Journal of Research in Instructional
e-ISSN: 2776-222X
Vol. 4(2) 2024, pp. 359 – 366
https://doi.org/10.30862/jri.v4i2.332

The practicality of connected type-based science teaching materials on simple plane principles in human movement systems

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Submitted: 10-01-2024

Accepted: 30-07-2024

Published: 08-08-2024

Abstract: The aim of this research is to determine the practicality of science teaching materials based on the connected type. This research uses a method of testing the level of practicality of teaching materials on simple aircraft and human movement systems. Data and information collection was carried out through interviews with science teachers regarding the teaching materials used for learning. The data collection technique consists of classroom management which can be determined from the results of the teacher's overall observations according to the number of students that have been determined and student response questionnaires are used to determine student responses to Integrated Science Teaching Materials. Meanwhile, data analysis techniques consist of classroom management analysis and student response analysis. The practicality of integrated science teaching materials is stated to be practical to apply. The results of the analysis of class management from all meetings obtained grades in the very good category and the questionnaire analysis of student responses in the learning process obtained results with good criteria.

Keywords: Integrated science, practicality, science learning

Abstrak: Tujuan penelitian ini untuk mengetahui kepraktisan bahan ajar IPA berbasis tipe *connected*. Penelitian ini menggunakan metode pengujian tingkat kepraktisan bahan ajar pada materi pesawat sederhana dalam sistem gerak pada manusia. Pengumpulan data dan informasi dilakukan melalui wawancara dengan guru IPA mengenai Bahan Ajar yang digunakan untuk pembelajaran. Teknik pengumpulan data terdiri dari pengelolaan kelas dapat diketahui dari hasil pengamatan guru keseluruhan sesuai jumlah peserta didik yang telah ditentukan dan Angket respon siswa digunakan untuk mengetahui tanggapan siswa terhadap bahan ajar IPA terpadu. Sedangkan untuk tekni analisis data yaitu terdiri dari analisis pengelolaan kelas dan analisis respon peserta didik. Kepraktisan bahan ajar IPA terpadu berbasis model keterpaduan tipe *connected* dinyatakan praktis untuk diterapkan. Hasil analisis pengelolaan kelas dari semua pertemuan memperoleh nilai dengan kategori sangat baik dan anlisis angket respon peserta didik pada proses pembelajaran memperoleh hasil dengan kriteria baik.

Kata kunci: IPA terpadu, kepraktisan, pembelajaran sains

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INTRODUCTION

Natural science is the study of natural elements and phenomena that are arranged systematically with facts, concepts, principles, and laws that can be examined through scientific methods (Fitriyati et al., 2017). Integrated natural science learning is one of the curriculum implementation models that can be applied at the primary and secondary education levels (Asrizal et al., 2023; Nasir et al., 2023; Retno, 2012). The integrated natural science learning aims to increase the efficiency and effectiveness of learning, increase student interest and motivation, and achieve several competencies simultaneously (Nasir et al., 2023; Nuraysha et al., 2024; Syauqi et al., 2024). An integrated natural science learning model can be more efficient regarding energy, facilities, and education costs. However, this has not been fully implemented because the textbook's content is not integrated yet

(physics and biology) (Retno, 2012). By implementing integrated natural science learning, it is expected that separate materials such as physics, chemistry, and biology can be taught in an integrated and comprehensive manner in one integrated natural science study program.

Natural Science learning in junior high school should be integrated based on the content standards (Nisak & Susantini, 2013). Integrated natural science learning in junior high school connects the fields of physics, biology, and chemistry (Asfiah et al., 2013). Through integrated natural science learning, students can comprehend the relationship between the fields (physics, biology, and chemistry studies) (Harimanto et al., 2015). According to Ramadhani and Erman (2019), natural science learning is often considered difficult to understand because of the complexities of concepts and equations. This condition will lead to a more complicated situation if the material taught by the teacher is uninteresting.

Students experience difficulties natural learning science because of their low ability to think abstractly. Thus, methods and models in learning activities become essential for students with less thinking skills. Conversely, students with high thinking skills (able to think abstractly) will still follow learning activities easily and understand the material well. Yunarti (2021) states that based on the interviews conducted with students, natural science learning is considered a complex subject, which makes them inattentive to follow the subjects and are very happy if the lesson is absent. Students also rarely reopen the prior material, which causes a low learning outcome.

In integrated natural science learning, related fields of study can be assimilated. The theme used in developing this teaching material is the movement system in humans and simple planes with a connected model. Due to the abstract material of movement systems in humans and simple planes, the teaching material needs familiar or real situations (close to the students' surroundings) as an example. According to Pujayanto and Ekawati (2012), the natural science learning process in schools still does not seem integrated because science is taught separately (biology and physics are taught separately), not associated with problems faced by students in everyday life, lack of active learning activities that train students' critical thinking, and implemented teacher-centered learning.

According to interviews and observations conducted with natural science instructors at SMP Negeri 1 Tapa, the school has implemented an integrated learning approach for natural science education, but it employs a shared type. The implementation of the method experiences several obstacles, such as unrelated examples (problems faced by students in everyday life), and the teaching materials used still do not reflect an optimal level of integration. In practice, teaching materials applied in schools have not been fully integrated even though they have been labeled as "integrated natural science." Although the material has been compiled in a book, the presentation of the material is still fragmented based on the field of study. Hence, students find it hard to understand the concept of the material holistically and apply it in everyday life.

In addition, a lack of comprehension of integrated natural science learning will affect students' understanding of the abstract material (Nasir et al., 2024). According to Piaget's 1972 theory, students at the secondary school level should be able to think abstractly based on cognitive development. Instead, learners are only trained to use abstract thinking skills to fit the theory. Therefore, a varied and innovative learning approach is needed to make

students easily understand and apply the integrated natural science concepts in everyday life (Silahooy et al., 2024; Yomaki et al., 2023). In order to achieve this goal, integrated natural science teaching materials are essential for teachers to maintain students' attractiveness. This will also reduce the difficulty students encounter in understanding the material that the teacher has delivered. According to Suprihatin and Manik (2020), teachers need to modify their teaching materials to help students comprehend the material taught.

Therefore, teachers must present more effective strategies and approaches (connected-type integrated natural learning models) during the learning session. The learning model can enhance student learning outcomes by connecting updated material with material that has been discussed. This motivates students to remember the lessons they have learned, strengthen understanding, and be able to correlate other concepts. The connected model is a learning model that connects one concept, topic, and skill with other skills in one field of study (Maruni et al., 2022). Connected-type integrated learning is a learning system that allows students, individually and in groups, to actively search, explore, and find scientific concepts holistically, meaningfully, and authentically (Fadila et al., 2024; Ibrahim et al., 2023).

This model organizes or integrates one concept, skill, or ability that develops in a subject or another subsubject in one field of study. This model helps students understand concepts and makes the knowledge transfer easier because the main concepts can be developed continuously. In the teaching and learning process, the connected model bridges certain materials or competencies with interrelated characteristics based on the competency standards and basic competencies. According to Hidayah and Fajari (2021), the strength of integrated learning in the connectedness model lies in the relationship between one concept and topic with another in a similar field of study.

Hidayah and Fajari (2021) also elaborated that students are expected to build their relationship understanding between the concepts or topics they learn comprehensively, in detail, and depth. With the development of integrated natural science teaching materials of connected-type, students are expected to understand the concept and connect the natural science they learned.

METHOD

The research was conducted on 27 students in grade VIII of SMP Negeri 1 Tapa located on Jl. Huduio, Popodu, Bulango Timur Subdistrict, Bone Bolango Regency, Gorontalo Province. This research was carried out for three months.

This research used a practicality testing level method of teaching materials on simple planes in movement systems in human materials. Data and information were collected through interviews with natural science teachers regarding the teaching materials used.

Data collection techniques in this assessment were taken from the practicality of classroom management (the results of teacher observations according to the number of students that have been determined) and student response questionnaires (to determine student responses to integrated natural science teaching materials). Meanwhile, data analysis consists of classroom management analysis and student response analysis. Two observers assisted in this whole process of analysis.

Table 1. Categories of class management by teachers

Score	Criteria
0%-20%	Very less
21%-40%	Not enough
41%-60%	Enough
61%-80%	Good
81%-100%	Very good

Source: Riduwan (2015)

RESULT

Results of classroom management analysis

Data from observations of classroom management can further be used as a reference for teachers to create an effective classroom atmosphere. This study used a limited trial by measuring 13 aspects in 27 grade VIII Natural Science 1 students for four meetings. The average value of the test results can be seen in Figure 1.

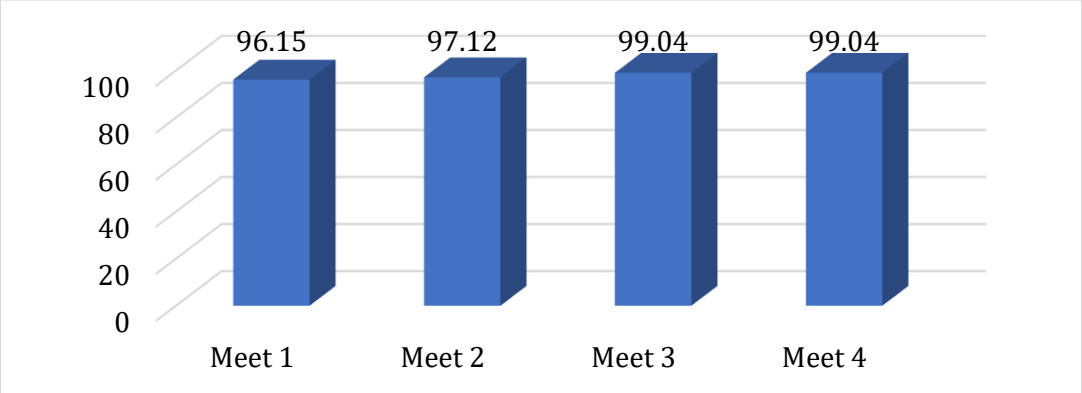

Fig. 1. Classroom management achievement percentage graph

Figure 1 shows the results of the analysis of classroom management by the teacher at three meetings. The first meeting was 96.15%, the second meeting was 97.12%, and there was another increase with a percentage of 99.04% in the third meetings. Therefore, the score from the first meeting to the last averages 97.8% with “good” criteria.

Based on questionnaire analysis from 27 students (checklist) grade VIII of SMP Negeri 1 Tapa in a limited trial (three meetings), it was found that an average percentage of 97.8% with ”very good” criteria indicated that the development of connected-type integrated natural science teaching materials (simple planes concept material and movement systems) was very effective and efficient in helping students’ learning process. In addition, efficient learning can be achieved if the classroom environment is supportive. According to Munir (2018), the learning process will be optimized if the educators can manage the class and place themselves as facilitators and mediators. The connected-type learning model can help educators control and manage the class to make the learning process more efficient.

Teaching materials developed and applied to students must be reviewed and assessed to create excellent and practical learning. Properly using teaching materials is essential because it can help students comprehend and implement the material. According to Hidayah

and Fajari (2021), connected-type integrated learning has three advantages: (1) it can integrate inter-field ideas so that students have a broad picture and are not focused on a particular aspect, (2) Students can develop critical concepts continuously so that an internalization process occurs, and (3) Integrate ideas between fields of study so that students can study, conceptualize, improve, and assimilate ideas to solve problems.

The connected-type learning model can be applied in several stages for effective classroom management. Preliminary stage: the teacher creates a stimulus through apperception (students are allowed to ask questions and participate in discussions) to prepare students to learn the material. According to Fatma et al. (2017), apperception helps teachers design effective learning to enhance the relationship between new material and previous knowledge. This learning process will increase the engagement, retention of information, and the ability of learners to correlate the latest concepts to a broader context.

Core activity stage: after instructing the students to form groups, the instructor hands out worksheets to each class. Then, students are given a chance to ask questions about things they missed, teachers conduct guidance in each group based on student worksheets, students are asked to analyze the results of the observations, students present the results of group work, and other groups are allowed to give responses. This connected-type model provides a space for students to interact and collaborate to create an interconnected learning environment. According to Ananda and Abdillah (2018), the connected-type learning model makes the classroom more dynamic and interactive and supports holistic learning.

Although some aspects still require improvement, other aspects have been declared well-managed. Related to the condition, teachers are expected to maintain consistency and be more attentive to improve the quality of teaching. Further, Warsono (2016) suggests that teachers must properly comprehend specific skills and methods to create a good learning atmosphere (skills related to learning conditions, both the conditions of the study room, facilities, and the conditions of students).

Results of student response analysis

The practicality of developing teaching materials can be seen in students' responses. Figure 2 displays the results of the data analysis conducted on the student responses.

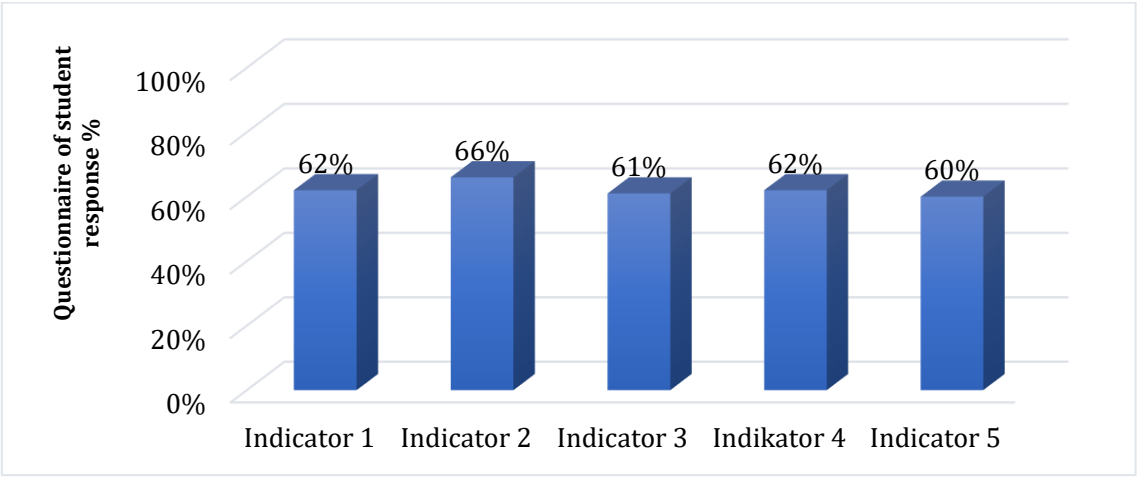

Fig. 2. A graph illustrating the results of the analysis of student response data

Based on the results of the assessment of student response questionnaires from 27 students, it was found that first indicator, “students' opinions about connected-type learning,” got an average score of 62%, second indicator ”students' impressions of connected-type learning ”got an average score of 66%, third indicator ”students' feelings during connected-type learning” got an average score of 61%, fourth indicator ”student attention when discussing in groups” got an average score of 62%, and fifth indicator ”student learning outcomes after learning” got an average score of 60%. The overall result of the average percentage of student response in each aspect is 62% with ”good” criteria and can be used as a learning resources at SMP Negeri 1 Tapa.

Based on the analysis of student responses, the use of connected-type integrated model-based teaching materials on simple plane materials and movement systems at SMP Negeri 1 Tapa obtained an average score of 62% with ”good” criteria. According to Riduwan (2015), 61% - 80% of students’ response values are classified as ”good.” Yadnya (2012) elaborates that questionnaires on student responses can disclose whether the learning tools developed can be adequately used during learning so that they can meet practical aspects.

Teaching materials in connected-type integrated learning (simple machine and human movement systems material) can help students connect the present and prior material. This will motivate students to remember, strengthen, and understand the lesson or concept that has been learned. According to Ananda (2018), this method can assist students in improving themselves and potentially increase student motivation. Learners tend to be more motivated to learn and remember the material when they know how the current information can be connected to previous knowledge.

In addition, Ananda and Abdillah (2018) discloses that connected-type learning can be a reference for students to easily remember the material and be more comprehensive in receiving information. Thus, this learning model builds a solid understanding of a particular material and helps students develop a more profound and integrated conceptual understanding.

CONCLUSION

The application of integrated natural science teaching materials that are based on connected-type integration models has been demonstrated to be practical. It is emphasized by the “very good” category for the analysis of classroom management and the “good” category for student responses.

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