



THE EFFECTIVENESS OF INTEGRATED SCIENCE TEACHING MATERIALS ON THE THEME OF WEATHER AND ITS CHANGES: A STUDY OF READABILITY, CONCEPTUAL UNDERSTANDING, AND USER RESPONSES (TEACHERS AND STUDENTS)

Yuliana Sari¹, Rachmani Maulidia²

¹Department of Science Education, Faculty of Teacher Training and Education, Universitas Muhammadiyah Bogor Raya, Indonesia

[*yulianasari@umbogorraya.ac.id](mailto:yulianasari@umbogorraya.ac.id)

DOI: <https://doi.org/10.32534/>

Accepted: 21/11/2025 Approved: 11/12/2025 Published: 31/12/2025

Abstract

This study aims to examine the effectiveness of implementing integrated science teaching materials with the theme Weather and Its Changes in improving seventh-grade junior high school students' conceptual understanding. The teaching materials were developed using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) combined with a didactic reduction approach to adjust the complexity of the content to students' cognitive level. The research employed a Research and Development (R&D) method with a one-group pretest-posttest design. The participants consisted of 20 seventh-grade students from a private junior high school in Bogor Regency, 9 science teachers from Bogor City, and 2 expert validator teams. Research instruments included a readability test, a conceptual understanding test, student response questionnaires, and teacher response questionnaires. The results indicate that the readability level of the teaching materials was high, with percentages of 71% in Chapter I and 69% in Chapter II, both categorized as independent level. Students' conceptual understanding improved with an N-Gain score of 0.40, which falls into the moderate category. Teacher responses were very positive, indicated by a CVI value of 0.85, categorized as highly feasible. Student responses also showed strong acceptance, with 61.4% agreed and 34.2% strongly agreed on the feasibility of the teaching materials. The findings suggest that the developed integrated science teaching materials are effective in improving students' conceptual understanding and feasible to be used as independent learning resources. Their effectiveness is influenced by attractive visual design, contextual phenomena, and systematic organization of the content. This study highlights the importance of integrating a didactic reduction approach in developing science teaching materials suited to junior high school students' cognitive characteristics.

Keywords: Integrated Science Teaching Materials, ADDIE, Readability, Conceptual Understanding, Didactic Reduction

INTRODUCTION

The implementation of the 2013 Curriculum mandates that science learning at the junior high school level be conducted through a contextual and integrated approach (integrated science). This approach aims to integrate various branches of science, such as Physics, Biology, Chemistry, and Earth and Space Science into a unified and holistic learning experience. Integrated science learning is expected to improve the efficiency and effectiveness of instruction, enhance students' interest and motivation, and facilitate the comprehensive achievement of basic competencies (Kemendikbud, 2016).

Nevertheless, the implementation of integrated science learning in practice still faces various challenges. Preliminary observations in several junior high schools in Bogor Regency indicate that science instruction is still delivered in a partial or fragmented manner, separated by individual science disciplines. Science teachers tend to teach Physics, Biology, and Chemistry in

separate sessions without integrating these disciplines within the context of real-life phenomena. This condition is further exacerbated by the limited availability of integrated science teaching materials that are aligned with the characteristics of Indonesian students, particularly those in Bogor Regency.

Afiana (2018) reported that integrated learning provides broader opportunities for students to understand the interrelationships among concepts, reduces fragmented learning, and stimulates more meaningful learning experiences. Insyasiska, Zubaidah, and Susilo (2015) reinforced these findings by stating that integrated learning can enhance students' learning motivation and encourage active engagement in the learning process. Furthermore, Sudarmin and Pujiastuti (2015) emphasized that integrated learning enables students to develop a holistic perspective on life and natural phenomena, which in turn facilitates problem-solving in everyday contexts.

One of the key factors determining the success of integrated science learning is the availability of high-quality teaching materials. Effective teaching materials should take into account students' cognitive developmental levels, employ communicative language, present content systematically from simple to complex, and be complemented by illustrations and examples that are relevant to students' daily lives (Prastowo, 2015). The level of difficulty and scope of the content should be aligned with the cognitive stage of junior high school students, who are generally in the transitional phase from concrete operational to formal operational thinking according to Piaget's theory of cognitive development (Wadsworth, 2015).

The novelty of this study lies in its distinction between two important concepts: readability and comprehensibility. Readability refers to the extent to which students are able to read the teaching materials fluently before fully understanding their scientific content, whereas comprehensibility refers to students' ability to understand the scientific content after reading the materials in their entirety. These two constructs are interrelated within a unified learning process.

The phenomenon of *Weather and Its Changes* was selected as the theme of this study for several strategic reasons. First, weather phenomena are everyday occurrences that can be easily observed and directly experienced by students, thereby making learning more contextual and meaningful. Second, the weather theme allows for natural integration across various science disciplines: Physics (temperature, pressure, heat), Chemistry (atmospheric composition, chemical reactions), Biology (the effects of weather on living organisms), and Earth Science (atmospheric layers, climate). Third, the increasing urgency of global climate change issues renders this theme highly relevant to contemporary conditions. Fourth, the weather theme encompasses five Basic Competencies that can be coherently integrated.

This study aims to comprehensively examine the effectiveness of implementing integrated science teaching materials on the theme *Weather and Its Changes* in terms of: (1) evaluating the readability level of the teaching materials for Grade VII junior high school students; (2) analyzing improvements in students' conceptual understanding through N-Gain analysis; (3) identifying science teachers' responses and evaluations of the feasibility of the teaching materials; and (4) exploring students' perceptions of the quality and benefits of the teaching materials. Practically, the findings of this study are expected to enrich the literature and serve as a reference for science teachers in developing integrated teaching materials that are aligned with the characteristics (abilities, needs, and psychological aspects) of Indonesian students, as well as to provide an effective alternative for independent learning resources for junior high school students.

METHOD

This study employed a Research and Development (R&D) method using the ADDIE development model, which consists of five stages: Analysis, Design, Development,

Implementation, and Evaluation. The analysis, design, and development stages focused on producing the integrated science teaching materials. The implementation and evaluation stages were intended to examine the effectiveness of the teaching materials in improving students' conceptual understanding. This study adopted a mixed-methods approach, combining quantitative and qualitative methods to obtain a comprehensive understanding of the effectiveness of the developed teaching materials.

The research subjects consisted of three groups. First, 20 Grade VII students from a private junior high school in Bogor Regency, West Java, were selected using purposive sampling. Second, nine junior high school science teachers from Bogor City were invited to evaluate the feasibility of the teaching materials. Third, two expert lecturers from the Graduate Program in Science Education at Pakuan University served as expert validators in the development of the teaching materials.

The instruments used in this study included: (1) a readability test instrument, consisting of a main-idea identification test, multiple-choice questions on paragraph content, and a student questionnaire on perceived paragraph difficulty. Readability was analyzed using the Rankin and Culhane categories: High/Independent (score > 60%), Moderate/Instructional (score 41–60%), and Low/Difficult (score ≤ 40%); (2) a conceptual understanding test in the form of 40 multiple-choice items covering five Basic Competencies, analyzed using N-Gain based on Hake's formula: $N\text{-Gain} = (\text{posttest score} - \text{pretest score}) / (\text{maximum score} - \text{pretest score})$; (3) a teacher response questionnaire consisting of 11 dichotomous (Yes/No) items, analyzed using the Content Validity Ratio (CVR) and Content Validity Index (CVI) based on the Lawshe formula as revised by Wilson, Pan, and Schumsky (2020); and (4) a student response questionnaire consisting of 18 statements using a four-point Likert scale (Strongly Agreed, Agreed, Less Agreed, Disagreed), supplemented by semi-structured interviews with eight purposively selected students.

The research procedures included: (1) a pretest to measure students' initial conceptual understanding; (2) independent implementation of the teaching materials at home over a three-week period, monitored through a WhatsApp group; (3) a posttest using the same items as the pretest but arranged in a different order; (4) readability testing using readability instruments for each chapter; (5) online administration of student and teacher response questionnaires via Google Forms; and (6) in-depth interviews with eight students selected based on variations in N-Gain scores (high, moderate, and low). Data were analyzed using descriptive quantitative methods (percentages, means, N-Gain, CVR, and CVI) and qualitative thematic analysis. Data triangulation was conducted by comparing results from multiple data sources to enhance the validity of the findings.

RESULTS AND DISCUSSION

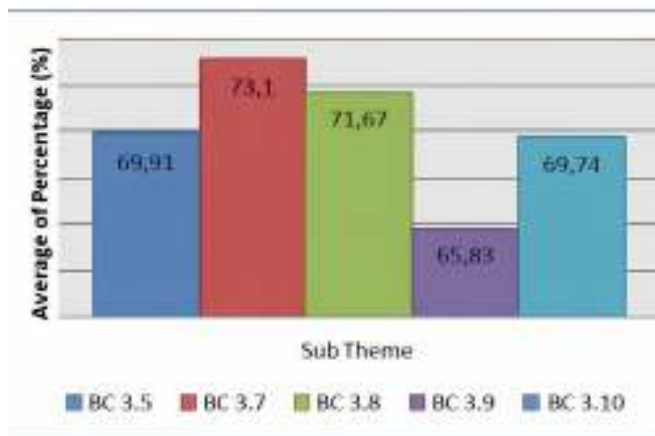
Readability of the Integrated Science Teaching Materials

The results of the readability test indicate that the integrated science teaching materials on the theme *Weather and Its Changes* exhibit a high level of readability (independent category). Chapter I (*Atmosphere and Weather*) achieved an average readability score of 71%, while Chapter II (*Weather and Climate Change*) obtained an average score of 69%. Overall, no paragraph fell into the low (difficult) readability category. These findings indicate that the teaching materials can be well understood by students without requiring intensive assistance from teachers.

Analysis by subtheme revealed variations in readability levels. The subtheme with the highest readability was Basic Competency (BC) 3.7 (*Temperature and Heat*) with a percentage of 73.1%, followed by BC 3.8 (*Characteristics of Matter*) at 71.67%, BC 3.10 (*Earth's Layers*) at 69.74%, BC 3.5 (*Energy*) at 69.91%, and BC 3.9 (*Air Pollution*) at 65.83%. Although BC 3.9 demonstrated

the lowest readability score, it still fell within the high readability category. This confirms that the didactic reduction process applied in the development of the teaching materials was successful in simplifying complex concepts into forms that are more accessible to junior high school students (see Figure 1).

Figure 1. Comparison Diagram of Readability Test Results between Sub Themes



However, a more detailed analysis by test type revealed an interesting phenomenon. In the main-idea identification test, several paragraphs received low scores ($\leq 40\%$), particularly those addressing complex topics such as atmospheric composition, astronomical theories of climate change, and the mechanism of the greenhouse effect. These findings indicate that although students perceived the paragraphs as easy to read, they experienced difficulty in accurately identifying the main ideas. This is consistent with the argument of Nopilda and Kristiawan (2018), who assert that reading literacy involves complex cognitive processes encompassing visual, metacognitive, thinking, and psycholinguistic dimensions.

Factors influencing readability levels include: (1) sentence length (longer sentences tend to be more difficult to comprehend); (2) vocabulary difficulty; (3) information density; and (4) paragraph structure. Meriza, Sinaga, and Syar (2019) emphasize that long sentences are more complex and place a greater burden on students' memory span. To address these issues, the teaching materials underwent a process of didactic reduction by applying eight methods: (1) returning to the qualitative stage; (2) eliminating non-essential information; (3) using symbols, images, and experiments; (4) employing analogies; (5) utilizing historical development; (6) generalization; (7) particularization; and (8) disregarding insignificant differences in concept statements (Prastowo, 2015).

Improvement in Students' Conceptual Understanding Based on N-Gain

The results of the conceptual understanding test indicate a significant improvement following the use of the teaching materials. The average pretest score was 48%, which increased to 68% on the posttest. The N-Gain calculation yielded a value of 0.40, which falls into the moderate category according to Hake's (2019) classification. Although the improvement did not reach the high category ($N\text{-Gain} \geq 0.7$), it nevertheless indicates that the teaching materials were effective in enhancing students' conceptual understanding in the context of independent learning.

Analysis by Basic Competency revealed variations in the degree of improvement. Basic Competency (BC) 3.5 (*Characteristics of Matter*) achieved the highest N-Gain of 0.52 (moderate category), followed by BC 3.7 (*Temperature and Heat*) with 0.48, BC 3.8 (*Interactions among Living Organisms*) with 0.42, BC 3.10 (*Earth's Layers*) with 0.38, and BC 3.9 (*Environmental Pollution*) with

0.31. These findings are consistent with the readability test results, in which BC 3.9 also demonstrated the lowest readability, confirming that readability level is positively correlated with conceptual understanding (see Table 1).

Table 1. Improvement in Conceptual Understanding by Basic Competency

Basic Competency	Pretest (%)	Posttest (%)	Difference (%)	N-Gain	Category
3.5	45	74	29	0,52	Moderate
3.7	52	75	23	0,48	Moderate
3.8	49	70	21	0,42	Moderate
3.9	46	63	17	0,31	Moderate
3.10	48	68	20	0,38	Moderate
Average	48	68	20	0,40	Moderate

The distribution of individual N-Gain scores shows that three students (15%) achieved a high N-Gain category ($g \geq 0.7$), thirteen students (65%) achieved a moderate category ($0.3 \leq g < 0.7$), and four students (20%) achieved a low category ($g < 0.3$). Further analysis revealed that students with low N-Gain scores shared the following characteristics: (1) low reading interest; (2) infrequent access to the teaching materials during the implementation period; and (3) limited participation in WhatsApp group discussions. In contrast, students with high N-Gain scores demonstrated the following characteristics: (1) regular engagement with the teaching materials; (2) active participation in questioning and discussions; and (3) serious engagement in completing the practice exercises.

Several factors were identified as influencing improvements in conceptual understanding: (1) students' reading interest (students with higher reading interest tended to achieve higher N-Gain scores); (2) learning autonomy (the ability to learn independently strongly determines the effectiveness of the teaching materials); (3) parental support (parents who assist their children's learning at home contribute positively); (4) reading literacy (the ability to comprehend scientific texts affects conceptual understanding); and (5) intrinsic motivation (internally motivated students show more significant improvement). Grabe and Stoller (2020) emphasize that reading is a learning tool that can effectively influence students in enhancing learning processes and thinking skills. This is consistent with the PISA 2018 results, which indicate that Indonesian students' reading literacy scores were below the international average (371 compared to the OECD average of 487), placing Indonesia 72nd out of 77 countries surveyed (OECD, 2019).

Variations in N-Gain across Basic Competencies reveal an interesting pattern. Basic Competency (BC) 3.5 (*Characteristics of Matter*) achieved the highest N-Gain, as the content is more concrete and easily connected to students' everyday experiences. In contrast, BC 3.9 (*Environmental Pollution*) recorded the lowest N-Gain, as it involves complex and abstract concepts related to chemical reactions of pollutants, the greenhouse effect, and the long-term impacts of climate change. These findings are consistent with Piaget's theory of cognitive development, which posits that junior high school students (aged 12–15 years) are still in the transitional stage from concrete operational to formal operational thinking, making concrete concepts easier to understand than abstract ones.

Teachers' Responses to the Feasibility of the Teaching Materials

The results of the teacher response questionnaire indicate a very positive evaluation of the developed teaching materials. Of the 11 items administered to nine science teachers, the majority

of responses were “Yes” (agree). The calculation of the Content Validity Index (CVI) yielded a value of 0.85 (85%), which falls into the “Very Feasible” category for use as independent learning materials for Grade VII junior high school students.

The aspects that received perfect ratings (all teachers agreed, CVR = 1.00) were: (1) the ability of the initial sections of the book to motivate to continue reading; (2) the systematic presentation of content from easy to difficult, simple to complex, and concrete to abstract; (3) the extent to which illustrations support conceptual understanding; (4) the usefulness of practice questions in enhancing conceptual understanding; (5) the use of language is easily understood by students; and (6) the contextualization of local/regional phenomena to support conceptual understanding. Aspects that received good ratings (eight to nine teachers agreed) included clarity of illustrations (CVR = 0.80), conceptual appropriateness (CVR = 0.80), visual attractiveness (CVR = 0.80), and the inclusion of spiritual and social values (CVR = 0.60). The novelty of content received the lowest rating (CVR = 0.40), although it still fell within the feasible category (see Table 2).

Table 2. Analysis Results of the Science Teachers’ Response Questionnaire

No	Assessment Aspects (Questions)	Yes	No	CVR
1	Motivation to continue reading (Are you motivated to read further after reading the first part of this textbook?)	9	0	1,00
2	Clarity of illustrations (Are you able to understand the meaning of each illustration (either drawing or modeling)? If not, on what page you can’t understand and why can’t you understand that part?)	8	1	0,80
3	Conceptual appropriateness (Is there a concept that contradicts with the concept that you know so far? If there is a conflict, what page is the concept on?)	8	1	0,80
4	Systematic presentation (Do you think that the presentation in teaching material is done from easy to difficult; simple to complex; and from the concrete to the abstract?)	9	0	1,00
5	Visual attractiveness (Are the illustrations (pictures or modeling) in the teaching material presented in an attractive manner?)	8	1	0,80
6	Illustrations support conceptual understanding (Can the illustrations (pictures or modeling) presented help improve students' concepts understanding?)	9	0	1,00
7	Practice questions enhancing conceptual understanding (Can the practice questions given help students in understand the concept?)	9	0	1,00
8	Language is easy to understand (Is the language used can be understood by students?)	9	0	1,00
9	The novelty of content (Have you found anything new in this teaching material with the theme of Weather and Its Changes? If so, on which page?)	7	2	0,40
10	Contextualization of local phenomena (Do you think that the presentation of descriptions in the form of local or regional phenomena in this teaching material can help students to understand the concept?)	9	0	1,00
11	Inclusion of spiritual and social values (Do you think that the presentation of descriptions or explanations in these teaching material has shown the value of God and social?)	8	1	0,60

CVI	0,85 (Very Feasible)
-----	----------------------

Qualitative analysis of teachers' comments revealed several strengths of the teaching materials: (1) the integration across science disciplines was conducted coherently, with weather serving as the unifying theme; (2) the use of Indonesian contextual phenomena (such as hailstorms in Bogor, air pollution in Jakarta, and the eruption of Mount Merapi) enhanced the relevance of learning; (3) illustrations and diagrams facilitated the visualization of abstract concepts such as atmospheric layers and the water cycle; (4) the glossary and index facilitated the retrieval of terms; and (5) the "Did You Know" and "General Knowledge" features broadened students' knowledge. Teachers' suggestions for improvement included increasing the number of application-oriented questions, adding simple home-based experimental activities, clarifying several illustrations, incorporating QR codes for instructional videos, and strengthening the integration of character education values in each chapter.

Students' Perceptions of the Teaching Materials

The results of the student response questionnaire indicate a very positive reception of the teaching materials. Of the 20 students who completed the questionnaire, 61.4% stated that they agreed (A) and 34.2% strongly agreed (SA) with various statements regarding the teaching materials, while only 4.4% expressed less agreed (LA), and none of the students disagreed (DA). The cumulative positive responses reached 95.6% of students, indicating that the teaching materials were very well accepted by students. The aspect receiving the highest level of strong agreement was the statement, *"These teaching materials help me learn about weather and its changes,"* with 60% of students strongly agreeing and 40% agreeing. The second highest aspect was *"I learned many new things after reading these teaching materials,"* with 55% of students strongly agreeing and 45% agreeing. Students also provided high ratings for the attractiveness of the teaching materials (50% SA), the ease and clarity of the language used (40% SA), relevance to real-world phenomena (25% SA), and the usefulness of the material summaries (30% SA) (see Table 3).

In-depth interviews with eight students revealed several noteworthy findings. First, students highly appreciated the use of local Indonesian weather phenomena, such as hailstorms in Bogor, flooding in Jakarta, and the eruption of Mount Merapi. Second, illustrations and diagrams were perceived as very helpful, particularly for abstract concepts such as atmospheric layers and the greenhouse effect. Third, the "Did You Know" and "General Knowledge" features became students' favorite sections because they presented unique information, such as facts about diamond rain on the planet Saturn. Fourth, the practice questions were considered useful for checking understanding, although some students expressed a desire for more application-oriented questions. Fifth, several students suggested the addition of instructional videos accessed via QR codes, especially for topics involving dynamic processes such as the water cycle and cloud formation.

Students also identified several weaknesses of the teaching materials: (1) some paragraphs were still perceived as too long and dense, particularly in the chapter on astronomical theories of climate change; (2) several technical terms, such as stratosphere, troposphere, and albedo, require simpler explanations; (3) the font size used for image captions was too small (8 pt); (4) more simple experiments that can be conducted at home are needed; and (5) an answer key for practice questions should be provided to better support independent learning.

The use of the weather theme as a unifying thread to integrate various branches of science has proven effective in fostering meaningful learning. In this study, students were able to understand how concepts of temperature (Physics), atmospheric composition (Chemistry), adaptation of living organisms (Biology), and Earth's layers (Geology) are interconnected within

weather phenomena. This finding is consistent with Ausubel's theory of meaningful learning, which emphasizes the importance of linking new knowledge with students' prior knowledge and their real-life experiences (Dahar, 2016). The positive responses of both teachers and students to the illustrations in the teaching materials further confirm the importance of multiple representations in science learning, in line with the principles of dual coding theory, which posit that information is processed through two distinct channels: verbal and visual.

Table 3. Summary of Students' Responses to the Teaching Materials (N = 20)

NO.	STATEMENTS	SA	A	LA	DA
1	Science textbook with the theme of "Weather and Its Change" are very interesting	10	10	0	0
2	This textbook helps Me in studying about Weather and Its Change	12	8	0	0
3	The use of sentences and language used in textbook can be understood easily	8	10	2	0
4	By using this textbook, I can study independently at home and at school	8	12	0	0
5	Science textbook with the theme of Weather and Its Change can interest Me to study	5	15	0	0
6	The use of images, symbols and writing in textbook is quite balance and not excessive	3	17	0	0
7	This textbook can answer my questions about various phenomena of Weather and Its Changes	8	12	0	0
8	This textbook raises problems and phenomena that occur in the surrounding environment or often raised in various newspapers and TV	5	11	4	0
9	The presentation of the material in this textbook is sequential, starting from the easy to the most difficult material	5	11	4	0
10	I learned a lot of new things after reading this textbook	11	9	0	0
11	The various phenomena of Weather and Its Changes contained in this textbook are able to encourage Me to think further about the weather	7	13	0	0
12	Various materials in this textbook can be an interesting discussion material with teachers and friends	9	11	0	0
13	The competency test questions in this textbook make it easy for Me to find out how much knowledge I know about Weather and Its Changes	9	11	0	0
14	The size and type of font used makes it easier for Me to read the textbook	4	14	2	0
15	The display of this textbook is quite interesting	5	14	1	0
16	With this textbook, I realized that studying the Weather and Its changes is quite fun	4	16	0	0
17	I can understand the pictures and symbols contained in the textbook	4	14	2	0
18	The summary of the material in this textbook helps Me understand the whole material	6	13	1	0
Total		123	221	16	0
The Highest Score		360	360	360	360
Percentage (%)		34,2	61,4	4,4	0

Note: SA = Strongly Agreed, A = Agreed, LA = Less Agreed, DA = Dissagreed

Overall, the findings indicate that integrated science teaching materials based on didactic reduction are effective in improving readability and conceptual understanding, as well as in eliciting positive responses from both teachers and students. Thematic integration, contextualization of local phenomena, and the use of visual representations were shown to support meaningful learning. However, the effectiveness of the materials remains influenced by

students' reading literacy, learning motivation, and the limited duration of implementation. Therefore, the development of integrated science teaching materials should be accompanied by strengthened literacy programs, sustained teacher support, and longer-term implementation across broader samples in order to achieve more optimal outcomes and enhance the generalizability of the findings.

CONCLUSSON

Based on the results of the study and the discussion, several conclusions can be drawn as follows. First, the integrated science teaching materials on the theme *Weather and Its Changes* demonstrate a high level of readability (independent category) with an average score of 70.05%, indicating that the materials can be well understood by Grade VII junior high school students without requiring intensive assistance from teachers. This is attributable to the systematic application of didactic reduction to adjust the complexity of the content to students' cognitive levels. Second, the use of the teaching materials successfully improved students' conceptual understanding, with an N-Gain of 0.40 (moderate category), where concrete concepts (such as the characteristics of matter) were more easily understood than abstract concepts (such as environmental pollution). Third, teachers' responses to the teaching materials were very positive, with a CVI score of 0.85 (very feasible category), covering aspects of motivation, systematic presentation, clarity of illustrations, appropriateness of language, and the contextualization of local phenomena. Fourth, students' perceptions of the teaching materials were very positive, with 95.6% of students indicating agreement or strong agreement, appreciating the use of Indonesian contextual phenomena, illustrations that support understanding, learning support features, and a balance between text and images. In-depth interviews revealed that the teaching materials successfully made learning more relevant and meaningful to students' lives. However, in the future, it is expected that teachers will be able to integrate the teaching materials into a blended learning model that combines independent learning with face-to-face instruction, provide scaffolding for students with low reading literacy, and add simple experimental activities.

REFERENCES

- Afriana, J. (2018). Penerapan Project Based Learning Terintegrasi STEM untuk Meningkatkan Literasi Sains Siswa Ditinjau dari Gender. *Jurnal Inovasi Pendidikan IPA*, 4(2), 152–165.
- BSNP. (2020). Instrumen Penilaian Buku Teks Pelajaran Tahun 2020. Jakarta: Badan Standar Nasional Pendidikan.
- Dahar, R. W. (2016). *Teori-Teori Belajar dan Pembelajaran*. Jakarta: Erlangga.
- Grabe, W., & Stoller, F. L. (2020). *Teaching and Researching Reading* (3rd ed.). New York: Routledge.
- Hake, R. R. (2019). *Analyzing Change/Gain Scores*. American Educational Research Association Division D. Bloomington: Indiana University.
- Insyasiska, D., Zubaidah, S., & Susilo, H. (2015). Pengaruh Project Based Learning terhadap Motivasi Belajar, Kreativitas, Kemampuan Berpikir Kritis, dan Kemampuan Kognitif Siswa pada Pembelajaran Biologi. *Jurnal Pendidikan Biologi*, 7(1), 9–21.
- Kemendikbud. (2016). *Panduan Pembelajaran IPA Terpadu untuk SMP/MTs*. Jakarta: Direktorat Pembinaan Sekolah Menengah Pertama.
- Kyeong, K. M., & Kyung, C. M. (2015). Development of STEAM Education Model for Science Subject. *Eurasia Journal of Mathematics, Science and Technology Education*, 11(1), 3–15.
- Meriza, N., Sinaga, P., & Syar, N. I. (2019). Analisis Keterbacaan Bahan Ajar Biologi SMA. *Jurnal Bioterdidik: Wahana Ekspresi Ilmiah*, 7(6), 45–54.

- Nopilda, L., & Kristiawan, M. (2018). Gerakan Literasi Sekolah Berbasis Pembelajaran Multiliterasi Sebuah Paradigma Pendidikan Abad ke-21. *JMKSP (Jurnal Manajemen, Kepemimpinan, dan Supervisi Pendidikan)*, 3(2), 216–231.
- OECD. (2019). *PISA 2018 Results: What Students Know and Can Do (Volume I)*. Paris: OECD Publishing. <https://doi.org/10.1787/5f07c754-en>
- Prastowo, A. (2015). *Panduan Kreatif Membuat Bahan Ajar Inovatif*. Yogyakarta: DIVA Press.
- Rankin, E. F., & Culhane, J. W. (2019). Comparable Cloze and Multiple-Choice Comprehension Test Scores. *Journal of Reading*, 13(3), 193–198. [Revised Edition]
- Sari, Y., & Harry, F. (2017). Analisis Kebutuhan Pengembangan Bahan Ajar IPA terpadu. Dalam *Prosiding Simposium Nasional Inovasi dan Pembelajaran Sains 2017* (hal. 234–239). Bandung: ITB.
- Sari, Y., Puspitasari, I. D., & Permana, I. (2024). Evaluation of Implementation Results of Integrated Science Teaching Materials with “Weather and Its Changes” Theme, to Improve Concept Understanding for Seventh Grade of Junior High School students. *AIP Conference Proceedings*, 3058, 040017. <https://doi.org/10.1063/5.0202088>
- Setyawan, D., Supriyono, & Rusmawati, D. (2021). Pengembangan E-Modul Berbasis Problem Based Learning pada Materi Perubahan Lingkungan untuk Meningkatkan Kemampuan Berpikir Kritis Siswa. *BioEdu: Berkala Ilmiah Pendidikan Biologi*, 10(1), 112–122.
- Sudarmin, & Pujiastuti, S. E. (2015). *Scientific Knowledge and Scientific Method dalam Pembelajaran Sains*. Semarang: FMIPA UNNES.
- Wadsworth, B. J. (2015). *Piaget’s Theory of Cognitive and Affective Development: Foundations of Constructivism* (6th ed.). Boston: Pearson.
- Widodo, W., & Rachmadiarti, F. (2017). Analisis Keterbacaan Buku Teks IPA SMP Berdasarkan Perspektif Guru. *Jurnal Penelitian Pendidikan IPA*, 1(2), 1–8.
- Wilson, F. R., Pan, W., & Schumsky, D. A. (2020). Recalculation of the Critical Values for Lawshe’s Content Validity Ratio. *Measurement and Evaluation in Counseling and Development*, 45(3), 197–210. <https://doi.org/10.1177/0748175612440286>