

The Effectiveness of Teaching Integrated Science Meterics on High Level Thinking for Junior High School Students Banda Aceh

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Abstract: The aim of this research is to test the effectiveness of integrated science teaching materials for junior high schools, especially the theme of household health and environmental sanitation. The research design uses a quasi-experiment with Pretest-Posttest Control Group Design. The research was carried out at SMPN 6 Banda Aceh class VII. The sample was determined by purposive sampling. The treatment in the experimental group was learning that used integrated science teaching materials, while the control group used electronic school books. The instruments used are test items, learning observation sheets, and learning tools. Data analysis was carried out using Anava to test mean differences and Scheffe test to test the effectiveness of integrated science teaching materials. The results of the research show that there are differences in high-level thinking abilities between junior high school students who use integrated science teaching materials and students who use separate/individual science teaching models in the field of biological studies. Students can remember 13%, understand 15%, application 18%, analysis 30% and evaluation 25% for thinking achievement. Teaching using integrated science teaching materials is very effective in improving the high-level thinking abilities of students at SMP Negeri 6 Banda Aceh.

Keywords: Effectiveness; High-level thinking abilities; Integrated science junior high schools; Teaching materials

Introduction

Changes in student character in implementing the 2013 curriculum teaching and learning with the current Merdeka Curriculum in accordance with the Content Standard guidelines have an impact on science learning in SMP/MTs, namely that science subject matter which covers the fields of study of physics, biology and chemistry must be taught in an integrated manner. The implementation of integrated science learning in junior high schools experiences several obstacles. These obstacles include the implementation of learning and the availability of science teaching materials which contain

themes involving the study of physics, chemistry and biology. Most of the science teaching materials owned by teachers are textbooks or textbooks obtained from publishers. These books do not yet refer to themes that can cover all fields of science study. The teaching materials of books that use the integrated science label are still just a formality and not all complete, while the contents of the books tend to refer to one area of science study, for example chemistry or biology, so that the presentation is conventional or separate between one teaching material and the next. During the implementation of the 2020 independent curriculum, there were still very few teachers who developed

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teaching materials individually or innovated on their own. At the end of 2022, research was conducted on the development of integrated science teaching materials for junior high school students by a grant team. The results of this research show that integrated science teaching materials are really needed by teachers and students, and this development research has produced a set of integrated science teaching materials for students. class VII of junior high school (Ansya, 2023).

The use of biological, chemical and physical science concepts in integrated science teaching materials begins with phenomena that exist around students and discusses them with a review of three areas of study. The integrated science teaching materials are presented contextually with the aim of making the study of the material adapted to the learning environment and easy for students to understand (C. M. Z. Ibrahim et al., 2023).

Providing integrated science teaching materials can integrate science, environment, technology, health and society (Chen et al., 2024). The presentation of the teaching material is taught using mutual theme learning. Teaching materials are provided using actual issues about science and technology that occur in society (Costa et al., 2022). Each material is linked to a social and technological context so that students see an integration between the universe as science, the human-made environment as technology and the students' everyday world as the social environment. This is done to develop students' learning activities and critical thinking skills well (Najilah et al., 2023).

Globally, thinking is assumed to be a cognitive process, a mental act to obtain knowledge. The thinking process is connected to other behavioral patterns and requires the active involvement of the thinker. Complex relationships are developed through thinking. These relationships can be interconnected with established structures and can be expressed by thinkers in various ways. Thinking is a naturally complex and reflective effort for all individuals (Chairatunnisa et al., 2023; Fahmi et al., 2023; D. Ibrahim et al., 2015; Tengku, 2022).

Thinking abilities are categorized into basic and very complex thinking abilities in the process. Basic thinking abilities include basic processes which are a description of the rational thinking process which contains a collection of mental processes from simple to complex. The basic thinking ability model includes causation, transformation, relations, classification, qualifications. Complex thinking ability is a thinking ability that is based on basic thinking processes. According to Hidayat et al. (2023), there are at least four complex thinking processes that occur in a person, namely problem solving, decision making, critical thinking, and creative thinking. In the context of the ability to think, it means that thinking can be taught and requires practice to be able to have it, as is the case with

other abilities. Thinking abilities are always developing and can be learned periodically. Compared to other abilities, thinking ability is a mental ability, while other abilities are manual abilities. Thinking ability is a grouping of thinking abilities that shows the sequence of thinking based on cognitive processes. The thinking ability model includes 1) basic thinking abilities, 2) complex thinking abilities, and 3) metacognitive/rational thinking abilities.

This research aims to test the effectiveness of integrated science teaching materials for junior high school students, especially the theme of environmental sanitation, on students' high-level thinking abilities. The teaching materials tested use the theme of health and environmental sanitation for seventh grade junior high school students. This theme includes Basic Competencies, being able to classify the properties of acid solutions, base solutions and salt solutions using biological practical tools and appropriate indicators, Being able to trace the properties of substances based on their form and their application in everyday life, Using a microscope and simple equipment in supporting other learning activities, including observing the symptoms of healthy living in a clean environment (Ibrahim et al., 2020).

Method

This research uses Pretest-Post-test Control group or Group Design. This design assigns certain subjects to two groups, namely the experimental group and the control group, carries out a pre-test, research treatment, and carries out a post-test. The research treatment was given to the experimental group, namely the implementation of learning using integrated science teaching materials, while the control group was given learning without using integrated science teaching materials but using students' usual teaching materials. The results of the analysis show that Fhitung is an electronic school book for integrated science subjects. The research was conducted at the end of 2023 on two class VII at SMP Negeri 6 Banda Aceh. Data collection in the research was carried out by recording all aspects that occurred during the learning process using observation guidelines, questionnaires and tests. Data on students' thinking abilities is collected through tests and processed using statistics.

Next, the data analysis is carried out using qualitative and quantitative analysis. The use of thinking abilities of students who use integrated science teaching materials is different from students who use electronic school books. The effectiveness test of the teaching materials was carried out after it was found that the integrated science teaching materials showed differences with electronic model school books. The

effectiveness test was carried out using the Scheffe Test. The results of data analysis show that integrated science teaching materials are more effective in improving students' thinking abilities than electronic school books, which shows that qualitative analysis is carried out in the implementation of learning and the use of quantitative analysis is carried out at the validation test stage of teaching materials. The analysis was carried out by testing hypotheses on students' thinking abilities using the two-way Anava (Variance analysis) statistical technique to measure the effectiveness of integrated science teaching materials.

Result and Discussion

The science teaching materials tested for their effectiveness are integrated science teaching materials with the theme of health and environmental sanitation. This teaching material contains seventh grade junior high school science material which is studied from studies in the fields of chemistry, biology and health. Integrated science teaching materials with the theme of environmental health include basic student competencies such as, Classifying a healthy, clean and comfortable environment with healthy living criteria as the main need of society. Students can research the properties and standards of environmental health, food substances or ingredients, drinks that are widely consumed by local residents in everyday life; Students' skills in using laboratory equipment and other supporting equipment to observe life symptoms that support our environmental sanitation and health practices.

Data from the implementation of integrated science teaching materials comes from a homogeneous population and has normally distributed data. This is demonstrated by the results of the pre-requisite test analysis of the teaching materials. This is supported by the number of students in each class, namely 30 students per group. With a sample size of more than 30 people, it is possible for the data obtained to come from normally distributed data. Based on the results of this prerequisite test, the next activity is to carry out hypothesis testing on teaching materials. Hypothesis testing was carried out with Anava to test the difference between integrated science teaching materials and science teaching materials from electronic school books on the thinking abilities of students who had high initial abilities and $4.840 > 2.731$ for students who had low initial abilities. 0.12.

Students' thinking abilities can be developed continuously so that students can solve problems that arise in their daily lives. Students who are trained in thinking skills from the start will find it easier to develop their thinking skills at the secondary school level. This

thinking ability can be developed and trained on students from the start (Zaharah et al., 2023).

If converted to the cognitive process dimensions from other theories, the ability to think includes the dimensions of the process of remembering, understanding, applying; ability to analyze, evaluate, and create. Based on this classification, high-level thinking abilities include abilities within the dimensions of the process of applying, analyzing, evaluating and creating with the basics of good remembering and understanding processes.

Students' high-level thinking abilities at junior high school level can be developed through integrated science teaching materials. Integrated science teaching materials prepared using an inductive approach, where students learn science by observing everyday life phenomena can actually arouse students' curiosity to study science more deeply. Through several alternative experimental activities provided in the teaching materials, students learn science in an integrated manner (Sahira et al., 2023). When studying the case being studied, students simultaneously examine the case through studies in the fields of physics, chemistry and biology. This is shown by the results of research which shows that there are differences in the thinking abilities of students who use integrated science teaching materials compared to students who use science teaching materials whose material is studied separately (Rizal et al., 2023). Support for this comes from the statement that the analysis of the concepts studied is carried out in a comprehensive, relevant manner that will train students to think at a higher level on an ongoing basis (Ridhwan et al., 2023). Apart from that, science teaching materials presented with real and contextual problems will make it easier to implement science learning (Andania, 2021).

Based on analysis of research data, the thinking abilities of students in the experimental group were different from the thinking abilities of students in the control group for each teaching material theme. These results indicate that the use of integrated science teaching materials can improve students' higher-level thinking abilities. Students who use integrated science teaching materials are more guided and encouraged to develop their thinking abilities comprehensively compared to students who use science teaching materials that present science with partial studies of physics, chemistry and biology (Ansya, 2023). The use of teaching materials that are presented in an integrated manner also makes it easier to implement science learning not only at the school level but also at tertiary institutions. The research results show that integrated teaching materials support learning activities at University Utara Malaysia (UUM) which are carried out in an integrated manner with integrated teaching

materials (Ibrahim et al., 2022). Meanwhile, the development of students' thinking abilities cannot be separated from the learning carried out. In this research, learning was carried out using integrated inquiry-based learning. This learning has the advantage of being able to encourage students to see meaningful relationships between the concepts discussed and other related concepts, increasing the level of students' thinking skills, presenting applications about real situations that they experience in everyday life in the form of applications (Dinanti, 2022).

Based on the results of data analysis, it shows that the thinking abilities of students in the experimental group are different from the thinking abilities of students in the control group. Based on the average test results, it shows that the thinking ability of the experimental group is better than the control group. This shows that the use of integrated science teaching materials in the experimental group can develop students' thinking abilities. The results of other research show that integrated science teaching materials combined with trials really help student learning outcomes (Ferawati et al., 2023). For this reason, integrating teaching materials with application in students' environments is very necessary to improve their thinking power (Marwan et al., 2024).

The effectiveness of the use of teaching materials is supported by the Scheffe test. The results of the Schelfe test show that the thinking ability of students who use Integrated Science teaching materials with high ability is better than the thinking ability of students who use science teaching materials which are separated into areas of study with high ability. This also happens to students with low abilities. Thus, integrated science teaching materials are effective in improving students' thinking abilities for students with high and low abilities (Hayati, 2023). The effectiveness of this integrated science teaching material is also reflected in the positive response from teachers and students to the teaching material used. Integrated teaching materials that can improve thinking abilities are also "independent" teaching materials. This means that the teaching materials can be studied by students independently because they are systematic and complete, thus helping students in their learning process. Students have independent responsibility in mastering the material. Students' ability to master the material must be supported by students' academic abilities (Hermila A., 2023; Ibrahim et al., 2015).

Students who are academically high will also have a higher speed of thinking. The ability to master material in the learning process will help students in efforts to improve their thinking abilities. Therefore, integrated science teaching materials will be better able to improve students' thinking abilities if applied to students who

have high academic abilities (I. Ibrahim et al., 2023). The effectiveness of integrated science teaching materials is also can improve the thinking abilities of students in the low group even though it takes longer when compared to students with high abilities (Ferawati et al., 2023). Based on the results of the analysis, it was stated that the control class which had low academic abilities could improve their thinking abilities if they were given Integrated Science teaching materials. This relates to "independent" teaching materials that can help students in their learning process, see the following graphic.

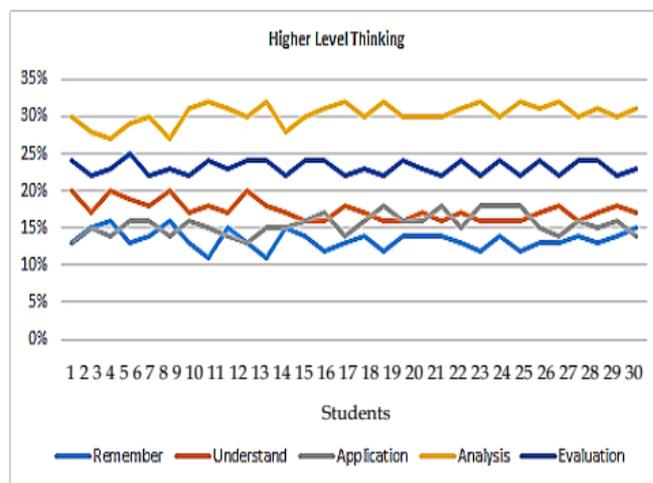


Figure 1. Level of critical thinking in integrated teaching materials

Figure 1 shows that the level of thinking of junior high school students in integrated science teaching materials varies, namely remembering 13%, comprehending/comprehending 15%, applying 18%, analyzing 30% and assessing/evaluating 25% for achieving thinking skills. So the level of effectiveness of the integrated science teaching materials being tested is related to the characteristics of the integrated science teaching materials used in seventh grade. These characteristics are (a) presented with a certain theme which is a combination of physics, biology and chemistry material, (b) the teaching material developed is more meaningful because in integrated learning students will understand the concepts they learn through direct experience and relate them to other concepts that they understand, (c) the teaching materials developed are also equipped with experimental activities with the aim of providing opportunities for students to actively work both independently and in groups to carry out experiments, make observations, collect data and process data. This is in accordance with the characteristics of integrated science learning as stated by other experts who state that several characteristics of integrated learning are holistic, meaningful, authentic, active (Fahrul, 2023).

However, there are also advantages, integrated science teaching materials also have disadvantages. This drawback is the practicality of carrying and using teaching materials. This is because integrated science teaching materials are still separated based on themes. Based on these shortcomings, there is a need for a complete revision of the integrated science teaching materials so that the teaching materials are in line with the demands of the curriculum and the field, and are also easy to use by teachers and students.

Conclusion

In general, the results of the research conclude that there are differences in high-level thinking abilities between junior high school students who use integrated science teaching materials and junior high school students who use junior high school science teaching materials in school books or textbooks. These differences are shown in each theme of integrated science teaching materials. The thinking abilities of students who use Integrated Science teaching materials are better than the thinking abilities of students who use school textbooks (electronic). Thus, the integrated science teaching materials that students use are effective in improving junior high school students' thinking abilities to the greatest extent in terms of analysis and evaluation. Shows that the thinking ability of students who use integrated science teaching materials is better than the thinking ability of students who use partial/separate science teaching materials. Therefore, it is recommended for junior high school science teachers to use integrated science teaching materials as a study guide for seventh grade students. They also use integrated science teaching materials that need to be adapted to the curriculum used by K-13 in accordance with the combination of several basic competencies of students from different semesters. For this reason, when preparing the science subject syllabus, teachers should examine the related basic competencies and determine the theme of integrated science teaching materials in accordance with the teaching themes that students are interested in and need.

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