PERJ
Physics Education Research Journal
ISSN 2685 - 6190 (p)
ISSN 2714 - 7746 (e)
Department of Physics Education
Faculty of Science and Technology
UIN Walisongo Semarang-Indonesia

Misconceptions Profile of Riyadul Mubarok Integrated Senior High School Students on Renewable Energy Materials

Maya Ainul Quroh[1,2*], Siti Patonah[1], Ari Susatyo Nugroho[1], Harto Nuroso[1]

[1]*Magister of Science Education, Universitas PGRI Semarang, Indonesia*
[2]*SMA Terpadu Riyadul Mubarok Brebes, Indonesia*

ARTICLE INFO

Article history:
Submitted : December 29th, 2024
Revised : April 14th, 2025
Accepted : June 11th, 2025

Keywords:
CRI; Renewable Energy; Misconception; Alternative Energy

ABSTRACT

This research aims to determine whether or not there are misconceptions of class X Riyadul Mubarok Integrated Senior High School students regarding renewable energy application of the Certainty of Response Index (CRI) technique; what sub-concepts are the most common misconceptions experienced by class X students at Riyadul Mubarok Integrated Senior High School regarding renewable energy material using the CRI method. Using the purposive sampling technique, twenty students from class X made up the sample. The phenomena of misunderstandings regarding renewable energy, which contains three subconcepts the the energy conservation law, energy conversion, and the topic of this form of descriptive qualitative research is alternative energy. According to the study's findings, students' misconceptions on renewable energy fall into the low category 19.34%, whereas the sub-concept of energy conversion has the highest number of misconceptions 31.7%. With a value of 14.45%, the alternative energy sub-chapter has the lowest misperception category.The questions with the highest percentage of misconceptions 40% are found in items 4 and 13, whereas question number 9 has the lowest rate of misconceptions 0%. Overall, comprehension of the material on renewable energy is not very high, 25.34% of students understood the concept, compared to a higher number of 37.67% of students.

.

Introduction

Renewable energy is one of the sciences (Physics) materials in the independent curriculum (Tatsar; et.al, 2023; Jumiati, 2023) which is one of the crucial materials (Ashad, 2024; Erdiwansyah, et.al, 2024; Didik, et.al, 2019) which needs to be studied thoroughly. in-depth by class X high school students to avoid conceptual errors. The independent curriculum proposes that the learning of Physics, Chemistry and Biology, which in the 2013 curriculum were separated, is now combined into one unit in the independent curriculum with science lessons.

Misconceptions are a situation where students have an inaccurate understanding (Dzulfikar, et.al, 2017; Yuliati, 2017) but assume that their understanding is correct. Misconceptions are a worrying situation (Kamarulloh, 2017; Helmi, et.al, 2019) for science learning, especially in the field of physics because of its abstract nature. Misconceptions in science learning develop at the most basic level (Fahmi, 2018; Noegroho, et.al, 2017) which influence the learning process (Shofiyah, 2017; Dewi, 2019) so that misconceptions become a serious problem when studying scientific concepts, by therefore, misconceptions must be handled properly (Nurulwati and Ayu, 2019). Misconceptions that occur among students in a class can differ from one student to another because misconceptions are influenced by several factors (Rohmah, et.al, 2023; Afifah, 2020) such as learners, instructors, textbooks, educational materials, and instructional strategies. So there is a need for identification to find out students experiencing misconceptions (Sheftyawan, 2018;

*Correspondence email: mayam0966@gmail.com
doi: 10.21580/perj.2025.7.1. 22083

Khairaty, et.al, 2018) or not understanding the material.

Science educators often find that students experience misconceptions, namely concepts that are different from the concepts believed by experts (Irani, et.al, 2020; Malikha, et.al, 2018). Misconceptions occur in almost all physics concepts (Rusilowati, 2006; Sari, et.al, 2020). Students with misunderstandings will find it more difficult to acquire new concepts (Pebriyanti, 2015; Artiawati, 2016). Students tend to carry misconceptions based on personal experiences (Mukhlisa, 2021; Ardiyanti, et.al, 2017) or the results of social interactions. Misconceptions can occur due to limited observation and experience (Wulandari, 2018; Solikah, 2020) in the environment. Misconceptions can also be received from inaccurate information.

Recognizing misunderstandings is a crucial step in the educational process (Wilantika, et.al, 2018). Identification can be done both during and after the learning process, and follow-up might take the form of working to help pupils avoid conceptual blunders (Sugita, 2020). The efforts made must be appropriate in order to avoid worse misconceptions.

One way that is considered effective in identifying misconceptions in students is a written diagnostic test (Siswaningsih, 2014; Zafitri, 2018). In scientific education, a variety of diagnostic exam assessments, such as multiple choice, concept maps, and open-ended questions, are used to find student misconceptions. A number of research have been successful in creating diagnostic tools that allow for fast and accurate determination of outcomes (Fenti, 2017). A multiple-choice test with two tiers and the CRI is one such instrument built in (Azizah et al., 2022).

CRI describes students' level of understanding (Zayyinah, et.al, 2018; Hasan, et.al, 2021) regarding subjects and measures students' level of confidence in answering questions. To measure students' level of understanding in answering multiple choice questions that are conceptual understanding, it is then measured using the CRI scale. Pupils who doubt the answer even when they give the correct response indicate that they do not understand the subject. Pupils who confidently and accurately respond to questions are those who comprehend the material. Students that answer poorly yet are confident in their response are said to have misconceptions.

This study uses a two-tiered multiple-choice exam to identify the characteristics of the material misconceptions among the pupils related to renewable. It is intended that the study findings would serve as a guide and source of information for researchers and educators to overcome and follow up on misconceptions that students have regarding renewable energy material, with the goal being to improve student learning outcomes. Therefore, researchers consider it necessary to conduct research at Riyadul Mubarok Integrated Senior High School looking at the condition of students who have limited sources of knowledge and information due to the Islamic boarding school system which limits the use of mobile phones and the internet.

Methods

Research was conducted at the Riyadul Mubarok Integrated Senior High School in Bandungsari Village, Banjarharjo District, Brebes Regency, Central Java. The kind of research that was done is qualitative descriptive research which aims to describe an object, phenomenon, data, facts and circumstances in the field.

Purposive sampling, a sample technique with specific goals and considerations, was used to choose research subjects (Sugiyono, 2019). In the chosen class, twenty students were taking the test. These students will receive 15 multiple-choice questions (two-tier) on topics related to renewable energy, together with a scale known as the CRI that they can select from according to how certain they are in their responses. Meanwhile, 4 students were selected as interview subjects. The selection of interview subjects was based on different student answer criteria. The meaning of the CRI scale is in Table 1.

Table 1
CRI Scale and Criteria

Scale	category	Code
1	Really don't know	STY
2	Don't know	TY
4	Certain	Y
5	Very confident	SY

A student who experiences misconceptions, understands the concept but is not sure, by contrasting the response with the CRI index provided on the question, it is possible to determine who comprehends the concept and who does not. Table 2 displays the CRI index.

(PK) means the student really understands the material and shows complete confidence in the truth of the knowledge in answering questions, in other words there is no element of guessing, (PKKY) means the student understands the concept but is not

Answer	Reason	Cri	Description	Code
Correct	Correct	$> 2,5$	Have a thorough understanding of the idea	PK
Correct	Correct	$< 2,5$	Know the idea, but not sure	PKKY
Correct	Incorrect	$> 2,5$	Misconceptions	M
Correct	Incorrect	$< 2,5$	Don't understand the idea	TTK
Incorrect	Correct	$> 2,5$	Misconceptions	M
Incorrect	Correct	$< 2,5$	Don't understand the idea	TTK
Incorrect	Incorrect	$> 2,5$	Misconceptions	M
Incorrect	Incorrect	$< 2,5$	Don't understand the idea	TTK

sure about the answer, (M) shows misconceptions and (TTM) shows that since the notion is beyond the grasp of the students, guesswork led to the response.

Table 2
Index CRI

The research's data analysis is predicated on the responses provided by the students. There are various steps involved in using the data analysis technique. First, determine the CRI value used referring to the scale compiled by Saleem Hasan in Table 1. Second, determine the value for the CRI scale then, using the CRI and the students' justifications for their answer selections, and classify the student's comprehension level. This category of understanding is derived from the Aliefman-modified category of understanding (Aliefman, 2012).

Third, to distinguish between misconceptions, not knowing the concept, and comprehending the concept but not being sure, an analysis of the responses was conducted. Fourth, the equation is used to determine the proportion of pupils in each stratum based on the four research findings Equation 2.

$$P = \frac{f}{N} \times 100\% \quad (2)$$

Information:

P= group percentage statistics

F= quantity of pupils in every cohort

N= all participants in total.

Table 3
Regarding the Sub-concept of Renewable Energy Materials

Draft	Number	Question indicator
Law of conservation of energy	1	Calculate the kinetic and potential energy in accordance with the rule of conservation of energy
	2	Establish the prerequisites for the energy conservation law
	3	Determine the reasons for switching from fossil energy to renewable energy
Energy conversion	4	Determining energy conversion in a device
	5	Determining energy conversion in a vehicle
	6	Determine the energy conversion that occurs during photo synthesis
Renewable energy	7	Determine the type of renewable energy that can be utilized from plants and animals
	8	Determine the supporting factors for renewable energy in an area
	9	Determine the type of renewable energy that is suitable for use in an area
	10	Determine the supporting factors for renewable energy in a region
	11	Determine the type of renewable energy that is suitable for use in an area
	12	Determining suitable renewable energy to be developed based on resource abundance
	13	Determine the type of renewable energy that is suitable for use in an area
	14	Determine policies for the use of renewable energy
	15	Know what is meant by renewable energy

Fifth, an overview of each student's average percentage understanding level was created. And the six levels of student understanding per sub-concept and analysis of misconceptions about the questions with the highest presentation of misconceptions.

Results and Discussions

A research was conducted in the classroom to ascertain the proportion pupils who comprehended the idea exceptionally well, according to the data analysis's conclusions, understood it but were unsure,

had misconceptions, or did not know it. If the response is right for the right reason and the students comprehend the subject, the CRI value is high. Pupils are aware of the idea, but they are unsure if their response is right or why it is incorrect. Students are categorized as lucky guesses if the student answers correctly but the reason is wrong. Students experience misconceptions if the answer is wrong but the reason is wrong so they give a high CRI score.

Table 4
Percentage of Students' Level of Understanding

Question items	Percentage (%)			
	PK	PKKY	M	TTK
1	15	35	30	20
2	25	15	25	35
3	75	10	10	5
4	35	10	40	15
5	25	15	25	35
6	25	20	30	25
7	45	5	25	25
8	20	10	5	65
9	10	15	0	75
10	0	10	10	80
11	25	40	5	30
12	15	25	20	30
13	10	5	40	45
14	10	20	5	65
15	45	20	20	15
Means	25,34	17	19,34	37,67

In the meantime, In the low group, while 17% of students comprehend the concept but are unclear, the average percentage of students with misunderstandings is 19.34%. The average percentage of pupils who understand the material is 25.34%. Students' misconceptions are brought about by their way of learning which only memorizes material without connecting one material to another. So, if different types of questions are encountered, students are unable to differentiate and answer the questions correctly. Students will only stick to the concept of the first material. Apart from that, students' insufficient reasoning can also lead to misconceptions since it causes them to make incorrect conclusions.

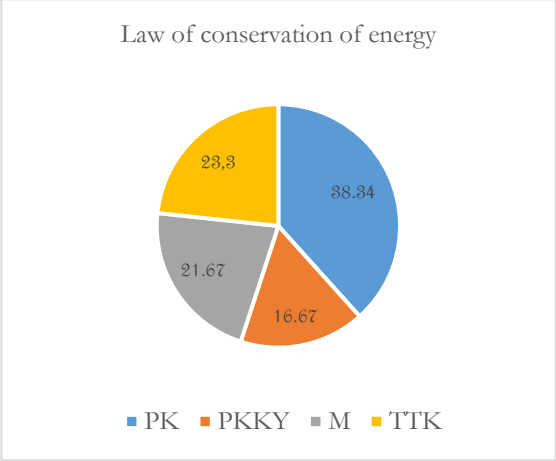
Table 4 shows that questions number 4 and 13 have the largest percentage of misconceptions, while question number 9 with the 0% category has the lowest number of misconceptions, or in other words, there are no students who have misconceptions about this question.

Table 5
Percentage of Student Understanding of Each Sub-concept

Subconcept	Percentage (%)			
	PK	PKKY	M	TTK
1	38,34	16,67	21,67	23,3
2	28,34	15	31,7	25
3	20,56	16,67	14,45	48,34

Table 5 lists the proportion of students who grasp each of the material's sub concepts related to renewable energy, as well as their misconceptions. There are three sub-concepts as in Table 3, namely: question no. 1, 2 and 3 are contained in the law's sub concept of conservation of energy, questions number 4,5 and 6 are Questions 7 through 15 are incorporated into the alternative energy sub concept, and questions contained within the energy conversion sub concept. Table 5 shows that, in comparison to the other two ideas, the energy conversion sub-concept has the largest percentage of misconceptions (31.7%). This value is quite high.

Figure 1
Students' Comprehension of Energy Conservation



Students have misunderstandings regarding every alternative energy idea in relation to the findings of diagnostic examinations. In the law of conservation of energy's sub concept, 21.67% of students experienced misconceptions as can be seen in Figure 1. A form of misconception experienced by students is that students assume that kinetic energy and potential energy in a system change for energy to be produced. According to the rule energy conservation, "energy can only change its form; it cannot be created or destroyed".

False beliefs about the energy conversion sub concept in alternative energy material amounted to 31.7% of students as in Figure 2 The form of misconception experienced by students lies in the difference between light energy and heat energy originating from the sun which is used in solar panels. Most students answered that the energy source for solar panels is heat energy, even though what

happens is light energy which is later converted into electrical energy. In this sub-concept, the misconceptions that occur are classified into the medium category and are the most prevalent fallacies in relation to the sub concepts of alternative energy sources and the law of energy conservation.

Figure 2
Students' Comprehension of The Energy Conversion Subconcept

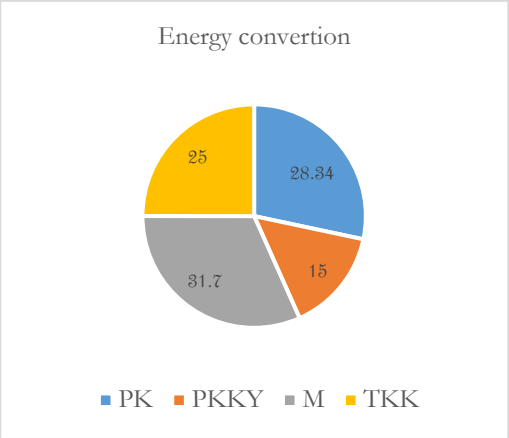
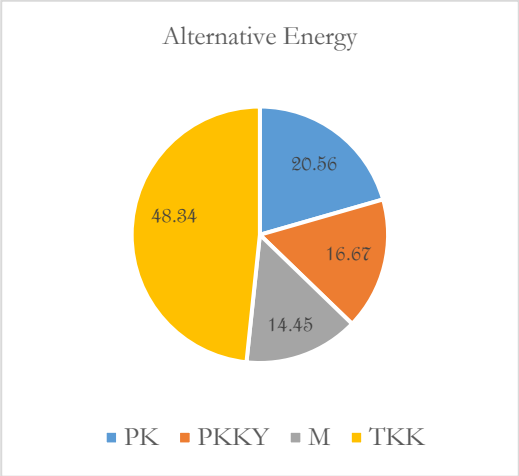


Figure 3
Students' Understanding of the Alternative Energy Sub-Chapter



Misconceptions that occur in the alternative energy sub-chapter are 14.45% as seen in Figure 3. The misconceptions that occur in this sub-concept are classified as low when compared to the other two sub-concepts. This demonstrates that a greater proportion of pupils comprehend the idea than have misconceptions. When it comes to the sub concept of alternative energy, there is a misperception that students are unable to match the geographical conditions in Indonesia with alternative energy that is suitable for development. Or students are unable to state the correct reason why an alternative energy is suitable to be developed in a particular area.

The cause of students' misconceptions at Riyadul Mubarok Integrated Senior High School is students' associative thinking. Associative thinking is words or sentences that have different meanings (Kusumawati, 2014; Adi, et.al, 2019). This could be purely due to students' thinking or choosing words that have two different meanings. Researchers discovered this during interviews with students. This is supported by answers that are still wrong. This is consistent with study by Hidayat (Hidayat, et al., 2020) that indicates that students' own ideas or inadequate communication abilities can lead to misconceptions (Zulfa, et.al, 2020). The level of student misconception depends on the student's thinking in building their own knowledge.

Furthermore, in this study, students' knowledge of renewable energy material was classified as low, with 23.34% of students understanding the concept, indicating that students' understanding of this material was still lacking so that students were unable to answer questions well. Apart from that, students are also unable to explain the answer, so there are many students who have the correct answer but are unsure about the answer. This is supported by the research results in Figure 3.1 with a presentation of 17% who correctly responded yet had doubts about their response.

Apart from that, even though there are multiple visuals and videos inserted throughout the session, the teacher still conducts the class using the traditional lecture style. Inappropriate and less engaging teaching methods might make pupils bored, which makes it difficult for them to fully comprehend the subject matter. According to research by Latifah, et al. (2020), one of the things producing misconceptions among students is the approaches utilized in the classroom. Therefore, teachers must have several variations of learning models such as PBL (Fitriyani, et.al, 2024), Inquiry (Patonah, et.al, 2018), STEM (Rohmah, et.al, 2021) and other learning models.

Conclusions

The information given leads to the conclusion that: The misconception profile of class This can be overcome by enriching students' knowledge and experience and correcting conceptual errors that occur. The sub-concept which has the highest misconception category is in the energy conversion sub-concept which is in the medium category with a presentation of 14.45%, the alternative energy sub-concept has the lowest misperception category, with a value of 31.7%.

References

Adi, Yogi Kuncoro, and Ndaru Mukti Oktaviani. "Faktor-faktor penyebab miskonsepsi siswa SD pada materi life processes and living things." Profesi Pendidikan Dasar 6.1 (2019): 91-104.

Afifah, Yeni Nur, and Mahanani Tri Asri. "Profil Miskonsepsi pada Submateri Struktur dan Fungsi Sel Menggunakan Four Tier Test." Berkala Ilmiah Pendidikan Biologi (BioEdu) 9.3 (2020): 390-396.

Ashad, Bayu Adrian. "Pemanfaatan PLTS Untuk Penerangan Jalan SMA Negeri 13 Maros." JBIMA: Jurnal Pengabdian kepada Masyarakat 1.1 (2024).

Ardiyanti, Yusi, and Marsah Rahmawati Utami. "Identifikasi miskonsepsi siswa pada materi sistem reproduksi." Biosfer: Jurnal Biologi dan Pendidikan Biologi 2.2 (2017): 18-23.

Artiawati, Putri Retno, Riski Mulyani, and Yudi Kurniawan. "Identifikasi kuantitas siswa yang miskonsepsi menggunakan three tier-test pada materi gerak lurus beraturan (GLB)." JIPF (Jurnal Ilmu Pendidikan Fisika) 1.1 (2016): 13-15.

Azizah, Nur Laeli, Lina Mahardiani, and Sri Yamtinah. "Analisis Miskonsepsi Dengan Tes Diagnostik Two-Tier Multiple Choice Dan In-Depth Interview Pada Materi Asam Basa." Jurnal Pendidikan Kimia 11.2 (2022): 168-177.

Dewi, Suci Zakiah, and Tatang Ibrahim. "Pentingnya pemahaman konsep untuk mengatasi miskonsepsi dalam materi belajar IPA di sekolah dasar." Jurnal Pendidikan UNIGA 13.1 (2019): 130-136.

Dzulfikar, Ahmad, and Ciptianingsari Ayu Vitantri. "Miskonsepsi matematika pada guru sekolah dasar." Suska Journal of Mathematics Education 3.1 (2017): 41-48.

Erdiwansyah, Erdiwansyah, et al. "Menuju Masa Depan Hijau: Sosialisasi Pemanfaatan Energi Terbarukan di Kabupaten Gayo Lues, Provinsi Aceh." BAKTIMAS: Jurnal Pengabdian pada Masyarakat 6.1 (2024): 19-30.

Fahmi, Fahmi. "Miskonsepsi dalam pembelajaran kimia di sekolah." Repository Universitas Lambung Mangkurat (2018).

Fenti, Susi, Siti Patonah, and Harto Nuroso. "Pengembangan Instrumen Keterampilan Komunikasi Ilmiah dalam Pembelajaran Fisika." Jurnal Penelitian Pembelajaran Fisika 8.2 (2017).

Fitriyani, Nurul, Siti Patonah, and Arfanny Hanum. "Efektivitas Model Pembelajaran Project Based Learning Berbantuan Media Diorama Lapisan Atmosfer terhadap Hasil Belajar Peserta Didik Fase C." Journal on Education 6.3 (2024): 15992-16001.

Hasan, Meiske, Astin Lukum, and Erni Mohamad. "Identifikasi Miskonsepsi Menggunakan Tes Pilihan Ganda dengan CRI Termodifikasi Materi Larutan Elektrolit dan Non Elektrolit." Jambura Journal of Educational Chemistry 3.1 (2021): 27-32.

Hidayat, F. A., Irianti, M., & Fathurrahman, F. (2020). Analisis Miskonsepsi Siswa Dan Faktor Penyebabnya Pada Pembelajaran Kimia Di Kabupaten Sorong. BASA (Barometer Sains) Jurnal Inovasi Pembelajaran IPA, 1(1). (https://unimuda.e-journal.id/basa/article/view/456, diakses 31 Juli 2022).

Helmi, H., et al. "Perubahan miskonsepsi siswa pada perkuliahan evolusi melalui dual situated learning model." Bioedukasi: Jurnal Pendidikan Biologi 12.2 (2019): 176-180.

Irani, Nafisha Vebiola, Zulyusri Zulyusri, and Rahmawati Darussyamsu. "Miskonsepsi materi biologi sma dan hubungannya dengan pemahaman siswa." Jurnal Biolokus: Jurnal Penelitian Pendidikan Biologi Dan Biologi Vol 3.2 (2020).

JUMIATI, SRI. "Implementasi Pembelajaran Etnosains Terintegrasi Ke Dalam Pelajaran Ipa Materi Keanekaragaman Hayati Dan Energi Terbarukan Di MAN Paser." ACADEMIA: Jurnal Inovasi Riset Akademik 3.1 (2023): 74-80.

Kamarullah, Kamarullah. "Pendidikan matematika di sekolah kita." Al Khawarizmi: Jurnal Pendidikan Dan Pembelajaran Matematika 1.1 (2017): 21-32.

Khairaty, Nurul Inayah, A. Mushawwir Taiyeb, and Hartati Hartati. "Identifikasi miskonsepsi siswa

pada materi sistem peredaran darah dengan menggunakan three-tier test di kelas XI IPA 1 SMA Negeri 1 Bontonompo." Jurnal Nalar Pendidikan 6.1 (2018): 7-13.

Kusumawati, Ike, Eny Enawaty, and Ira Lestari. "Miskonsepsi Siswa Kelas XII SMA Negeri 1 Sambas pada Materi Reaksi Reduksi Oksidasi." Jurnal Pendidikan dan Pembelajaran Khatulistiwa (JPPK) 3.6 (2014).

Latifah, U. L. N., Wakhyudin, H., & Cahyadi, F. (2020). Miskonsepsi Penyelesaian Soal Cerita Matematika Materi FPB dan KPK Sekolah Dasar. JRPD (Jurnal Riset Pendidikan Dasar), 3(2), 181-195. (DOI: https://doi.org/10.26618/jrpd.v3i2.4078).

Malikha, Ziadatul, and Mohammad Faizal Amir. "Analisis miskonsepsi siswa kelas vb min buduran sidoarjo pada materi pecahan ditinjau dari kemampuan matematika." Pi: Mathematics Education Journal 1.2 (2018): 75-81.

Mukhlisa, Nurul. "Miskonsepsi pada peserta didik." SPEED Journal: Journal of Special Education 4.2 (2021): 66-76.

Noegroho, Dwi Herry, F. X. Sudarsono, and Samsi Haryanto. "Identifikasi miskonsepsi dalam pembelajaran IPA ruang lingkup materi dan sifatnya di SMP Joannes Bosco Yogyakarta kelas VIII tahun ajaran 2014-2015." Wiyata Dharma: Jurnal Penelitian dan Evaluasi Pendidikan 5.1 (2017): 22-30.

Nurulwati, Nurulwati, and Ayu Rahmadani. "Perbandingan hasil diagnostik miskonsepsi menggunakan threetier dan fourtier diagnostic test pada materi gerak lurus." Jurnal Pendidikan Sains Indonesia (Indonesian Journal of Science Education) 7.2 (2019): 101-110.

Pebriyanti, Dwi, Hairunnisyah Sahidu, and Sutrio Sutrio. "Efektifitas model pembelajaran perubahan konseptual untuk mengatasi miskonsepsi fisika pada siswa kelas X SMAN 1 Praya Barat tahun pelajaran 2012/2013." Jurnal Pendidikan Fisika dan Teknologi 1.2 (2015): 92-96.

Patonah, Siti, Duwi Nuvitalia, and Ernawati Saptaningrum. "Content analysis of science material in junior school-based inquiry and science process skills." Journal of Physics: Conference Series. Vol. 983. No. 1. IOP Publishing, 2018.

Rohmah, Miftakhur, Sigit Priyono, and Resti Septika Sari. "Analisis Faktor-Faktor Penyebab Miskonsepsi Peserta Didik Sma." UTILITY: Jurnal Ilmiah Pendidikan Dan Ekonomi 7.01 (2023): 39-47.

Rohmah, Risma Ulinnuha, and Wirawan Fadly. "Mereduksi miskonsepsi melalui model conceptual change berbasis STEM education." Jurnal Tadris IPA Indonesia 1.2 (2021): 189-198.

Rusilowati, Ani. "Profil kesulitan belajar fisika pokok bahasan kelistrikan siswa SMA di kota Semarang." Jurnal Pendidikan Fisika Indonesia 4.2 (2006).

Sari, Agung Suci Dian, Ning Nikma, and Saniatul Kamilah. "Analisis Uji Miskonsepsi Siswa Dengan Two-Tier Multiple Choice Menggunakan Sistem Hibrid Learning Pada Masa Pandemi." Jurnal Education and Development 10.3 (2022): 138-142.

Sheftyawan, Widya Bratha, Trapsilo Prihandono, and Albertus Djoko Lesmono. "Identifikasi miskonsepsi siswa menggunakan four-tier diagnostic test pada materi optik geometri." Jurnal Pembelajaran Fisika 7.2 (2018): 147-153.

Shofiyah, Noly. "Penerapan model pembelajaran modified free inquiry untuk mereduksi miskonsepsi mahasiswa pada materi Fluida." SEJ (Science Education Journal) 1.1 (2017): 19-28.

Sholikah, Annis, Dwi Suci Febriyanti, and Bakhrul Rizky Kurniawan. "Analisis Miskonsepsi Mahasiswa Calon Guru Fisika Menggunakan Quizziz Pada Pokok Bahasan Optika Geometri." Jurnal Penelitian Pembelajaran Fisika 11.1 (2020): 27-36.

Siswaningsih, Wiwi, et al. "Pengembangan tes diagnostik two-tier untuk mengidentifikasi miskonsepsi pada materi kimia siswa SMA." Jurnal Pengajaran MIPA 19.1 (2014): 117-127.

Sugita, Iqbal, et al. "Penerapan model pembelajaran relating, experiencing, applying, cooperating, transferring (REACT) untuk meningkatkan pemahaman konsep fisika sma." *Physics Education Research Journal* 2.2 (2020): 141-150.

Tatsar, Mohammad Zaky, Daniel Cholilur Rohman, and Umu Salamah. "Analisis Kemampuan Kreativitas Siswa Berbasis Proyek Energi

Terbarukan Berbantuan Model Pembelajaran Project Based Learning pada Kurikulum Merdeka." QUANTUM: Jurnal Pembelajaran IPA dan Aplikasinya 3.1 (2023): 23-35.

Wilantika, Nurul, Nur Khoiri, and Saifullah Hidayat. "Pengembangan penyusunan instrumen four-tier diagnostic test untuk mengungkap miskonsepsi materi sistem ekskresi di sma negeri 1 mayong jepara." *Phenomenon: Jurnal Pendidikan MIPA* 8.2 (2018): 200-214.

Wulandari, Fitriani, Haratua Tiur Maria, and Diah Mahmuda. "Miskonsepsi siswa tentang suhu dan kalor menggunakan tes diagnostik di sma negeri 1 sejangkung." Jurnal Pendidikan dan Pembelajaran Khatulistiwa (JPPK) 7.9 (2018).

Yuliati, Yuyu. "Miskonsepsi siswa pada pembelajaran IPA serta remediasinya." Bio Educatio 2.2 (2017): 279470.

Zafitri, Reni Eka, Syarif Fitriyanto, and Fahmi Yahya. "Pengembangan tes diagnostik untuk miskonsepsi pada materi usaha dan energi berbasis adobe flash kelas XI di MA NW Samawa Sumbawa Besar Tahun Ajaran 2017/2018." Jurnal Kependidikan 2.2 (2018): 19-34.

Zayyinah, Zayyinah, Fatimatul Munawaroh, and Irsad Rosidi. "Identifikasi Miskonsepsi Siswa SMP Dengan Certainty Of Response Index (CRI) Pada Konsep Suhu dan Kalor." Natural Science Education Research 1.2 (2018): 78-89.

Zulfa, Alfi Rodhiyah, and Zuhriyatur Rosyidah. "Analysis of communication skills of junior high school students on classification of living things topic." INSECTA: Integrative Science Education and Teaching Activity Journal 1.1 (2020): 78-92.