the validity of the learning device, a percentage of 94.00% was obtained. The validity results are conserved in the range of 81.00%-100.00% with a very valid category.

Product Trials

Small Group Trial

The result data obtained an average percentage of 92.00% of lesson plans' implementation using teaching materials based on local wisdom. The results of implementing the lesson plans are 100.00%-81.00%, namely the very good category. In addition, observations were also carried out by observing student activities in small group trials during learning, as listed in Table 4 and Table 5.

Table 4. Implementation of field trip-based teaching materials with local wisdom.

No.	Aspect	Score
1	Introduction	92.00
2	Core activities	92.00
3	Closing	93.00
	Average	92.00%

Table 5. The result of a small group.

No.	Student	Pretest	Post-test	d	xd
1	ABM	60.00	85.00	25.00	625.00
2	RSK	65.00	80.00	15.00	225.00
3	PTU	70.00	75.00	5.00	25.00
4	TYS	75.00	90.00	15.00	225.00
5	UIB	70.00	80.00	10.00	100.00
6	BIM	60.00	85.00	25.00	625.00
7	WKS	75.00	80.00	5.00	25.00
8	AGN	70.00	90.00	20.00	400.00
9	BMS	65.00	85.00	20.00	400.00
Total		610.00	750.00	140.00	2,650.00
Average		67.78	83.33	15.56	294.44

Table 5 shows that the pretest scores of 9 students in class V obtained an average of 67.78, while the students' post-test scores obtained an average of 83.33. After calculating using the t-test, the count or empirical value is 6.07. If df = 8.00 with a significance rate of 5.00%, a table of 1.860 is obtained. Based on this, count 6.07 > Table 1.86 at a significance level of 5.00%. Thus, there is an increase in critical thinking skills, which is significant before and after using science teaching materials based on local wisdom.

Large Group Trial

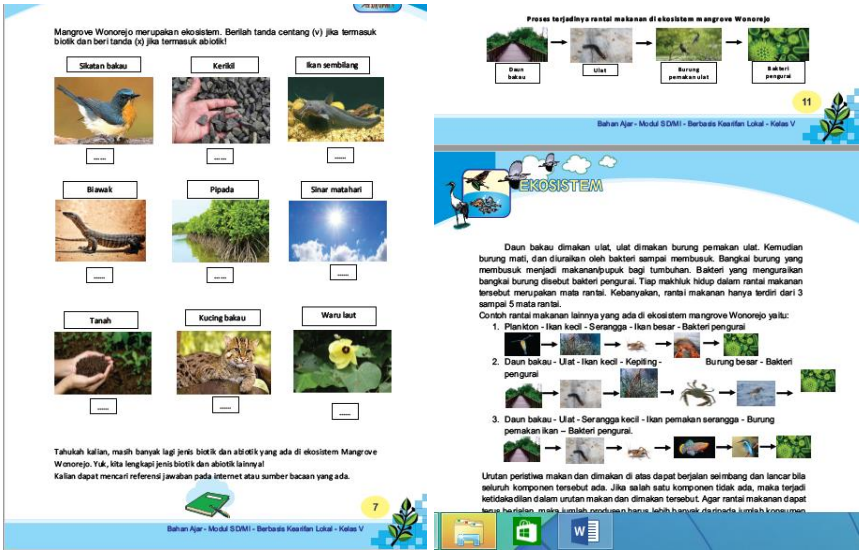


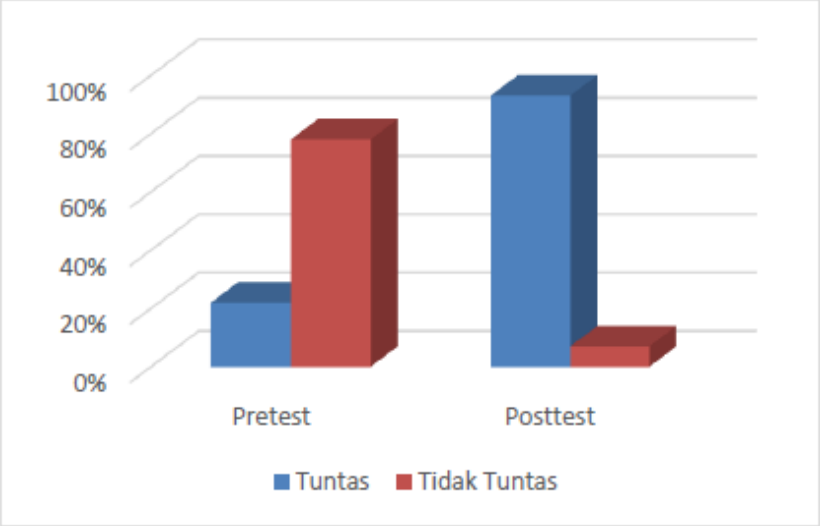
Figure 4. The final product.

Table 6. The result of a large group.

Student	Pretest		Post-test		Enhancement	
	Value	Category	Value	Category	d	xd
AAN	65.00	TT	90.00	T	25.00	625.00
ADR	45.00	TT	85.00	T	30.00	900.00
ANK	90.00	T	95.00	T	5.00	25.00
ADA	90.00	T	95.00	T	5.00	25.00
APR	55.00	TT	90.00	T	30.00	900.00
BSP	90.00	T	95.00	T	5.00	25.00
DMM	55.00	TT	90.00	T	30.00	900.00
DNN	55.00	TT	80.00	T	25.00	625.00
ENR	70.00	TT	90.00	T	20.00	400.00
FIH	80.00	T	95.00	T	15.00	225.00
GAD	85.00	T	95.00	T	10.00	100.00
GG	60.00	TT	90.00	T	30.00	900.00
HMA	85.00	T	95.00	T	10.00	100.00
JML	60.00	TT	95.00	T	30.00	900.00
LFR	65.00	TT	90.00	T	25.00	625.00
MFS	55.00	TT	90.00	T	30.00	900.00
MNS	70.00	TT	90.00	T	20.00	400.00
NPA	65.00	TT	90.00	T	25.00	625.00
NCF	75.00	TT	85.00	T	10.00	100.00
NQN	75.00	TT	80.00	T	5.00	25.00
NAR	60.00	TT	90.00	T	30.00	900.00
QG	65.00	TT	80.00	T	15.00	225.00
RR	65.00	TT	85.00	T	20.00	400.00

Student	Pretest		Post-test		Enhancement	
	Value	Category	Value	Category	d	xd
RRC	45.00	TT	70.00	TT	25.00	625.00
SFA	45.00	TT	75.00	TT	30.00	900.00
VDA	60.00	TT	90.00	T	30.00	900.00
ZAN	55.00	TT	90.00	T	30.00	900.00
Percentage of students who pass the Pretest: 22.00% Post-test: 93.00%						
Percentage of students who did not complete the Pretest: 78.00% Post-test: 7.00%						

Table 6 shows that the pretest scores of 27 fifth-grade students obtained an average of 66.00, while the students' post-test scores obtained an average of 87. After calculating using the t-test, the count or empirical value is 11.00. If df = 26.00 with a significance level of 5.00%, a table of 2.05 is obtained. Based on this, count 11.00 > table 2.05 at a significance level of 5.00%, so there is a significant increase between before and after using science teaching materials based on local wisdom.



Picture 4. Graph of students' critical thinking ability.

The results of the pretest and post-test were assessed concerning the indicators of students' critical thinking, namely the ability to provide clear explanations, build essential skills, draw conclusions, provide additional explanations, and determine strategies and tactics. Science teaching materials encourage students to practice critical thinking by combining the local wisdom of the Wonorejo mangroves. Critical thinking skills are a form of ability to solve problems and write down new ideas/ideas.

Discussion

Based on the results of the study, it was found that the critical thinking skills of students taught using field trip-based science learning modules were higher than those taught using conventional methods. This is due to the usefulness and effectiveness of field trip-based science teaching modules developed by researchers. This research is supported by the findings of Amprasto et al. (2020). Field trip learning methods in mangrove ecosystems can stimulate students' critical thinking skills improvement. Presentation of concepts in topics using graphic elements and hands-on experience adds interest and excitement to students, and this helps them to focus on teaching (Deviana, 2018). Students who used field trip-based science teaching modules had higher achievement

in the three types of questions, namely objective, structured, and essay, compared to students taught using conventional methods, which only showed improvement in objective questions. This proves that using field trip-based science teaching modules can encourage students' critical thinking skills compared to conventional methods (Diarini et al., 2020). This is because the questions asked in objective questions are low-level questions, and structured questions and essays are high-level questions that require students to think in order to be able to answer these questions.

By integrating local wisdom, such as Mangrove Ecotourism, educators can introduce existing local wisdom and improve the character of caring for the environment for students. As stated by Hapidin et al. (2020), local content study materials can provide students with knowledge, skills, and behavior so that they have solid insights about environmental conditions and community needs per the values/rules that apply in their area. as well as support the sustainability of regional development and national development. A study by Zahara & Hamdu (2022) revealed that the mangrove ecosystem has various potential benefits, both directly and indirectly. In addition to improving student character, local wisdom and mangrove ecotourism can increase student understanding, as expressed (Nuralita, 2020). Local wisdom can increase students' environmental knowledge and attitudes in protecting the environment. Previous research on the development of teaching materials and textbooks based on local wisdom has been carried out, but the difference lies in the place where local wisdom is used; in previous research, no one has ever used Wonorejo mangroves as an addition to students' insights regarding local culture associated with the material discussed so that the Wonorejo mangroves have never been explored, especially to improve students' critical thinking.

CONCLUSION

Fundamental Finding: Based on the results of research and discussion, the development of field trip-based science learning teaching modules to improve critical thinking skills begins with a preliminary study showing that it is necessary to develop teaching modules with a field trip approach. The validation results show that it met the module and media feasibility standards. The individual trial results stated that the field trip-based science learning teaching module received a positive response. The results of the limited scale trial showed that the field trip-based science learning teaching module as a whole was included in the good category. In conclusion, the field trip-based science learning teaching module is good. In conclusion, the field trip-based science teaching module is valid and effective. **Implication:** Overall, this study shows that the field trip-based science learning module is valid and effective in improving learners' critical thinking skills. The implication is that teachers can use this learning approach as an effective strategy for developing learners' critical thinking skills in the context of science learning. **Future Research:** Conduct a broader study involving more learners from different school levels and backgrounds. This will provide a more representative picture of the effectiveness of field trip-based science learning modules in improving critical thinking skills.

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