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Literature Study: Students' Misconceptions on Sound Waves

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Abstract
Misconception is a mistake understand draft scientifically based on understanding the beginning of something material. The aim of this research is to explore what just misconceptions experienced students on the material wave sound and identify factor the cause, which can made into reference by prospective teachers for minimize misconceptions in students and to increase understanding students on the material wave sound. This research uses method fist literature, this study identifies and summarizes findings relevant research about misconceptions in material wave sound. Of the 10 articles analyzed, misconceptions in the sub-material propagation sound own percentage the largest (80%), misconception related material connection between fast propagation, frequency and length waves (70%), misconceptions about intensity sound and influence distance (60%), on the material Doppler effect (40%). overall this research can give contribution in identify misconceptions For repair quality from learning physics and reducing misconceptions in students.

Keywords: misconceptions, students, sound waves

INTRODUCTION

Science learning has role important in the educational process. One of the branches of science is that is physics. One of the condition absolute for success in learning physics namely by mastering concept. Ability understand draft is matter important subject emphasized by schools and universities. So physics is not a subject memorization, will but lessons that require understanding and application concepts now (Kurniasih et al., 2023). However, basically in the learning that is carried out often happen misunderstandings received by students. Lack of understanding to draft plus the learning process is less than optimal cause A misconception. Mistake in understand draft scientifically based on understanding the beginning of something matter also creates misconception. If it continues continue will result in weakness quality learning knowledge knowledge nature (Fajarianingtyas, et al, 2018).

One of material in eye lesson potential physics occurrence misconceptions in students that is vibration wave Because wave own several types like wave sound and waves light. Sound is included wave mechanic It means need a medium for propagating, waves sound is longitudinal waves, namely propagating waves one way direction vibrations that occur consequence compression and stretching in gas, liquid and solid media. Waves sound resulting in 2 consequences existence vibrations that are propagated in the medium through interaction between molecule molecule the compiler. (Tipler. 1998).

The problem that becomes base this research is still often found misconceptions students on the material waves, especially wave sound. This happens because student consider draft wave this sound is still nature abstract and only can heard and not can seen so student difficulty relate it to life a day days. From several study previously show that student Still often experience misconceptions about the material wave sound. From research by Lailiyah & Ermawati 2020, it was found misconceptions in five subconcepts wave sound, where student consider wave sound as transverse waves, students think sound only

propagates in the air, not on objects solid and liquid, students believe faster sound spreads in gas (air) rather than in solid/liquid, students consider the basic tone has 1 length waves are not ½ λ, students consider intensity sound earthquake felt in all cities same, no depending on the distance, students consider the more long strings so frequency the more big even though it is getting bigger small. And students consider received frequency listener no influenced distance.

Therefore, the purpose of this research is to explore what misconceptions students experienced on the material wave sound and identify factor the cause, which can made into reference by prospective teachers for minimize misconceptions in students and to increase understanding students on the material wave sound.

METHOD

The methodology used in this research includes review library scientific for identifying, selecting, evaluating, and summarizing findings relevant research. This research uses criteria specific to determine which article will used to answer question The databases in this research are Google Scholar, Perplexity AI, SINTA, Sematintic Scholar, and Elsevier (SCOPUS) in collecting data. Searching for data in English and Indonesian using keywords Misconceptions on Sound Waves and Misconceptions on Sound Waves. Selection article chosen according to the criteria this research, namely:

1) Original articles that have been done and written
2) Articles can studied in Language English and Indonesian
3) The article was written with the aim For analyze and identify misconceptions in material wave sound
4) Article published between 2019-2025
5) Involving participant educate level School Upper Middle School
6) Published in journal scientific national and international

Stages carried out in this research started from compatibility title articles that meet the criteria previously which has been determined. Then, in the section abstract adjusted to the criteria said. Every publications are checked in a way carefully and entered in a way overall. Information obtained from relevant articles. Starting from the author's name, date and year publication, journal, objectives, methods research, variables (bound and independent), findings, and finally conclusions.

Of the 870 articles found from searches using the keywords”Misconceptions on Sound Wave Material”and”Misconception on Sound Waves”found there is about 45 articles with titles relevant to the topic research. Then through filtering criteria misconceptions There are 10 articles published in the range 2019-2025. And these 10 articles involve students at the level School Upper Middle School.

RESULT AND DISCUSSION

Selected Research Article Categories

Selected articles that discuss misconceptions about the material wave These sounds are categorized based on the year, method, samples involved, and also the learning outcomes. know whether article the can fulfil all over criteria, from results search and filtering that has been done then 10 articles were obtained that met the requirements all over criteria. In Table 1. Shown characteristics selected articles.

Table 1. Characteristics of Article l

No	Type Study	Year 2019	2020	2021	Rise 2022	2023	2024	2025	(N)
1.	Quantitative Descriptive		1		1		1		3
2.	R&D	1					1		2
3.	Descriptive Qualitative	1	1				1		3
4.	Quasi Experiment					1		1	2
	Amount								10

In table 1. designated that there are 8 types research and year rise research. Where is the type of the most research used that is quantitative quantitative descriptive (N=3) and Descriptive Qualitative (N=3). Quasi -Experimental research type (N=2), and other types study RnD (N=2).

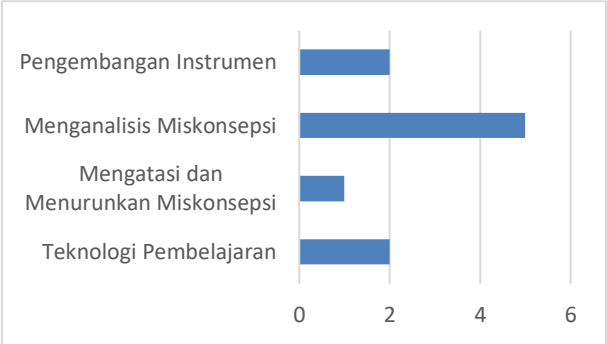

Figure 1. Main Concept of Research

General description about draft main used in articles the shown in Figure 1. Most of articles the focus analyze misconceptions students on the material wave sound. also exists articles discussing learning and development models instruments, as well as overcome and reduce misconceptions.

Table 2. List of Journals

No	Journal Name	Number of Articles
1.	Momentum: Physics Education Journal	1
2.	Journal of Physics and Physics Education	1
3.	Proceedings of the National Physics Seminar (E-Journal)	1
4.	Physics Education Journal (JPFT)	1
5.	Proceedings: National Seminar on Physics and Its Applications	1
6.	Journal Physics Education Research	1
7.	Journal Science Education Innovation (JIPS)	1
8.	JPF: Journal of Physics Education	1
9.	CHARM SAINS: Journal of Physics Education	1
10.	IPF: Innovation in Physics Education	1

Misconceptions on Materials Sound Waves

In *Table* 3. Shows misconceptions found in the material wave sound from research that has been written in articles said. In a way overall article own a number of diverse coverage, starting from from misconceptions found, focus main, and innovations offered.

Table 3. Analysis Misconception

No	Article	Results
1.	(Silaban & Jumadi, 2022)	This article uses instrument test choice double as many as 10 questions with a scale level belief by using CRI (Certain of Response Index) method. Research results in This article shows that student Still own a number of misconceptions about the material wave sound. Misconception in the form of students wrote it wrong sign speed sources and observers, so that frequency obtained became wrong (45.45%). Students also made mistakes in determining factors that influence the level of intensity, especially related amount source sound and distance to source (45.45%). Students also misinterpreted symbols and shapes from formula intensity sound. While For grains question other show level misconceptions with a percentage of 12.12% to 34.85%, so concluded that on the material wave this sound is still often cause misconceptions. From this article it is analyzed the cause that is, students Already bring wrong concept before learning, interpretation sound based on life everyday (non-Science), understanding wrong and half-hearted material, students interesting conclusions and understanding that are not comprehensive, use of everyday language, and interests low students.
2.	(Febriyana et al., 2020)	In this study, the use of five-tier diagnostic test instrument functions as tool For identify in detail the forms misconceptions experienced students on this material. From the application instrument the found a number of misconceptions main that is student consider that frequency influenced by the medium in its propagation, and this is misconceptions with percentages the biggest namely 30.97%. Besides that, it was followed by misconceptions students who think reflected waves will form valley with a percentage of 12.90%. As many as 11.61% of students consider If give style big produce

		credit bigger waves. Misconception other student assume increasingly big frequency so fast creeper the waves will also the more large by percentage by 12.26%. And as many as 15.48% of students consider If the voltage guarded constant, then long the waves remains. The five-tier diagnostic test instrument in this study also allows researchers For know reason misconceptions mentioned. Where in this study the factors that cause misconceptions is explanations given by the teacher, own thoughts, books used in learning, and the answers given friends. But in this research, one's own thoughts become source reason misconceptions experienced by participants educate. Source this cause is obtained from level fifth tier on each grains question diagnostic test.
3.	(Mellyana et al,. 2024)	In this article it is shown misconceptions about the material wave mechanic Still classified as high, known from all over student only 21% of students meet the requirements value above the KKM. Misconceptions found in article namely in the sub material effect Doppler, frequency natural, and difficulties student in understand draft wave mechanics. Causes misconceptions among them knowledge the beginning not enough right, learning with the method lectures, and the lack of assimilation-accommodation processes. In identifying misconceptions study using a 5- item pretest-posttest instrument two tier and descriptive questions.
4.	(Lailiyah & Ermawati, 2020)	In this article used instrument study in the form of test five tier diagnostics consisting of from choice double, level belief, reason, conviction reasons, and questions open to 15 students. This study found various misconceptions in five subconcepts wave sound, where student consider wave sound as transverse waves, students think sound only propagates in the air, not on objects solid and liquid, students believe faster sound spreads in gas (air) rather than in solid / liquid, students consider the basic tone has 1 length waves are not ½ λ, students consider intensity sound earthquake felt in all cities same, no depending on the distance, students consider the more long strings so frequency the more big even though it is getting bigger small. And students consider received frequency listener No influenced distance. From the article identified the cause misconceptions originate from preconceptions, wrong intuition, wrong reasoning, thinking associative, and humanistic.
5.	(Widiastuti & Purwanto, 2019)	In this study it was found that student experience various misconceptions on the material wave sound, especially in the concept fast creeper wave sound in the air and organ pipes. In the concept fast creeper waves, students consider that amplitude and frequency influence fast creeper waves, that the more tall frequency so wave sound penetrate faster air, as well as wrong in understand movement oscillation airborne particles that are considered follow form transverse waves. Meanwhile, in the concept of organ pipes, students incorrectly described form standing waves from pipe closed and open as well as consider that the more tall column air so the frequency produced the more big. Percentage misconceptions highest before treatment reached 96.43% on the indicator changes in air volume with the resulting tone, while the average misconception on the material fast creeper wave sound reached 54.17%, pda The concept of organ pipes reached 58.34 %. P Cause misconceptions originate from intuition wrong student, book less lessons precise, and method learning previously less in accordance.
6.	(Sari et al., 2024)	In this article, the research instrument used is The three-tier diagnostic test consists of 16 questions. This study found that various misconceptions about matter, vibrations, waves, and sound. Misconceptions found in the material vibration that is student wrong identify long waves (53%). Students also thought object on the surface of the water moving follow direction creeper waves, not up and down in place (42%). At fast creeper wave misconceptions reach percentage highest namely 63% because students don't understand that mass rope influence fast propagation. Meanwhile, in the material wave sound misconceptions found student consider sound No propagates in matter dense, misconception reached 62% because student wrong understand connection between room air and frequency sound. Cause misconceptions the originate from unfounded preconceptions appropriate, use evaluation One level that is not capable identify misconceptions, and learning previously not yet emphasize understanding draft.
7.	(Febryanti et al., 2024)	This study reveals that before test done, Most of the student Not yet fully understand draft intensity and level intensity sound. In the pre-cycle 15.91% of participants truly educated understand concept and 44.69% only understand part concept. This shows still can misunderstanding conceptual as well as trend misconceptions about the material sound. Misunderstanding the caused by more frequent learning teacher -centered (student centered), low activity student in ask and discuss, and habit students who only focused on solving mathematical without dead represent draft verbally. Instrument research used deep This research includes test in the form of understanding draft in the form of verbal, mathematical representation, and conclusions as well pre-cycle diagnostic instruments and sheets observation For monitor the learning process.
8.	(Hermanto et al., 2023)	This study reports misconceptions in the form of assumption that sound is something propagating material objects, not energy, and belief that sound can compressed, experiencing friction, hold, and move as if object physical. Students also demonstrate existence confusion in represent wave sound for example by considering it as transverse waves. In sub -material Doppler effect, students explain that change frequency in a way general without relate it to the concept of relative motion between source and listener. Reason identified misconceptions come from; experience daily students, the use of

		everyday language that is not scientific interpretation intuitive to phenomenon as well as low understanding beginning about concepts base waves. In this study the instrument used that is a test understanding concept with type test choice double five options developed based on the C2 indicator and have reliability 0.74.
9.	(Tumanggor et al., 2025)	In this article it is found there are two misconceptions main thing that often experienced students on the material intensity sound, namely assumption that intensity sound similar to frequency as well as existence belief that high pitch always sounds stronger. Although research in this article is not count percentage misconceptions directly, because quoting from study previously shown that 30.91% of students experience misconceptions and 26.83% failed differentiate intensity sound from frequency. The cause misconceptions is dominated by experience daily learning conventional which is still abstract, and difficulty student in differentiate the role of amplitude and frequency in determine intensity sound. Instruments used b in This research covers test objective understanding draft through pretest and posttest which have reliability 0.79, questionnaire appreciation culture and reliability 0.81, and sheet observation participatory For monitor enthusiasm and involvement student during angklung practice.
10.	(Roistiya et al., 2019)	In this study it was found a number of misconceptions covering error in understand large-scale wave, error in interpret connection between magnitude such as $v = \lambda f$, difficulty in explain wave in a way intact, misinterpreted symbols, as well as difficulty in reading and drawing chart waves. Causes misconceptions found in This research is low understanding will concept, error in conception early, lack of experience concrete. The instruments used in This research is about essay as netter beginning answer students, sheets construction concept, sheet validation experts, as well as the four- level MW4T instrument consisting of of 17 grains question diagnostic For measure understanding and belief students at each draft wave.

Discussion

Reason Misconceptions about Sound Waves

Based on research that has been done done a number of researchers previously, can known that misconceptions found in the material wave sound caused by several factors. According to Febriyana et al (2020), Participants students who experience misconceptions the caused by several factor like teacher's explanation, own thoughts, books, and friends. But, deep this study participants students who experience misconceptions Lots caused by one's own thoughts.

From research by Silaban & Jumadi, 2022, analyzed the cause that is, students Already bring wrong concept before learning, interpretation sound based on life everyday (non-Science), understanding wrong and half-hearted material, students interesting conclusions and understanding that are not comprehensive, use of everyday language, and interests low students.

Whereas from research by Tumanggor et al., 2025, causes misconceptions is dominated by experience daily learning conventional which is still abstract, and difficulty student in differentiate the role of amplitude and frequency in determine intensity sound. This shows that in the material wave sound student Still difficult understand the correct concept, so that Still Lots misconceptions that occur.

Learning model For Reduce Misconception

Based on research conducted by Febryanti et al., (2024), Based on research that has been implemented can concluded that through learning with the PBL model with verbal and mathematical representation can increase understanding draft participant educate on the material intensity and level intensity sound. Thus can it is said that implementation of the PBL model with verbal and mathematical representation can increase understanding draft participant educate. This matter due to capable increase activity students, improve skills think critical, and ability solve problem. As for suggestions for study furthermore that is using the PBL learning model on the material others by providing mini games and entering element technology inside it For increase motivation and learning achievement of participants educate.

Whereas research by Tumanggor et al., (2025) proves that integration tool music traditional Angklung through Culturally Responsive Teaching (CRT) approach has an influence significant to improvement understanding draft intensity sound and appreciation culture high school students, learning physics based culture via CRT-Angklung no only increase understanding draft science in a way significant, but also growing literacy and appreciation culture local, support the principle of Independent Learning and learning contextual based wisdom local.

And in the research Widiastuti et al (2019), stated that after student given learning use approach constructivism effective 5E method For minimize the average misconception participant

educate by 26%.

Listen thus use of learning models influence student learning outcomes. Selection of appropriate learning models can help reduce misconceptions in students and at the same time can increase understanding students, compared learning that only teacher -centered.

Instrument Measurement Misconception

Various method used For measure and identify misconceptions students, including five-tier diagnostic test used by Lailiyah & Ermawati (2020), Mellyana (2024), and Febriyana et al (2020). This method is designed For measure understanding student to draft draft wave more specific sounds, such as direction propagation, frequency, resonance, and Doppler effect. This test has five levels question consists of from choice double, level belief, reason, conviction reasons, and questions open. Test results show Lots students who experience misconceptions on sub topics, direction creeper wave sound, frequency, and the Doppler effect.

Meanwhile, in the research Silaban and Jumadi (2022), on identification misconceptions student about material Intensity level sound and Doppler effect using Certainty of Response Index (CRI) instrument. This instrument allows researchers differentiate whether answer students are wrong because Because No know, or wrong because truly own belief false height. Test results show quite a misconception strong for example in the sub- topic intensity sound and distance, wrong in interpret changes in intensity levels, and understanding phenomenon false Doppler effect. Thus use instrument For measure and identify type misconceptions are very necessary For detect error conceptions in students. Without the right instruments, misconceptions difficult detected Because student can give correct answer in a way coincidence or just memorize formula without understand draft.

The Role of Teachers in Overcome Misconception

Widiastuti et al (2019), identified the role of teachers seems very important in an effort to overcome misconceptions students. teachers can play a role as facilitator who reveals conception beginning student so that misconceptions can identified since beginning of the learning process. Then the teacher can direct student For build return correct concept. Then the teacher can also give guidance for students can apply revised concept. And finally the teacher can evaluate change conception student For ensure what is a misconception has Correct Correct reduced. Therefore, teachers play a very important role in overcome misconceptions in students, teachers can also using test instruments For identify misconceptions students, and implementing appropriate and reflective learning models For add understanding student against something draft physics.

CONCLUSION

Existing research show that misconceptions in material wave sound in students can caused by from various factor like understanding draft false starts, own thoughts, explanations from teachers who do not comprehensive, use Language everyday that makes student difficult differentiate context, experience daily life, and low interest in learning. Insufficient use of learning models and media interactive can also make things worse understanding of the concept abstract physics.

Implementation of learning models such as Problem Based Learning, Culturally Responsive Teaching (CRT), and learning models Constructivism proven can reduce percentage misconceptions in students and can add understanding conceptual students on the material physics. Identifying misconceptions use the right instrument can also assist teachers in detect misconceptions students. Teachers have a very important role in overcome misconceptions in students, as facilitator and evaluator of student learning outcomes.

However, this study has limitations especially in amount sample. The research is also limited to the space scope limited study. Further research with a wider and more varied sample expected For get description representative about misconceptions students and factors reason misconceptions about the material wave sound. In a way overall this research can give contribution in identify misconceptions For repair quality from learning physics and reducing misconceptions in students.

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