JURNAL
Pendidikan, Sains, Sosial dan Agama
SEKOLAH TINGGI AGAMA BUDDHA NEGERI RADEN WIJAYA WONOGIRI

Identification Of Students' Misconceptions And Information Sources Using The Five-Tier Diagnostic Test Model Fluid Dynamic Concept

Taufik Hidayat Harita[1], Hebron Pardede[2], Juliaster Marbun[3], Bajongga Silaban[4], Irving Josafat Alexander Silaban[5]
Pendidikan Fisika, Fakultas Keguruan Dan Ilmu Pendidikan, Universitas HKBP Nommensen, Medan, Indonesia
taufikhidayat.harita@student.uhn.ac.id, hebronpardede@uhn.ac.id, juliaster.marbun@uhn.ac.id, bajongga.silaban@uhn.ac.id, irving.alexander@uhn.ac.id

Article History:
Accepted: 6 December 2024 *Revised: 8 May 2025* *Published: 30 August 2025*

Abstract

One of the main issues in physics education is the high incidence of student misconceptions, particularly regarding the concept of dynamic fluids. Misconceptions can hinder conceptual understanding and negatively affect students' cognitive abilities in comprehending more advanced material. This study aims to identify the level of misconceptions and determine the sources of information that contribute to the formation of these misconceptions. The research employed a descriptive quantitative approach using the Five-Tier Diagnostic Test instrument, which consists of five components: answer selection, confidence in the answer, reasoning, confidence in the reasoning, and source of information. The research subjects were all 19 eleventh-grade students of SMA Swasta Methodist 7 Medan in the 2024/2025 academic year. The results showed that 12% of the students experienced misconceptions, with the most dominant subtopic being the continuity equation (14%). The primary sources of misconceptions were identified as personal reasoning (25%) and peer interaction (20%). These findings indicate that both internal and social factors significantly influence the development of incorrect conceptual understanding. Therefore, the use of a five-tier diagnostic instrument is recommended as an early identification tool to design more effective and targeted learning improvement strategies.

Keywords: Misconception, Dynamic Fluids, Five-Tier Diagnostic Test, Source Of Information, Conceptual Understanding

INTRODUCTION

Education is a conscious and planned effort aimed at developing human morals and character, and also serves to prepare students to become members of society capable of contributing to the development and future of the nation (Sitorus & Dalimunthe, 2024) . In this context, teachers play a crucial role by implementing education through learning activities, namely by teaching students (Fajar et al., 2023).

Teaching is an activity of directing, providing convenience in how to find something (not giving something) based on the abilities of the teacher referring to the Republic of Indonesia Law No. 14 of 2005 concerning teachers and lecturers, that teachers are professional educators with the main task of educating, guiding, directing, training, assessing, and evaluating students in early childhood education on the formal education path, basic education, and secondary education, from the statement From the above, it can be concluded that teaching is a professional activity carried out by teachers to guide and facilitate students in finding knowledge based on their own abilities.

Physics is a branch of Natural Sciences (IPA) which is a systematic effort to build and organize knowledge in the form of explanations that can be tested and are able to predict natural phenomena (Minister of Education and Culture Regulation Number 59 of 2014), according to (Prasetyo Zuhdan K,) fun, creative and challenging physics learning can be implemented by choosing approaches, methods, and media that are appropriate to the material presented, in addition physics teachers must also act as good facilitators and mediators in creating an interactive and inspiring learning atmosphere so that students are more active in exploring physics concepts.

Many students experience difficulties in understanding physics concepts, which causes misconceptions that can hinder the learning process. To understand physics concepts effectively, special skills are needed, such as mastering how to formulate equations or calculations, so that not everyone who has intelligence is able to understand physics concepts (Laila, 2024).

One of the obstacles that often occurs in physics learning is misconception, namely the difference in students' understanding that does not correspond to the concepts that have been determined by experts in the context of learning (Zufri et al., 2024), these misconceptions are caused by several main factors, firstly they arise within the students themselves, the initial wrong understanding of concepts formed since the previous level of education or knowledge that already exists in the minds of students, this causes students to find it difficult to grasp the core of the concept as a whole, so that students are not able to interpret the concept correctly, the second factor comes from teachers as educators according to about 20% of students' misconceptions are caused by the role of teachers, in the learning process the teacher is more active in class, so that students play a less active role and experience difficulty in understanding the material being studied, the third factor causing misconceptions is from the textbooks used (Diny, 2024) , therefore, the causes of misconceptions in learning are very important to be addressed so that prolonged misconceptions do not occur.

To overcome this, strategic steps are needed such as identifying student misconceptions, tracing the causes, and designing appropriate learning interventions, according to Suparno Paul (2013) steps that can be taken to overcome misconceptions are (1) looking for or revealing misconceptions made by students, (2) trying to find the causes of these misconceptions, (3) and looking for appropriate treatment to overcome them. To overcome this, it is necessary to identify and analyze the existence of misconceptions in learning materials, an instrument is needed that can reveal student misconceptions in depth. One effective way to detect misconceptions is through the use of diagnostic tests, which are specifically designed to reveal students' thought patterns and understanding of a concept (Safitri, 2022).

Based on the results of interviews conducted by researchers with teachers at Methodist 7 Medan Private High School, especially with physics teachers, teachers realized that there were still many students who had misconceptions about physics learning, which they considered as an abstract concept, teachers stated that these misconceptions had emerged since students were in junior high school, as an effort to overcome these problems, teachers had implemented various learning strategies, including teachers giving tests, demonstrations, practicums and using interesting learning approaches, this approach aims to help students understand physics concepts more concretely, but teachers also stated that there had not been any specific and systematic tests to measure the level of students' misconceptions, therefore, an instrument was needed that could identify and measure misconceptions more accurately so that learning actions could be taken that were in accordance with students' needs more accurately.

Conventional evaluation instruments, such as multiple-choice or essay tests, generally only measure basic cognitive aspects through right-or-wrong answers, without being able to reveal the reasoning behind the answers, the level of confidence students have in their answers, or the sources of information used to develop their understanding. This limitation highlights the need for more comprehensive and diagnostic evaluation instruments to gain a deeper understanding of students' conceptual understanding and potential misconceptions.

Diagnostic tests are tests used to identify students' strengths and weaknesses in learning, which can then be used to adjust teaching strategies (Ananda et al., 2025) . According to Jubaedah (2017) in (Irianti, 2021), diagnostic tests are instruments used to detect misconceptions or misunderstandings of student concepts. According to Wijaya (2016), diagnostic tests used include interviews, questionnaires, open-ended questions, and multiple-choice tests. Furthermore, multiple-choice tests were developed into multi-tier tests with two tiers (two-tier), three tiers (three-tier), four tiers (four-tier), and five tiers (five-tier). In this study, a five - tier diagnostic test instrument was used.

Several previous studies have been conducted to identify student misconceptions in physics learning. One frequently used approach is multi-tier diagnostics, as in this study. A study by (Erlangga & Susanti, 2022) showed that a tier -based diagnostic approach can reveal students' conceptual understanding and the sources of errors in understanding concepts. Furthermore, this study also found that factors causing misconceptions include students' lack of understanding of concepts, difficulty converting units, and low confidence in asking questions to teachers (Ananda et al., 2025).

Other research conducted by (Simamora et al., 2023a) discusses the Identification of Student Misconceptions Using Five Tier Diagnostic A test on static fluid material at SMAN 7, Jambi City. The results of this study indicate that many students still experience misconceptions in physics learning. This study specifically examines the concept of fluid dynamics using the Five-Tier model. Diagnostic Testing and simultaneously tracing the source of misconceptions is still very limited. (Andani, 2022).

This study focuses on identifying students' misconceptions in the concept of fluid dynamics using the Five-Tier approach. Diagnostic Tests, which are still rarely applied in the context of physics learning in schools. The instrument used in this study was designed not only to measure the level of misconceptions, but also to explore the sources of information that shape students' understanding. (Kusuma, 2025) .

Based on the description above, the researcher is interested in conducting research with the title "Identifying Misconceptions and Information Sources of Students Using the Five-Tier Model" Diagnostic Test on the Concept of Dynamic Fluids ". The researcher hopes that through this research, the causes of students experiencing misconceptions and even experiencing a lack of understanding of the concept can be identified

RESEARCH METHODS

In accordance with the objective of this research, namely to determine the existence of misconceptions and the dominant sources of misconceptions experienced by students in the material on fluid dynamics, the researcher used a quantitative method. According to (Mukarromah, 2022) method study quantitative there is method based on on philosophy positivism used For research on population and sample certain, data collected through instrument research. Approach quantitative chosen Because study This involving data collection in form number through test calculated diagnostics in a way statistics simple.

Design research used is descriptive, namely research that aims For describe something phenomenon in a way systematic without give treatment or intervention to variables studied. According to Arikunto in (Aminatussaadah, 2022) Design study descriptive aim For get description about something phenomenon or test connection between events that have occurred happen on subject research. In design this, researcher No do manipulation to treatment and arrangement subject research. Research descriptive focus on effort describe and interpret object study in accordance with condition actually. In context this research will focus on identification types misconceptions experienced participant educate based on results Five-Tier Diagnostic test.

Study This held at Methodist 7 Private High School Medan, Jalan Madong Lubis No. 7 Medan. Time study This implemented in the even semester of the 2024/2025 academic year Population in study This is all over participant educate Class XI Private High School Medan 7 Year Methodist Academic Year 2024/2025. Population is overall object or subjects who have characteristics and quantity certain that have been set by researchers as focus study, so that can analyzed and drawn conclusion based on results study the (Musdar et al., 2025) . Based on the data obtained, the amount participant educate grade XI only consists of from One class with a total of 19 people.

Sample is part from population that has characteristics certain and made as data sources in something research. Considering amount population in study This relatively small and only consists of on One class, then all over member population made into as sample. By Because that, technique taking samples used is saturated sampling or total sampling. Technique This used when amount population classified as a little, so that all member population made into sample study (ARBAVIONITA, 2025) .

Data obtained from test diagnostic Then analyzed For identify various type emerging misconceptions. Diagnostic data the counted For determine most dominant source reason misconceptions. Analysis done with method classify answer participant educate based on pattern error that occurred as well as level belief they to the answers given. Results analysis This will show as far as where participant educate experience misconception as well as category the most dominant misconception on material fluid dynamic (Sandra et al., 2022)

RESULTS AND DISCUSSION

Instrument Trial Results

A trial of the five-tier diagnostic test instrument on the concept of fluid dynamics was conducted on 16 students from HKBP Sidorame Medan Private High School, which was conducted on May 25, 2025. The purpose of this trial was to evaluate the quality of the test items empirically before being used in the main research, especially regarding the construct validity and reliability of the instrument. This evaluation was carried out through an analysis of the level of difficulty of the questions, the discriminating power, and the calculation of the reliability coefficient (Zohdi & Kafrawi, 2023) .

Research result

This section will describe the research results regarding the general overview based on the research data obtained. The data to be described was obtained from the results of a test using a diagonal test. *five-tier* As many as 20 questions cover fluid dynamics material, the diagnostic instrument has gone through a content validation process by experts and field trials, ensuring adequate construct validity and reliability. (Oktavia, 2022) . The research data was then processed by the researcher and the research results were as follows:

Category of Student Understanding of the Concept of Dynamic Fluids

Students' answers were grouped into categories of understanding level based on a combination of answers: understanding the concept, partially understanding the concept, not understanding the concept, and misconceptions. The results of data processing from the test obtained percentages based on the overall student understanding category, which are presented in the following graph. (Silaban et al., 2024) .

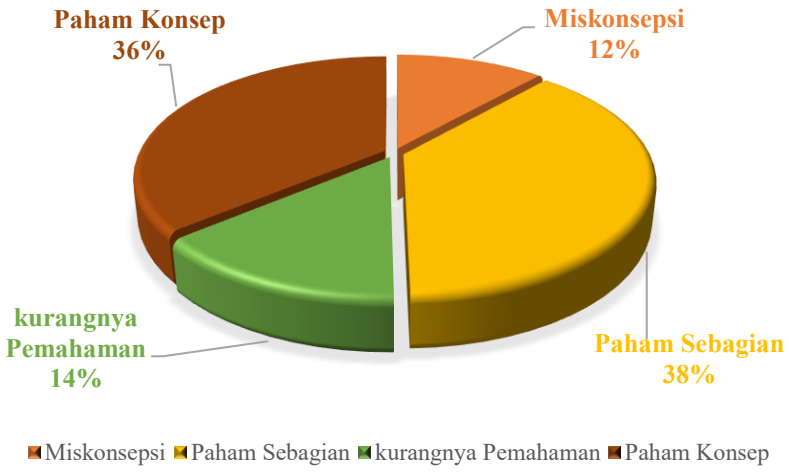

Figure 1. Percentage of Students' Concept Mastery Level in Dynamic Fluid Material

From chart above, it can be seen that students' conceptual mastery of fluid dynamics material shows different variations. The partial understanding category represents the largest proportion, covering 38% of the total students. This figure is closely followed by the conceptual understanding category, which reaches 36% of students. Meanwhile, the

percentage of students who fall into the lack of understanding category is 14%. (Permana & Bakri, 2024). The misconception category found the lowest proportion among all categories, namely 12%. This distribution indicates that the majority of students have at least a partial or complete understanding of the concept of fluid dynamics, while the proportion of students experiencing pure misconceptions is relatively small compared to other understanding categories (WAHYUNI, 2022) .

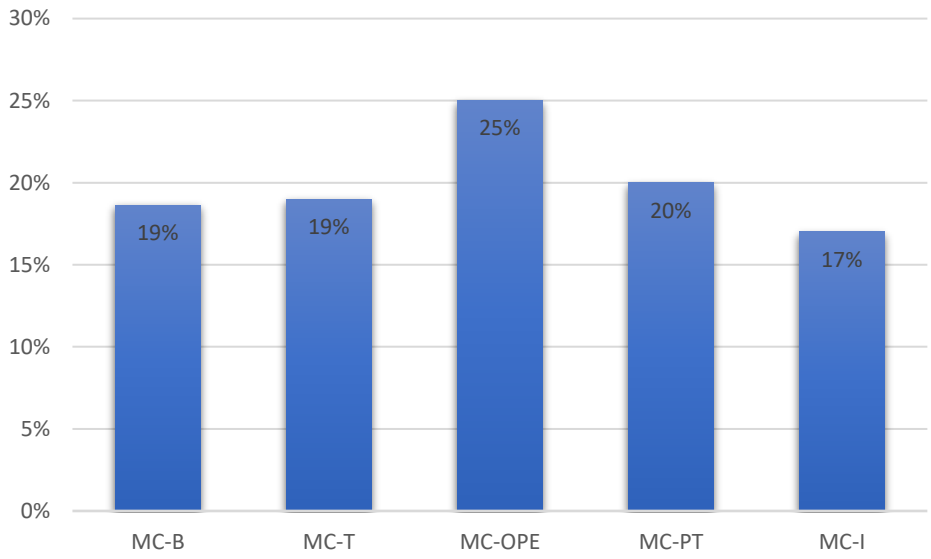

Figure 2. Average Percentage of Students Experiencing Misconceptions Based on Information Sources

misconception categories experienced by students based on the learning sources identified for each question, the data shows variations in the sources of misconceptions between questions, with several sources being dominant on average. Overall, misconceptions originating from interactions with friends or family members (MC-PT) and from personal thoughts (MC-OPE) have the highest average percentages, namely 25% and 20% of the total misconceptions per question, with an average of 8 and 11 students, respectively. (Ramadhani et al., 2023) . This indicates that internal factors such as student reasoning or previous experiences are often the root of misconceptions. On the other hand, misconceptions originating from books (MC-B), friends (MC-T), and the internet (MC-I) also contribute, with relatively balanced average percentages of 19% and 17% for MC-B and MC-I, respectively, and 19% for MC-T, each involving an average of 7 to 11 students.

Specifically, in several questions, the dominance of certain sources was evident. For example, in Questions 5, 10, and 19, all misconceptions (100%) originated from MC-OP. Meanwhile, in Question 8, misconceptions originated entirely from the internet (MC-I). Questions 1 and 17 showed the dominance of MC-T and MC-PT as the main causes of misconceptions. This pattern underscores that intervention strategies to address misconceptions need to consider the diverse sources of learning resources, both internal and external to students. (Sandra, 2022) .

Discussion

five-tier diagnostic test instrument has one combination of answers that falls into the misconception category. If a student answers the first level question incorrectly, then answers "sure" at the second level, then answers "wrong" at the third level, and then answers "sure" again at the fourth level, then the student's answer falls into the misconception category. (Agnia, 2024) . Questions at the fifth level, namely the sources of information used by students in answering questions, will later be said to be sources of information that cause student misconceptions (Simatupang, 2023) . For more details, see Table 4.7 below:

Table 1. Five-item Diagnostic Test Answer Combinations Tier In Misconception Category

Tier-1	*Tier-2*	*Tier-3*	*Tier-4*	*Tier-5*	**Conception Level**
0	Y	0	Y	Book	MC-B
				Teacher	MC-T
				Personal Thoughts	MC-PT
				Friend	MC-OPE
				Internet	MC-I

The sample size used was 20 questions, multiplied by the total sample size of 19 students, which amounted to 380 questions answered. Of the 19 students, 12% were identified as having misconceptions. (Solehat, 2020)

This instrument, consisting of 20 questions, represents the four sub-topics that are the focus of this study. The results show that for each sub-topic, identified as having misconceptions. Based on the percentage chart of students' misconceptions based on the dynamic fluid sub-material, it is known that the continuity equation identified misconceptions of 14%, sub-material Bernoulli's law 12%, sub-material Theorem Torricelli 11% and Bernoulli's law 12%. Each sub-material identified misconceptions

CONCLUSION

Based on results research obtained from test five-tier diagnostics against participant educate Class XI Private High School methodist 7 Medan, can concluded that :

1. Level of mastery draft participant educate on material fluid dynamic show different variations. The majority participant educate own at least understanding partial or full to concept, with category understand part reached 38% and understood draft 36 % of the total participants educate. Although however, still identified existence participant less educated understanding by 14% and 12% of participants educate experience misconceptions.
2. Misconception identified on every sub-material fluid dynamic that becomes focus study This is the most dominant misconception found on sub-material equality continuity by 14%, followed by by Bernoulli's law of 12%, application Bernoulli's law is 12%, and Torricelli's theorem is 11%
3. Analysis to source information misconception show that misconceptions experienced participant educate can originate from diverse source. On average,

misconceptions that originate from from Friend or member family (MC-OPE) shows percentage highest by 25% of total misconceptions per question, involving an average of 8 participants educate. This is indicates that internal factors such as reasoning or intuition participant educate often become root misconceptions. Misconceptions that originate from from thinking personal (MC-PT) with an average of 20%, involving an average of 11 participants educate. Other sources such as book (MC-B) and teacher (MC-T) respectively contributed 19%, while the internet (MC-I) was 17%. The pattern This underline that misconception is complex and can be a phenomenon formed from various track acquisition information participant educate.

4. Five-Tier Diagnostic Test instrument developed has fulfil criteria quality good instrument. Test validity content show instrument own validity tall For aspect material (0.90), construct (0.88), and language (0.89). Instruments Also stated reliable with mark KR-20 coefficient of 0.93, indicating high internal consistency. Level of difficulty question varied (40% easy, 52% moderate, 8% difficult) and power differentiator part big grains question including in category Good once (80%), confirmed eligibility instrument For measure various levels understanding and identifying misconception participant educate.

Suggestion

Based on results research and conclusions that have been presented, several suggestions were put forward as input that can be considered by various party :

1. For Physics Teachers : Remembering that misconception Still found and some big sourced from thinking personal or experience participant educate, teachers are advised For more proactive in identify pre-conception participant educate before start learning.
2. For Participant Educate : Participants educate expected For more critical in accept information, good from books, friends, and the internet. Important for participant educate For always confirm understanding they with valid and invalid sources hesitant ask to the teacher if find ambiguity draft.
3. For Researchers Next : Research This can become base For development more Continued. Recommended For do study similar with scale more samples big or on level different education For get more generalization wide

BIBLIOGRAPHY

agnia, S. (2024). *Identifikasi Konsepsi-Konsepsi Peserta Didik Dan Sumbernya Pada Fluida Dinamis Menggunakan Instrumen Berformat Five-Tier Di Sma Negeri 1 Kota Jambi*. Universitas Jambi.

Aminatussaadah, A. (2022). *Pengembangan Five-Tier Diagnostic Test Berbasis Web Pada Materi Gelombang*. Universitas Jambi.

Ananda, R., Ginting, F. W., Sari, A. M., Safriana, S., & Setiawan, T. (2025). Analisis Miskonsepsi Siswa Melalui Five-Tier Diagnostic Test Pada Materi Kinematika Gerak Berbasis Quizziz. *Lamda: Jurnal Ilmiah Pendidikan Mipa Dan Aplikasinya*, *5*(2), 341–349. Https://Doi.Org/Https://Doi.Org/10.58218/Lambda.V5i2.1388

Andani, N. (2022). *Pengembangan Instrumen Berformat Five-Tier Untuk Mengidentifikasi*

Miskonsepsi Siswa Pada Materi Elastisitas Dan Hukum Hooke. Universitas Jambi.

Arbavionita, D. (2025). *Identifikasi Miskonsepsi Peserta Didik Pada Materi Larutan Asam Dan Basa Menggunakan Instrumen Tes Diagnostik Five-Tier Multiple Choice*. Universitas Islam Negeri Sultan Syarif Kasim Riau. Https://Doi.Org/Http://Repository.Uin-Suska.Ac.Id/Id/Eprint/90572

Diny, S. P. (2024). *Analisis Miskonsepsi Mata Pelajaran Biologi Pada Materi Sistem Kekebalan Tubuh Menggunakan Five Tier Diagnostic Pada Peserta Didik Di Sma Negeri 16 Bandar Lampung*. Uin Raden Intan Lampung.

Fajar, M. R., Kusasi, M., & Almubarak, A. (2023). Pengembangan Tes Diagnostik Five-Tier Untuk Mengidentifikasi Miskonsepsi Peserta Didik Dalam Materi Hidrokarbon Kelas Xi Mipa. *Jcae (Journal Of Chemistry And Education)*, *6*(3), 129–138.

Kusuma, P. N. (2025). *Pengembangan Tes Diagnostik Five-Tier Untuk Mengidentifikasi Miskonsepsi Ipa Dan Sumber Penyebabnya Pada Peserta Didik Kelas Vii*. Universitas Pendidikan Ganesha. Https://Doi.Org/Http://Repo.Undiksha.Ac.Id/Id/Eprint/26584

Laila, E. (2024). Identifikasi Miskonsepsi Peserta Didik Menggunakan Diagnostic Test Berformat Five-Tier Berbasis Website Pada Materi Pesawat Sederhana. *Jurnal Luminous: Riset Ilmiah Pendidikan Fisika*, *5*(1), 19–24. Https://Doi.Org/10.31851/Luminous.V5i1.11728

Mukarromah, L. (2022). *Identifikasi Miskonsepsi Peserta Didik Menggunakan Five-Tier Digital Diagnostic Test Pada Materi Dinamika Rotasi Dan Kesetimbangan Benda Tegar Di Sma Negeri 17 Kabupaten Tangerang*. Jakarta: Fitk Uin Syarif Hidayatullah Jakarta. Opgehaal Van Https://Repository.Uinjkt.Ac.Id/Dspace/Handle/123456789/63882

Musdar, M., Hamid, A., & Saputri, M. (2025). Identifikasi Miskonsepsi Mahasiswa Fisika Menggunakan Five-Tier Diagnostic Test (Ftdt) Pada Materi Kesetimbangan Benda Tegar. *Gravitasi: Jurnal Pendidikan Fisika Dan Sains*, *8*(01), 31–38. Https://Doi.Org/Https://Doi.Org/10.33059/Gravitasi.Jpfs.V8i01.11494

Oktavia, W. D. (2022). *Pengembangan Instrumen Berformat Five-Tier Untuk Mengidentifikasi Miskonsepsi Siswa Tentang Gaya Sentripetal Dan Sentrifugal Miskonsepsi, Gaya Sentripetal Dan Sentrifugal, Pengembangan, Five-Tier.* Universitas Jambi.

Permana, A. H., & Bakri, F. (2024). Identifikasi Tingkat Pemahaman Konsep Siswa Pada Materi Gelombang Menggunakan Five-Tier Diagnostic Test Online. *Prosiding Seminar Nasional Fisika (E-Journal)*, *12*.

Ramadhani, I., Pardi, H., & Fitriyah, D. (2023). *Pengembangan Instrumen Five Tier Multiple Choice Diagnostic Test Untuk Mengidentifikasi Miskonsepsi Siswa Dan Penyebabnya Pada Materi Hidrolisis Garam*. Universitas Maritim Raja Ali Haji.

Safitri, P. R. (2022). *Pengembangan Instrumen Five-Tier Untuk Mengidentifikasi Miskosenpsi Siswa Pada Topik Cahaya*. Universitas Jambi.

Sandra, R. O. (2022). *Pengembangan Instrumen Miskonsepsi Berformat Five-Tier Pada Topik Tekanan Menggunakan Dreamweaver Berbasis Web*.

Sandra, R. O., Maison, M., & Kurniawan, D. A. (2022). Pengembangan Instrument

Miskonsepsi Menggunakan Dreamweaver Berbasis Web Pada Materi Tekanan Berformat Five-Tier. *Jurnal Fisika : Fisika Sains Dan Aplikasinya*, *7*(1), 22–28. Https://Doi.Org/10.35508/Fisa.V7i1.6575

Silaban, B., Surbakti, M. B., Silaban, I. J. A., & Purba, J. (2024). Identifikasi Miskonsepsi Peserta Didik Sma Melalui Tes Diagnostik Four-Tier Pada Hukum Newton. *Lensa: Jurnal Kependidikan Fisika*, *12*(2), 260–274.

Simatupang, A. Y. (2023). *Pengembangan Instrumen Berformat Five–Tier Berbasis Web Untuk Mengidentifikasi Miskonsepsi Pada Materi Energi Dan Hukum Kekekalan Energi*. Pendidikan Fisika.

Sitorus, D. M., & Dalimunthe, M. (2024). Pengembangan Instrumen Tes Diagnostik Five-Tier Multiple Choice Untuk Mengidentifikasi Miskonsepsi Siswa Pada Materi Kesetimbangan Kimia. *Jurnal Pendidikan Kimia Fkip Universitas Halu Oleo*, *9*(1), 55–72. Https://Doi.Org/10.36709/Jpkim.V9i1.77

Solehat, D. (2020). *Identifikasi Miskonsepsi Peserta Didik Menggunakan Metode Tes Diagnostik Five-Tier Pada Materi Termodinamika*. Jakarta: Fitk Uin Syarif Hidayatullah Jakarta.

Wahyuni, S. R. I. (2022). *Pengembangan Instrumen Five-Tier Diagnostic Test Untuk Mengidentifikasi Miskonsepsi Siswa Tentang Energi Dan Hukum Kekekalan Energi*. Universitas Jambi.

Zohdi, A., & Kafrawi, M. (2023). Analisis Tingkat Pemahaman Dan Miskosepsi Fisika Siswa Pada Materi Suhu Dan Kalor Menggunakan Five Tier Diagnostic Test Di Sman 1 Brang Rea. *Cahaya: Journal Of Research On Science Education*, *1*(1), 51–62.

Zufri, M. F., Huda, N., & Falani, I. (2024). *Pengembangan Tes Diagnostik Berbentuk Five-Tier Untuk Mendeteksi Miskonsepsi Siswa Pada Materi Bentuk Aljabar Dan Operasi Bentuk Aljabar Kelas VII Mts.* Universitas Jambi.