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# Development of Natural Laboratory Teaching Modules to Improve Learning Achievement of VII Grade Junior High School Students

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**Abstract:** This study aims to develop a valid, practical, and effective natural laboratory teaching module in improving the learning achievement of seventh grade junior high school students in science subjects. The study used the Research and Development (R&D) method with the Borg & Gall development model which includes the stages of needs analysis, planning, product development, expert validation, product revision, limited trials, and product implementation. The research subjects consisted of material experts, media experts, science teachers, and seventh grade junior high school students. Data collection techniques were carried out through observation, interviews, validation sheets, teacher and student response questionnaires, and learning outcome tests. Data analysis was carried out descriptively quantitatively using the feasibility percentage and N-Gain test. The results of the study showed that the natural laboratory teaching module obtained a very high level of validity with an average percentage of 92.4% based on the assessment of material experts, media experts, and language experts. The results of the practicality test showed that teacher responses obtained a percentage of 91.2% and student responses were 89.7% with a very practical category. The effectiveness of the module is demonstrated by the improvement in student learning achievement with an average pretest score of 58.4 increasing to 84.7 in the posttest, as well as an N-Gain value of 0.74 in the high category. The use of the environment as a natural laboratory is able to create more contextual, active, and meaningful learning so that students more easily understand science concepts through direct learning experiences. Thus, the developed natural laboratory teaching module is suitable for use as an innovative teaching material to improve learning achievement and science process skills of seventh grade junior high school students.

**Keywords:** Contextual learning; Junior high school science; Learning achievement; Nature laboratory; Teaching modules

## Introduction

21st-century education demands a transformation in the learning process, oriented not only toward mastering concepts but also toward developing critical thinking, creativity, communication, and collaboration skills in students. This transformation encourages teachers to provide contextual, active, and student-centered learning, thereby making the learning process more meaningful. In the context of Natural Science (IPA) learning at the Junior High School (SMP) level, learning should provide students with direct experiences through observation, experimentation, environmental exploration, and solving real-life problems. Science learning cannot simply be delivered through lectures and memorizing concepts; it needs to provide

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opportunities for students to discover knowledge through direct interaction with the natural environment.

In reality, science learning in various schools still faces several challenges. Learning tends to be dominated by conventional teacher-centered methods, the use of textbooks as the sole learning resource, and a lack of practical and experimental activities. This condition causes students to be less active in learning and have difficulty understanding abstract concepts in science. Low student engagement in the learning process impacts low student achievement (Lou et al., 2000). Research conducted by Pangestu et al. (2020) shows that science learning in junior high schools is still monotonous because students only listen to teacher explanations without conducting experiments or direct field observations. This condition results in low science process skills and student learning outcomes.

Furthermore, the challenges of modern education are also influenced by technological developments and changing characteristics of digital generation students. Today's students require more interactive, engaging, and real-life learning experiences. Therefore, teachers are required to develop innovative teaching materials that not only deliver content but also facilitate active student engagement in the learning process. One form of teaching material considered effective in supporting active learning is the teaching module (Aisyah et al., 2025; Sartika & Shofiyah, 2021; Setiawan, 2019).

A teaching module is a systematic and structured learning material designed to enable students to learn independently or under guidance. Modules serve not only as a source of material but also as a guide to learning activities, containing learning objectives, usage instructions, student activities, exercises, evaluations, and learning reflections. The use of teaching modules in science learning can help students understand concepts in a more focused and in-depth manner. Research by Kamaludin et al. (2018) shows that science learning modules can improve the quality of learning by providing students with opportunities for independent and systematic learning.

In the implementation of the Independent Curriculum, the use of learning modules is a crucial component in supporting differentiated learning, project-based learning, and contextual learning. Learning modules are designed to provide students with flexible, meaningful learning experiences tailored to their individual learning environments. Therefore, developing learning modules that utilize the surrounding environment as a learning resource is highly relevant for junior high school science instruction.

One learning approach that can support contextual learning is a nature laboratory. A nature laboratory utilizes the surrounding environment as a learning tool, enabling students to directly observe, experiment, and explore real-world objects. Both the school environment and the students' immediate surroundings have significant potential as learning resources because they provide a variety of natural phenomena relevant to science material. Using a nature laboratory can make learning more concrete, making it easier for students to grasp the concepts being studied.

Natural laboratory-based learning can also increase student motivation because students not only receive theory in the classroom but also directly engage in scientific observation and investigation activities. Research by Azis et al. (2020) shows that natural phenomenon-based learning can improve student learning outcomes by helping students understand science concepts through real-life experiences and direct visualization of learning objects (Azis et al., 2020).

In addition to improving learning outcomes, nature laboratories can also develop students' science process skills, such as observing, classifying, measuring, concluding, and communicating observation results. These skills are crucial in science learning because they support students' scientific thinking skills. Research by Pangestu et al. (2020) shows that local environment-based modules effectively improve science process skills and learning outcomes for junior high school students, with a high effectiveness score (Rustan et al., 2020).

The development of natural laboratory-based teaching modules is also relevant to the constructivist learning paradigm, which emphasizes that knowledge is built through direct learning experiences. In constructivist theory, students do not simply receive information passively but construct their own understanding through interaction with the environment. Therefore, learning that involves environmental exploration activities will help students grasp science concepts more meaningfully.

Various previous studies have shown that developing learning modules can improve student learning outcomes. Simbolon (2023) explains that developing STEM-based e-modules can increase student engagement in science learning because students gain a more active and technology-integrated learning experience (Seprianingsih et al., 2023). Another study conducted by Hermala et al. (2024) showed that guided inquiry-based modules have a very high level of validity and are able to improve junior high school students' analytical skills on temperature and heat. Furthermore, research by Rosalina et al. (2024) shows that the use of teaching modules based on the Prediction, Observation, and Explanation (POE) model can significantly improve students' science process skills because students are

directly involved in the process of observing and proving science concepts.

Research by Yuliana et al. (2023) also confirmed that developing e-modules based on local wisdom and ethnoscience can increase student engagement in science learning because the learning material is linked to the students' culture and environment (Wibowo & Ariyatun, 2020; Suja, 2022). Meanwhile, research by Pane et al. (2024) showed that the use of STEM-based virtual lab media effectively increases scientific literacy and student learning motivation in science learning (Winaningsih et al., 2022; Pertiwi & Firdausi, 2019; Zidatunnur & Rusilowati, 2021).

Other research also shows that the use of project-based and environment-based teaching materials can improve students' higher-order thinking skills (Kamaludin et al., 2018; Savira et al., 2019). Bagus et al. (2022) explain that technology-integrated science modules can improve junior high school students' Higher Order Thinking Skills (HOTS) because learning becomes more interactive and challenging. Furthermore, Triyanti and Sulistiyono (2023) state that Project-Based Learning (PjBL) modules are effective in improving junior high school students' factual and conceptual knowledge (Rahayu et al., 2022; Abdullah et al., 2025).

Rosana et al. (2021) explained that inquiry-based learning combined with technology can improve students' scientific thinking and investigative skills. This research emphasizes the importance of exploratory activities in science learning to build students' conceptual understanding.

Furthermore, research by Taş et al. (2022) shows that a student-centered learning approach in science education can significantly improve junior high school students' inquiry skills. Students who are actively involved in learning have a better understanding of concepts than those who learn through conventional methods.

Research by Valls et al. (2021) also shows that dialogic and collaborative learning can help students develop scientific thinking skills through active interaction and group discussions. This demonstrates that science learning requires strategies that encourage active student participation.

Furthermore, Ülger (2021) explains that 21st-century science education must integrate contextual learning and environmental sustainability to enable students to understand the relationship between scientific concepts and real life (Purwati et al., 2015). Utilizing the environment as a natural laboratory is one form of contextual learning implementation that is relevant to the needs of modern education.

Research by Dewi et al. (2025) shows that developing science teaching modules based on augmented reality and ethnoscience can improve junior high school students' science skills by making learning more interactive and contextual. Furthermore, research by Wijaya et al. (2025) through a systematic literature review shows that the use of virtual laboratories and environment-based laboratories has a positive influence on improving students' understanding of concepts and scientific skills.

Candra et al. (2020) also stated that laboratory practicals and observations significantly contribute to improving students' science process skills and learning activities. Science learning that involves hands-on experience has been shown to be more effective than learning that is solely lecture-oriented.

Pujowati et al. (2020) added that integrated science modules based on scientific literacy can help students understand science concepts more deeply because the material is developed based on investigative and problem-solving activities. Meanwhile, Widianto et al. (2020) emphasized that the ADDIE model and other systematic teaching materials are highly effective in developing innovative science learning media (Rohana et al., 2020; Rediani et al., 2023).

These findings reinforce that the development of innovative teaching modules has a major contribution to improving the quality of science learning, especially in improving science process skills, learning motivation, critical thinking skills, and learning achievement of junior high school students.

However, initial observations in schools indicate that the use of natural laboratory-based teaching modules remains very limited. Teachers tend to use simple textbooks and worksheets without integrating the potential of the surrounding environment as a learning resource. Learning activities are also largely conducted in the classroom, resulting in students receiving limited hands-on learning experiences. This situation makes science learning less engaging and impacts student achievement.

Learning achievement is a crucial indicator for assessing the success of the learning process. It not only reflects students' mastery of knowledge but also demonstrates the effectiveness of the strategies, methods, and teaching materials used in learning. Low science achievement among junior high school students is often influenced by a lack of variety in teaching methods, minimal practical activities, and the use of less contextual teaching materials. Therefore, learning innovations are needed to increase student active engagement in the learning process.

The development of a natural laboratory teaching module is seen as an appropriate solution to address these issues. This module is designed by integrating environmental observation activities, simple

experiments, discussions, and reflections so that students can learn actively through real-world experiences. Using the environment as a natural laboratory also allows students to understand the relationship between science concepts and phenomena around them.

In addition to supporting improved learning achievement, the nature laboratory teaching module can also assist teachers in implementing more innovative learning that aligns with the demands of the Independent Curriculum. This module can be used as a systematic and flexible learning guide, making it easier for teachers to manage learning activities both inside and outside the classroom.

Based on this description, the development of a nature laboratory teaching module is crucial to support the improvement of the quality of science learning in junior high schools. This research aims to develop a valid, practical, and effective nature laboratory teaching module to improve the learning achievement of seventh-grade junior high school students. The developed product is expected to serve as an alternative, innovative teaching material capable of creating active, contextual, and meaningful science learning.

## Method

This study uses the Research and Development (R&D) method with the Borg & Gall development model which aims to produce a product in the form of a natural laboratory teaching module to improve the learning achievement of seventh grade junior high school students. The Borg & Gall model used in this study is simplified into several main stages, namely: (1) needs analysis, (2) product planning, (3) module draft development, (4) expert validation, (5) product revision, (6) limited trials, the research subjects consisted of material experts, media experts, science teachers, and seventh grade junior high school students. Data collection techniques were carried out through observation, interviews, validation sheets, teacher and student response questionnaires, and learning outcome tests. Data were analyzed descriptively quantitatively to determine the level of validity, practicality, and effectiveness of the developed teaching module.

## Result and Discussion

This development research resulted in a product in the form of a natural laboratory teaching module for science subjects for grade VII of junior high school. Product development was carried out using the Borg & Gall model, which includes the stages of needs analysis, product planning, initial draft development, expert validation, product revision, limited trials, final revision, and product implementation.

*Needs Analysis*

The initial stage of the research was conducted through observations and interviews with science teachers and seventh-grade junior high school students. Observations showed that science learning was still dominated by lecture methods and the use of textbooks as the primary learning resource. Teachers had not utilized the surrounding environment as a learning medium, resulting in passive student learning activities.

Furthermore, interviews revealed that students struggled to grasp abstract science concepts due to a lack of practical activities and direct observation. Teachers also cited the limited availability of contextual teaching materials as a barrier to implementing environment-based learning.

**Table 1.** Needs Analysis Results

| Aspects Analyzed | Research Findings |
|---|---|
| Learning Resources | Dominant use of textbooks |
| Learning activities | Teacher-centered |
| Environmental utilization | Not optimal |
| Science Practical | Rarely done |
| Student learning achievement | Still low |
| Need for teaching materials | Environment-based modules |

The results of the needs analysis indicate the need to develop a natural laboratory teaching module that is able to support contextual learning and increase student involvement in the learning process.

*Product Development*

Based on the results of the needs analysis, the researcher developed a nature laboratory teaching module by taking into account the science learning outcomes of grade VII. The module was designed systematically by containing the module identity, learning objectives, science materials, nature laboratory activities, student worksheets, evaluations, and learning reflections.

The nature laboratory activities in the module are structured around the school's natural environment, allowing students to directly observe real-world objects. The material developed covers the classification of living things, ecosystems, interactions between living things and their environment, and environmental pollution.

*Expert Validation Results*

The product that has been developed is then validated by material experts, media experts and language experts to determine the level of feasibility of the module.

Based on the validation results, the nature laboratory teaching module achieved an overall average score of 92.4%, categorized as highly valid. The validator provided several suggestions, such as adding environmental illustrations, simplifying some scientific terms, and adapting the practical activities to school conditions.

**Table 2.** Material Expert Validation Results

| Assessment Aspects | Percentage | Category |
|---|---|---|
| Material suitability | 94% | Very Valid |
| Conceptual accuracy | 92% | Very Valid |
| Suitability of learning objectives | 95% | Very Valid |
| Presentation of material | 93% | Very Valid |
| Average | 93.5% | Very Valid |

**Table 3.** Media Expert Validation Results

| Assessment Aspects | Percentage | Category |
|---|---|---|
| Display design | 90% | Very Valid |
| Image quality | 92% | Very Valid |
| Layout | 91% | Very Valid |
| Module readability | 92% | Very Valid |
| Average | 91.2% | Very Valid |

**Table 4.** Linguist Expert Validation Results

| Assessment Aspects | Percentage | Category |
|---|---|---|
| Language accuracy | 93% | Very Valid |
| Clarity of sentences | 92% | Very Valid |
| EYD Compliance | 93% | Very Valid |
| Communicative | 92% | Very Valid |
| Average | 92.6% | Very Valid |

*Practicality Test Results*

After revisions were made based on validator input, the module was tested on teachers and students to determine the level of practicality of using the module. The results of the practicality test show that the module is easy to use in learning and is able to increase student engagement during the learning process.

**Table 5.** Teacher Response Results to the Module

| Assessment Aspects | Percentage | Category |
|---|---|---|
| Ease of use | 92% | Very Practical |
| Material suitability | 90% | Very Practical |
| Implementation of learning | 91% | Very Practical |
| Benefits of the module | 92% | Very Practical |
| Average | 91.2% | Very Practical |

**Table 6.** Student Response Results to the Module

| Assessment Aspects | Percentage | Category |
|---|---|---|
| Student interest | 90% | Very Practical |
| Ease of understanding the material | 88% | Very Practical |
| Natural laboratory activities | 91% | Very Practical |
| Module view | 90% | Very Practical |
| Average | 89.7% | Very Practical |

*Effectiveness Test Results*

The effectiveness of the natural laboratory teaching module is measured through the results of students' pretests and posttests.

**Table 7.** Student Learning Achievement Test Results

| Component | Mark |
|---|---|
| Average pretest score | 58.4 |
| Posttest mean score | 84.7 |
| Difference in increase | 26.3 |
| N-Gain | 0.74 |
| Category | Tall |

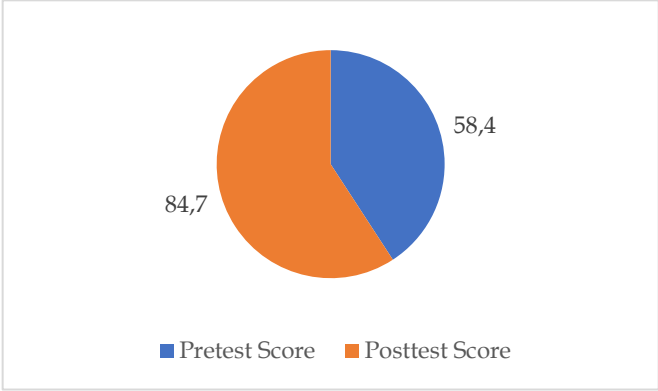


**Figure 1.** Diagram of pretest and posttest results

The results of the effectiveness test show that the natural laboratory teaching module is effective in improving student learning achievement with a high improvement category.

*Discussion*

The research results show that the developed nature laboratory teaching module has a very high level of validity. The high validation results indicate that the module meets the appropriateness of content, presentation, language, and learning media design. The suitability of the material to the seventh-grade science learning outcomes is a key factor supporting the module's quality. Furthermore, the use of communicative and systematic language facilitates students' independent understanding of the learning material.

The high module validity also demonstrates that the development of natural laboratory-based teaching materials is able to integrate science concepts with students' real-world environments. This integration makes learning more contextual, enabling students to understand concepts through direct experience. This aligns with Piaget's constructivism theory, which states that knowledge is built through active interactions between students and their learning environment. According to Vygotsky, learning is more effective when students are directly involved in social activities and

real-world experiences that enable them to construct understanding independently.

This opinion is reinforced by Setiawan (2019), who stated that science learning must emphasize hands-on experience so that students can understand concepts scientifically and meaningfully. Learning that provides students with opportunities to directly observe real objects will help them develop deeper concepts than learning that is solely theoretical.

The results of the practicality test showed that teachers and students responded positively to the use of the nature laboratory teaching module. Teachers assessed that the module was easy to use in the learning process because it had clear instructions, systematic learning activities, and evaluations aligned with learning objectives. Meanwhile, students felt more engaged in the learning process because they could directly observe objects in the school environment.

The practicality of the module demonstrates that natural laboratory-based teaching materials can create a more active and enjoyable learning environment. Learning takes place not only in the classroom but also involves the surrounding environment as a primary learning resource. Environmental observation and exploration activities provide students with real-life learning experiences, making learning more meaningful.

According to Abdullah et al. (2025), a good teaching module should encourage students to learn independently through systematic and engaging learning activities. A contextually structured module will help students understand the connection between the learning material and everyday life. This opinion supports the findings of this study, which showed that the use of a natural laboratory in a learning module can increase student interest and engagement in the learning process.

Furthermore, Lou et al. (2000) stated that using the environment as a learning resource can increase student motivation because students gain concrete, hands-on experience. The environment provides opportunities for students to develop curiosity, make observations, and discover concepts independently. In this study, students appeared more active during learning because they were directly involved in environmental observation and exploration activities.

The improvement in student learning achievement, demonstrated by an N-Gain value of 0.74, demonstrates the effectiveness of the nature laboratory learning module in junior high school science instruction. This improvement in learning outcomes occurs because students have the opportunity to connect science concepts with phenomena they directly observe in their surroundings. This learning experience helps students grasp concepts concretely, making the material easier to understand and remember.

The results of this study align with Bruner's theory that learning is more effective when students gain hands-on experience through discovery learning. In Bruner's theory, students will more easily grasp concepts if they are actively involved in the learning process through exploration and discovery activities. The nature laboratory activities included in the module provide students with opportunities to observe and discover science concepts independently.

Natural laboratory-based learning can also improve students' science process skills. During learning activities, students engage in activities such as observing, classifying, measuring, drawing conclusions, and communicating their observations. These skills are essential to science learning because they support scientific thinking and problem-solving skills.

According to Rustan et al. (2020), science process skills are fundamental skills that must be developed in science learning because they help students understand scientific processes systematically. Learning that involves direct observation and experimentation will improve students' critical thinking and problem-solving abilities. This opinion aligns with the results of this study, which showed that the use of a natural laboratory module can enhance students' scientific activity during learning.

The results of this study also align with Johnson's theory of contextual teaching and learning (CTL), which states that contextual learning helps students understand material by connecting it to real-world situations. A contextual approach makes learning more relevant and meaningful for students because the material is not learned abstractly but is linked to real-life experiences.

In addition to improving cognitive learning outcomes, the nature laboratory teaching module can also increase student motivation. Students become more enthusiastic about participating in learning because learning activities are conducted through direct observation of their surroundings. This demonstrates that using the environment as a natural laboratory can create more engaging learning experiences than conventional learning (Shofiyah et al., 2020; Rini et al., 2021).

Winaningsih et al. (2022) stated that student motivation to learn will increase if learning provides new, interesting, and challenging experiences. An active and interactive learning environment can increase student attention, allowing them to focus more on the learning process. This was evident in this study, where students demonstrated high enthusiasm during

observations and field practicums (Zulhaini et al., 2016; Utari et al., 2021).

Overall, the research results indicate that the development of a natural laboratory teaching module positively contributes to improving the quality of science learning in junior high schools. The developed module is not only suitable for use as teaching material but also improves student achievement, science process skills, and learning motivation. These findings reinforce the belief that utilizing the environment as a natural laboratory is an effective learning strategy for creating active, contextual, and meaningful science learning.

## Conclusion

Based on the results of research and development, it can be concluded that the nature laboratory teaching module for seventh-grade junior high school students is declared very valid, very practical, and effective for use in science learning. The module obtained an average validation of 92.4% with a very valid category. Teacher and student responses to the module are in the very practical category. The effectiveness of the module is shown through an increase in student learning achievement with an N-Gain value of 0.74 in the high category. The use of the nature laboratory teaching module is able to increase student involvement in the learning process through the use of the surrounding environment as a contextual learning resource. Therefore, this module is suitable for use as an innovative teaching material in seventh-grade junior high school science learning.

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The authors hereby declare no conflicts of interest.

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