Jurnal Pendidikan Fisika
Vol. 14 No. 2, Desember 2025_174-189
DOI: 10.24114/jpf.v14i2.62546
p-ISSN: 2552-732X
e-ISSN: 2301-7651

Research Article

OPEN ACCESS

First-Year Students' Initial Understanding of The Basic Concept of Static Fluid

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ARTICLE INFO

Article History:
Submitted: 18-04-2025
Revised : 13-07-2025
Accepted : 16-11-2025
Published: 19-12-2025

Keywords:
Contextual Learning;
Initial Understanding;
Maritime Context;
Physics Learning;
Static Fluids

Kata Kunci:
Pembelajaran Kontekstual;
Pemahaman Awal;
Konteks Maritim;
Pembelajaran Fisika;
Fluida Statis

ABSTRACT

Indonesia is one of the largest maritime countries in the world. Learning should be carried out contextually by linking knowledge with contexts relevant to students' daily lives, such as the maritime context. This research is descriptive to determine students' initial understanding of the basic concept of static fluids. This research involved 66 first-year students in biology education as research subjects. The data collection technique used in this research is a test that uses 6 questions that represent the concepts of density, hydrostatic pressure, and buoyant force. Data was analyzed descriptively, quantitatively and qualitatively. The research results show that many students still experience problems understanding the basic concepts of static fluids, including density, hydrostatic pressure, and buoyant force. This indicates the need for implementing learning that can improve students' understanding of basic concepts of static fluid and enable them to link their knowledge with conditions and situations related to the maritime context in their daily lives. One of the effective approaches to address this issue is implementing a problem-based learning model. This study highlights the importance of contextualized general physics instruction to bridge students' experiential and conceptual understanding, especially in maritime-based learning contexts.

ABSTRAK

Indonesia merupakan salah satu negara maritim terbesar di dunia. Pembelajaran sains, khususnya fisika, perlu dilaksanakan secara kontekstual dengan mengaitkan materi dengan situasi yang relevan dalam kehidupan sehari-hari mahasiswa, termasuk konteks kemaritiman. Penelitian ini merupakan penelitian deskriptif yang bertujuan untuk mengetahui pemahaman awal mahasiswa terhadap konsep dasar fluida statis. Subjek penelitian terdiri atas 66 mahasiswa tahun pertama pada program studi pendidikan biologi. Teknik pengumpulan data menggunakan tes yang terdiri atas enam butir soal yang mewakili konsep massa jenis, tekanan hidrostatis, dan gaya apung. Data dianalisis secara deskriptif, kuantitatif, dan kualitatif. Hasil penelitian menunjukkan bahwa sebagian besar mahasiswa masih mengalami kesulitan dalam memahami konsep dasar fluida statis, khususnya terkait massa jenis, tekanan hidrostatis, dan gaya apung. Temuan ini menunjukkan perlunya penerapan pembelajaran yang dapat meningkatkan pemahaman konsep dasar fluida statis sekaligus mendorong kemampuan mahasiswa untuk mengaitkan pengetahuan tersebut dengan kondisi dan situasi kemaritiman dalam kehidupan mereka. Salah satu pendekatan yang dinilai efektif untuk mengatasi masalah ini adalah model pembelajaran berbasis masalah (*problem-based learning*). Studi ini menegaskan pentingnya pembelajaran fisika umum yang dikontekstualisasikan untuk menjembatani pemahaman pengalaman dan konsep mahasiswa, terutama dalam konteks pembelajaran berbasis kemaritiman.

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INTRODUCTION

The more advanced technological developments become, the higher the demand for skills each person must have. Among the skills that everyone in the 21st century must have are critical thinking skills (Heard et al., 2020; Rios et al., 2020; Thornhill-Miller et al., 2023). This skill allows someone to face various challenges in the world of work by criticising and finding solutions to problems (HACIOĞLU & GÜLHAN, 2021; Shaw et al., 2020; Wale & Bishaw, 2020).

To create a generation that is critical in responding to and finding solutions to various problems in everyday life, various efforts are made through education (Bellaera et al., 2021; Cáceres et al., 2020; Ho et al., 2023). Among the efforts made is implementing contextual learning (Irhasyuarna et al., 2022; Lestari et al., 2021; Toheri et al., 2020). Contextual learning allows students to link their knowledge with experiences or situations related to their everyday lives (Afni & Hartono, 2020; Juniwati et al., 2020; Maynastiti et al., 2020; Satriawan et al., 2020).

Physics is a part of natural science whose field of study closely relates to various phenomena and events related to everyday life (Martawijaya et al., 2023; Sari et al., 2022). To strengthen students' conceptual understanding of physics material and improve students' ability to use physics concepts to solve problems or explain various phenomena, learning must be linked to real problems that exist in everyday life. (Astra et al., 2020; Farhodovna et al., 2020; Massolt & Borowski, 2020; Silitonga et al., 2020). This makes physics learning more meaningful because students can feel the benefits directly (Juniwati et al., 2020; Oladejo et al., 2022, 2023).

Indonesia is one of the maritime countries in the world. This is because Indonesia's territory is dominated by the ocean (Iskandar et al., 2020; Liandi & Andryawan, 2022). Because of these conditions, the learning should be linked to the maritime context, including physics learning. There are many maritime contexts related to physics, one related to static fluid concepts (Widyastuti & Sahal, 2023). There are many maritime phenomena related to physics, particularly in static fluid concepts, such as hydrostatic pressure and buoyant force (Kim & Paik, 2021; Liu et al., 2022).

Previous studies have widely examined students' misconceptions in static fluid concepts (Cari et al., 2020a; Jamaludin & Batlolona, 2021). However, few have explored how students' initial understanding develops within a maritime context, where such phenomena are part of their everyday lives. Addressing this gap, this study focuses on first-year students in maritime regions to investigate how local experiences shape their understanding of basic static fluid concepts. The maritime context provides a unique setting to examine how students' real-life experiences influence their conceptual understanding in physics. Such contextual situations offer authentic phenomena—like floating, sinking, and pressure changes—that can reveal how experiential knowledge connects (or fails to connect) with scientific reasoning.

General Physics is a compulsory course taught to first-year students in natural science–related majors. The participants in this study were students who entered university in the 2023–2024 academic year, whose previous learning experiences were affected by the COVID-19 pandemic (Cucinotta & Vanelli, 2020; Phan, 2020; Wang et al., 2020). Learning disruptions during the pandemic caused difficulties in mastering physics concepts (Fardiah et al., 2023; Puspitasari & Mufit, 2021; Sarkity & Fernando, 2021), which may have influenced their initial understanding when starting university courses.

When starting a course, some or even all students must initially understand the lecture topic being studied. This initial understanding can be obtained from learning at previous education levels (Puji et al., 2020) or previous learning (Adeel et al., 2023). This student's initial understanding plays an important role in learning because this students' initial understanding can influence students' learning outcomes (Shangguan et al., 2020).

Therefore, this study aims to identify first-year students' initial understanding of static fluid concepts within the maritime context of the Riau Islands. The findings are expected to contribute to the improvement of contextual general physics instruction by revealing how maritime-based experiences influence students' conceptual understanding. The novelty of this study lies in its focus on students living in maritime regions, who, despite their daily exposure to ocean-related phenomena, still demonstrate conceptual difficulties in understanding basic static fluid principles.

METHODS

This research employed a descriptive quantitative approach with supporting qualitative analysis through content analysis. The quantitative analysis was used to describe the distribution of correct and incorrect answers, while the qualitative analysis was used to explore the reasoning given by students. Descriptive research focuses on finding a variable, which, in this case, is the student's initial knowledge, without comparing it or linking it with other variables (Sugiyono, 2019). In descriptive research, the researcher does not treat or manipulate the variables and only takes actual measurements of the variables (Siedlecki, 2020).

This research was conducted in March 2024 at Raja Ali Haji Maritime University. This research involved 66 Biology Education Students in their first year of study as research subjects. The sample was determined using a total sampling technique, since all 66 students enrolled in the General Physics course during the second semester of the 2023/2024 academic year were involved as research participants.

Data were collected through a test designed to assess students' initial understanding of static fluid concepts within a maritime context. The test was administered during the first lecture meeting, before any formal instruction on the topic. The question grid is presented in Table 1.

Table 1. *Question Grid*

No	Topics	Items Number	Question form
1	Density	1	Reasoning multiple choice
		2	Reasoning multiple choice
2	Hydrostatic pressure	3	Reasoning multiple choice
3	Bouyant force	4	Essay
		5	Essay
		6	Essay

To illustrate the maritime context embedded in the test, one example of an item used is: *"A wooden block and an iron nail are both placed in seawater. Which one will float and why?"* This item connects students' prior experiences with floating and sinking objects in seawater to the scientific explanation of density and buoyant force, allowing the assessment of their contextual understanding of static fluid concepts. The validity and reliability of the instruments were analyzed before being used. The multiple-choice test obtained a validity coefficient of 0.87, while the essay test obtained a validity coefficient of 0.73. Both coefficients fall into the high validity category (Cohen, Manion, & Morrison, 2018). The reliability analysis also confirmed that both test formats were reliable, indicating that the instruments were appropriate for use in this study.

Students' responses were analyzed descriptively using both quantitative and qualitative approaches. Quantitative analysis was performed by displaying the distribution and percentage of correct and incorrect answers (Sidel et al., 2018). This study displays the percentage of correct and incorrect answers. Qualitative analysis was conducted through content analysis (Vaismoradi et al., 2013), focusing on students' reasoning in both multiple-choice and essay items. Each response was categorized into one of three groups, as presented in Table 2.

Table 2. Criteria for Categorizing Students' Answers in Qualitative Analysis

No.	Category	Description
1	Correct answer with correct reason	The student selected the correct option (for Multiple choice) or gave the correct response (for essay) and explained using the appropriate physics concept
2	Correct answer with incorrect/ incomplete reason	The student selected the correct option/response but the reason was inaccurate, incomplete, or based on daily experience without referring to the physics concept.
3	Incorrect answer	The student selected the wrong option/response and the reason given did not reflect the correct physics concept.

In the qualitative analysis, students' written explanations were examined using open coding procedures. Each response was categorized into one of the three groups shown in Table 2. The coding process was carried out carefully and consistently by the researchers to ensure analytical accuracy. To enhance credibility, the categorization results were reviewed and discussed among the research team until a consensus was reached regarding the interpretation of students' reasoning.

RESULTS AND DISCUSSIONS

RESULTS

The results of this research will be presented based on each question topic with the following details.

1. Density

To measure students' initial understanding of the density concept, 2 questions were given, as seen in Table 1. The results of each question will be presented to determine students' initial understanding of the density concept.

Question 1

The first question used to measure students' understanding of density is shown in Figure 1. The correct answer to question 1 is A. This is due to the difference in density where the density of nails made of iron is greater than the seawater density, causing the nail to sink. In contrast, wood's density is smaller than seawater's density, causing the wood to float.

1. A nail made of iron with a mass of 9 grams and a wood with a mass of 10 kg are dropped into the sea. What will happen in this event?

   A. The nail will sink and the wood will float on the surface of the seawater.
   B. The nail will float on the surface of the sea water and the wood will sink.
   C. Both nail and wood will float on the surface of seawater.
   D. Both nail and wood will sink.

   Choose and explain your answer!

Figure 1. Question 1

Student answers to each option in Question 1 are presented in Figure 2. As shown, 81.82% (54 students) selected the correct option. However, based on the reasons provided, only 20 students were able to justify their answers using the correct concept of density, while 34 students relied on daily experiences without explicitly referring to the density concept. Examples of these misconceptions are illustrated in Figure 3. A more detailed categorization of students' answers into three groups—correct answer with correct reason, correct answer with incorrect or incomplete reason, and incorrect answer—is summarized in Table 3.

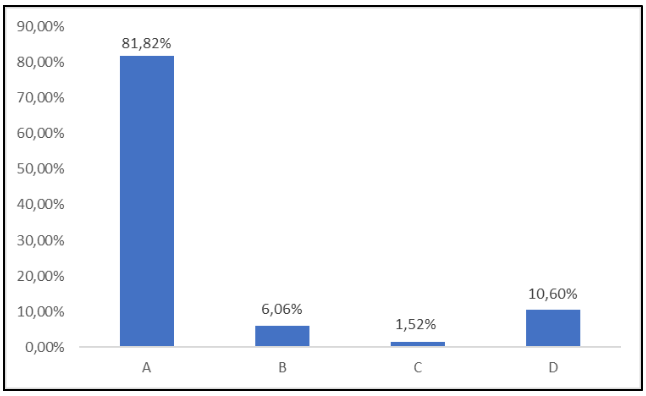


Figure 2. Percentage of Students Who Chose Each Answer Option for Question 1

Table 3. Categories and Distribution of Students' Answers for Question 1

No.	Categories of answer	Percentage of students
1	Correct answer with the correct reason	30.30 %
2	Correct answer with incorrect reason	51.52 %
3	Incorrect answer	18.18 %

For students who choose B, these students focus on the object's mass so that objects with a small mass are considered to float, and objects with a large mass will sink (Figure 3b). Students who answered C focused on the very large area of the ocean, which would cause all small objects to float on it (Figure 3c). For students who answered D, the reasons given were unclear and stated that the wood continued to sink with a mass of 10 kg (Figure 3d).

Question 2

Question 2, which still measures students' initial understanding regarding density, is shown in Figure 4. In this question, the correct answer is C. In this case, the seawater put into vessels A and B comes from the same place; therefore, the density of the seawater is the same.

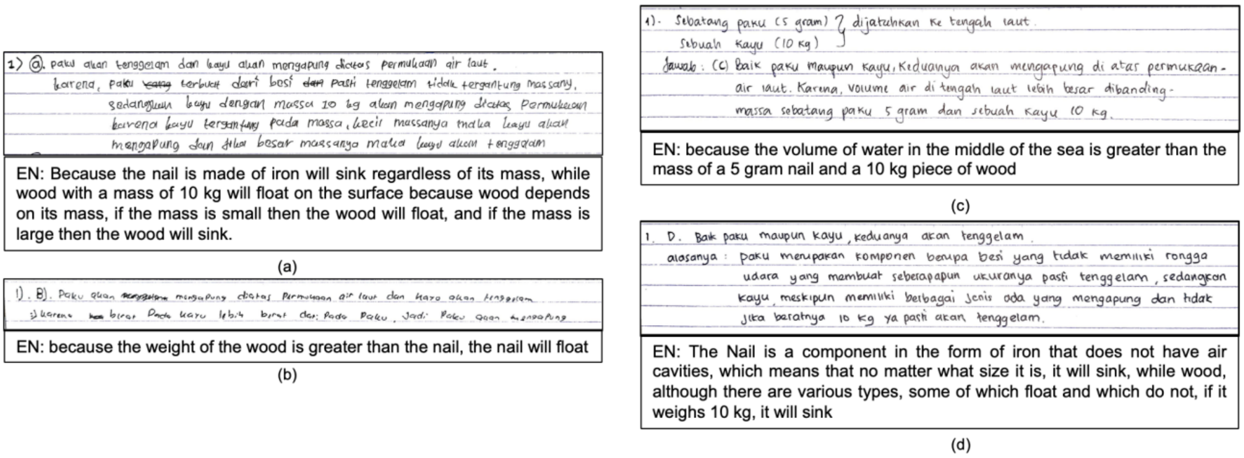


Figure 3. Example of an error in the answer to question 1

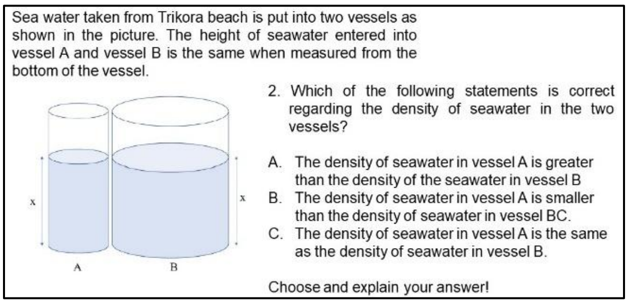


Figure 4. Question 2

The results of Question 2 show that only 19.70% (13 students) selected the correct answer, as presented in Figure 5. However, only 3 students provided the correct reasoning using the concept of density, while 10 students gave incomplete or incorrect reasons, focusing mainly on the height of the water. The majority of students (53 students or 80.30%) answered incorrectly, as illustrated in Figure 6c. The categorization of students' answers for Question 2 is summarized in Table 4.

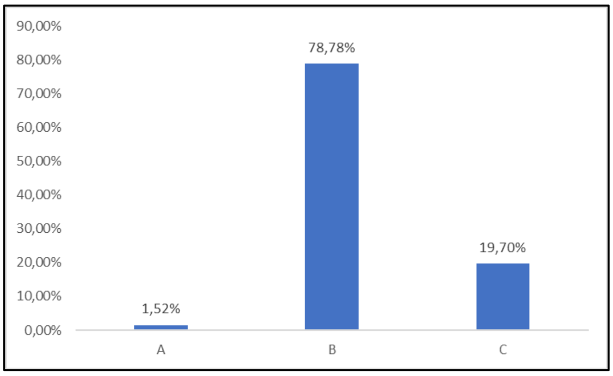


Figure 5. Percentage of Students Who Chose Each Answer Option for Question 2.

Table 4. Categories and Distribution of Students' Answers for Question 2

No.	Categories of answer	Percentage of students
1	Correct answer with the correct reason	4.55 %
2	Correct answer with incorrect reason	15.15 %
3	Incorrect answer	80.30 %

In Figure 5, it can be seen that the highest percentage of students chose answer B. For the reasons given, students chose answer B because they focused on the amount of water in the vessel, so a larger amount had a greater density (Figure 6b). Students who chose answer A gave the opposite reason, where students stated that the smaller the amount of water, the greater the mass of the object, even though what was asked in this question was density, not mass (Figure 6a).

2. Hydrostatic Pressure

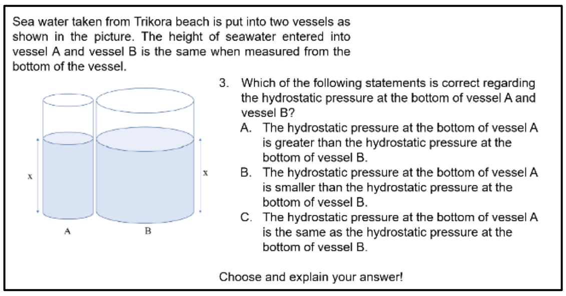


Figure 7. Question 3

Measuring students' initial understanding of hydrostatic pressure was carried out using one question, namely question 3. This is a child

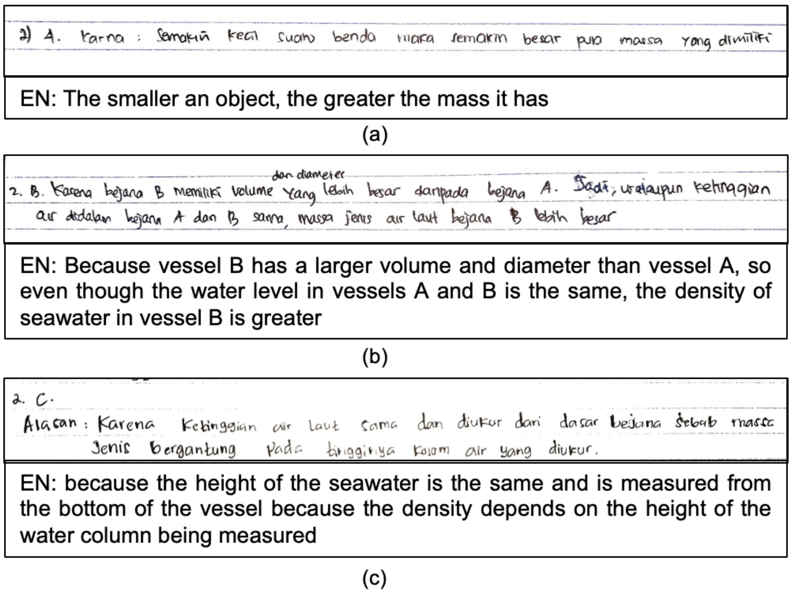


Figure 6. Example of An Error in The Answer to Question 2

question, the same as question 2, as shown in Figure 7. The correct answer to question 3 is C because hydrostatic pressure depends on the density of the fluid, gravity acceleration, and the height of a point from the surface of the fluid. These three factors have the same value for seawater in vessels A and B.

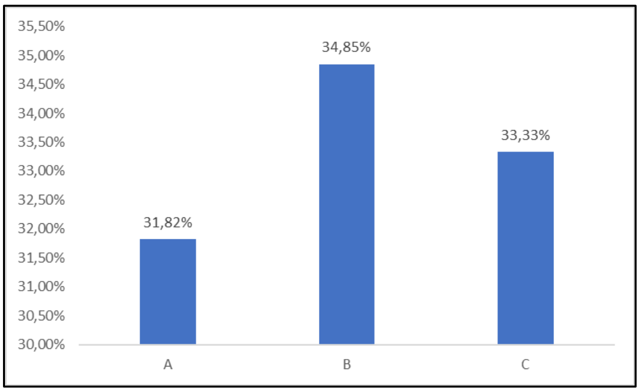


Figure 8. Percentage of Students Who Chose Each Answer Option for Question 3.

As presented in Figure 8, 33.33% (22 students) selected the correct answer to Question 3. Of these, 12 students provided correct reasoning in line with the concept of hydrostatic pressure, while 10 students gave incomplete or incorrect reasoning, focusing only on the type of water. The majority of students (44 students or 66.67%) answered incorrectly, as illustrated in Figure 9. A summary of the categorization of students' answers for Question 3 is presented in Table 5.

Table 5. Categories and Distribution of Students' Answers for Question 3

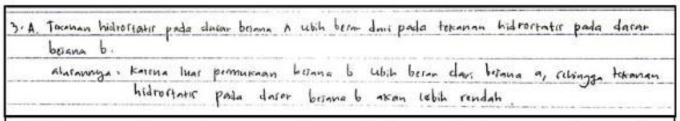
No.	Categories of answer	Percentage of students
1	Correct answer with the correct reason	18.18 %
2	Correct answer with incorrect reason	15.15 %
3	Incorrect answer	66.67 %

3. Buoyant Force

Students' initial understanding of buoyant force was measured using 3 questions. Descriptions of the questions and answers given by students will be presented as follows.

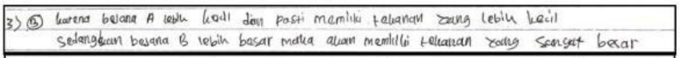
Question 4

The first question given to measure students' initial understanding of the concept of buoyant force is shown in Figure 10. The pain felt by the foot when stepping on a small pebble is due to the pressure exerted on the foot due to the gravity acting on the surface of the pebble, which has a large cross-sectional area. Following the concept of pressure, a large gravity value and a small cross-sectional area of the gravel being stepped on will produce large pressure. The answer to this question is, of course, that the pain felt in the feet will not be the same because there will be a reduction in the pressure placed on the



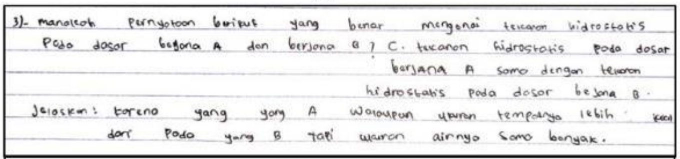
EN: Because the surface area of vessel b is greater than vessel a, so the hydrostatic pressure at the bottom of vessel b will be lower

(a)



EN: Because vessel A is smaller and must have less pressure, while vessel B is larger and therefore has greater pressure

(b)



EN: Because although vessel A is smaller than vessel B, it contains the same amount of water

(c)

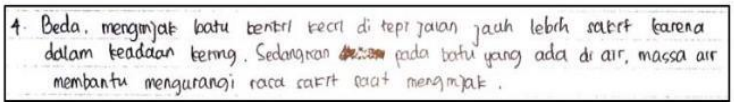
Figure 9. Example of An Error In The Answer to Question 3

feet. This is because the force acting on the pebbles, which produces pressure on the feet when we step on the pebbles in the sea, is the resultant force of gravity and buoyant force (uplifting force). This buoyant force will reduce the force acting on pebbles to reduce the pressure generated on the feet.

4. When you step on small pebbles on the side of the road, your feet will feel sore if you step on them without wearing any footwear. If you do the same thing to pebbles in seawater, will the pain your feet feel still be the same? Explain!

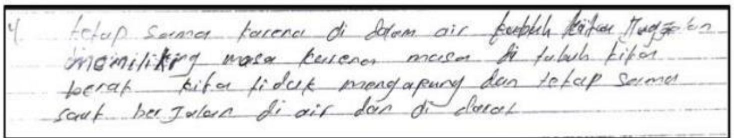
Figure 10. Question 4

in Table 6. The results show that only 6.06% (4 students) provided answers accompanied by correct reasoning. Although 69.70% (46 students) selected the correct answer, their reasoning was incomplete or inaccurate, generally stating that water reduces the pain in the feet without explaining the underlying principle (Figure 11a). Meanwhile, 24.24% (16 students) answered incorrectly, focusing on irrelevant aspects such as the structure of the rocks or the condition of the human body mass. For instance, some students stated that there would be no difference between stepping on rocks on land or in seawater because



EN: Different, stepping on small pebbles on the side of the road is much more painful because they are dry, whereas on stones in the sea, the mass of water helps reduce the pain when stepping on them.

(a)



EN: remains the same because in water our bodies also have mass. Because our body mass is heavy, we do not float and remain the same when walking in water and on land

(b)

Figure 11. Example of an error in the answer to question 4

The answers given by students to Question 4 were categorized into three groups, as presented

body mass remains the same in both conditions (Figure 11b)

Table 6. Categories and Distribution of Students' Answers for Question 4

No.	Categories of answer	Percentage of students
1	Correct answer with the correct reason	6.06 %
2	Correct answer with incorrect reason	69.70 %
3	Incorrect answer	24.24 %

Question 5

The second question used to measure students' initial understanding regarding the concept of buoyant force is shown in Figure 12. As explained in the answer to question 4, a stone in water will feel lighter because of the buoyant force. If measured, the weight of a stone in seawater will be lighter because the measuring instrument reads as the resultant of gravity (which is directed downwards or towards the centre of the earth) and buoyant force (which is directed upwards). With the opposite direction of force, the resulting force will be smaller, so lifting the stone in the water will feel lighter.

5. When you are on land, you will feel that lifting a stone with a mass of 5 kg feels heavy. If you lift the same stone in seawater, you will feel that the stone feels lighter. Why is that? Explain!

Figure 12. Question 5

Based on students' answers to Question 5, responses were categorized into correct and incorrect, as shown in Figure 13. The results indicate that 40.91% (27 students) were able to provide correct answers accompanied by appropriate reasoning using the concept of buoyant force. On the other hand, many students gave inaccurate explanations that were not linked to physics concepts. Their reasoning generally stated that on land, the entire weight of the rock rests on the person, whereas in seawater the rock feels lighter, without connecting this observation to the principle of buoyant force (Figure 14). This type of explanation reflects experiential knowledge, such as swimming or feeling lighter in water, but does not demonstrate an understanding of the underlying physics. The categorization of students' answers for Question 5 is summarized in Table 7.

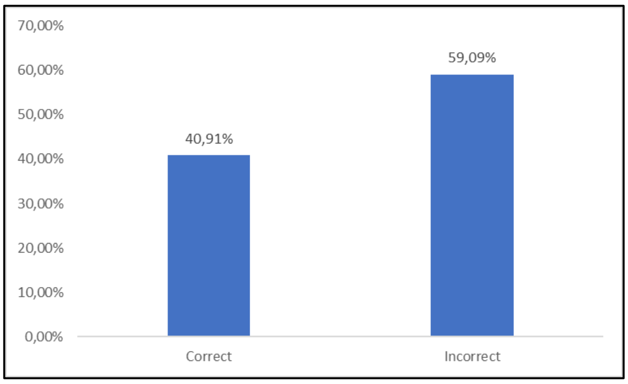


Figure 13. Percentage of Students Who Chose Each Answer Option for Question 5.

Table 7. Categories and Distribution of Students' Answers for Question 5

No.	Categories of answer	Percentage of students
1	Correct answer with the correct reason	40.91 %
2	Correct answer with incorrect reason	0 %
3	Incorrect answer	59.09 %

5. ~~karena~~ Adanya tekanan berbeda.
Pada saat mengangkat batu 5kg di atas daratan terasa berat karena massa batu tersebut bertumpu pada kita seperuhnya. sedangkan di dalam air akan lebih ringan karena massa batu tersebut di bantu oleh volume air.

EN: because of different pressures. When lifting a 5 kg stone above land, it feels heavy because the mass of the stone is completely supported by us, whereas in water it will be lighter because the mass of the stone is supported by the volume of water.

Figure 14. Example of An Error in The Answer to Question 5

Question 6

The final question used to measure students' initial understanding of the buoyant force concept is question 6, shown in Figure 15. This question is also related to the density concept. Drums made of iron, when empty, can float on seawater because the empty cavity in the drum can be filled with air. The air that fills the drum can reduce the total density of the drum so that the total density of the drum containing air is smaller than the density of seawater. This also results in the buoyant force acting on the drum being greater than the weight force of the air-filled drum. This is what causes empty drums filled with air to float on the surface of seawater.

6. When a small nail made of iron is dropped into seawater, it will sink. We often see that an empty drum made of iron can float on the surface of seawater. Why can a drum, which is also made of iron, float on the surface of seawater? Explain!

Figure 15. Question 6

For Question 6, none of the students provided the correct answer. Several students explained that the drum could float because there was an empty cavity inside. However, they did not elaborate on how the air cavity affects the overall density of the drum, which enables it to float (Figure 16). In addition, students did not relate their reasoning to the concept of buoyant force. The categorization of students' answers to Question 6 is summarized in Table 8.

Table 8. Categories and Distribution of Students' Answers for Question 6

No.	Categories of answer	Percentage of students
1	Correct answer with the correct reason	0 %
2	Correct answer with incorrect reason	0 %
3	Incorrect answer	100 %

determine what kind of learning should be done to correct this (Bada & Olusegun, 2015). Errors in students' initial understanding can be corrected by implementing learning so that students can use concepts and answer questions related to phenomena in everyday life scientifically (Supena et al., 2021).

Unlike previous studies that mainly investigated students' misconceptions in general classroom contexts (Cari et al., 2020b; Madsen et al., 2017), this study provides new insight by exploring students' initial understanding of static fluid concepts in a maritime context. The results highlight that even students who live in maritime regions and are familiar with ocean-related phenomena still exhibit substantial misconceptions. This finding indicates that contextual familiarity alone does not automatically lead to scientific understanding. This finding represents a novel contribution by contextualizing conceptual understanding within maritime physics learning, providing new insight into how local experiences shape students' comprehension of scientific concepts.

The concept of static fluid is closely related to maritime phenomena and has been introduced since junior high school (Sarkity & Fernando,

6. Karena perbedaan ukuran dan juga volume. Drum kosong memiliki ruang untuk udara, ~~...~~ sedangkan paku yang kecil memiliki kerapatan yang padat dan tidak memiliki ruang untuk udara. Hal inilah yang menyebabkan paku yang kecil tenggelam dan drum besi mengapung.

EN: Due to differences in size and volume. Empty drums have room for air, while nails are dense and have no room for air. this is what causes the small nails to sink and the iron drum to float

Figure 16. Example of An Error in The Answer to Question 6

DISCUSSION

Students' initial understanding needs to be explored with the demand for independent learning at the university student level. Students' initial understanding is often dominated by the students' learning environment (Basham et al., 2016). By measuring students' initial understanding, teachers can get an idea or description of students' understanding of the concept being measured through the questions (Dhanil & Mufit, 2021; Sarkity et al., 2022; Sarkity & Sundari, 2020). If there are errors in the students' initial understanding, lecturer or teacher can

2023). However, many students still struggle to understand even the basic concept of density and often confuse it with mass (Gregorcic & Bodin, 2017; Madsen et al., 2017; Seah et al., 2015). Previous studies consistently reported similar findings, showing that density is a common source of misconception in physics learning (Niss, 2017; Zouhor et al., 2016). In the maritime context, misconceptions about density are critical because they affect how students explain why steel ships can float while smaller, denser objects may sink. The findings of this study confirm that students failed to connect such familiar maritime experiences with scientific reasoning, revealing a gap between experiential knowledge and conceptual understanding.

Apart from the basic concept of density, students also experienced difficulties understanding hydrostatic pressure. Similar to previous research (Berek et al., 2016; Cari et al., 2020a; Saputra et al., 2019), many students were unaware that hydrostatic pressure increases with depth. This misconception also affects their critical thinking skills (Jufriadi et al., 2021) and indicates the need for conceptual change strategies (Ozkan & Selcuk, 2016). These findings have strong maritime relevance, since understanding pressure changes is essential in diving and swimming activities. Even though students have personal experiences related to these phenomena, such experiences were not transformed into scientific understanding.

Another concept in static fluids is Archimedes' law, which explains the buoyant force acting on immersed objects (Consales et al., 2018; Pisano, 2021; Rusoke-Dierich, 2018). Although this concept is central to maritime life - such as in ships, ferries, and fishing vessels - many students still fail to apply it scientifically (Buteler & Coleoni, 2016; Jamaludin & Batlolona, 2021; Koes-H et al., 2018; Ozkan & Selcuk, 2015). The findings show that students in maritime regions, despite their daily exposure to such phenomena, were unable to transfer contextual experiences into conceptual understanding. This emphasizes the importance of explicitly integrating maritime contexts into physics learning to promote conceptual change (Aydin-Gunbatar et al., 2020; King & Ritchie, 2012).

Errors in students' initial understanding can be influenced by various factors, including their previous learning experiences during the COVID-19 pandemic, which limited opportunities for meaningful conceptual development (Puspitasari & Mufit, 2021; Sundari & Dewi, 2021). Students' informal interpretations of everyday phenomena may also contribute to misconceptions (Neidorf et al., 2020; Pieschl et al., 2021; Setiani & Dewi, 2023), and these misconceptions tend to persist when personal experiences are not linked to scientific reasoning (Kulgemeyer & Wittwer, 2023; Menz et al., 2021). Therefore, teachers' and lecturers' pedagogical skills play a crucial role in designing learning activities that promote conceptual reconstruction (Pramana et al., 2024).

From a pedagogical perspective, these findings emphasize the importance of explicit instructional strategies that connect scientific principles with maritime phenomena. Context-based learning has been shown to promote conceptual change and reduce misconceptions (AYDIN et al., 2021; Duit & Treagust, 2003). In this regard, integrating maritime contexts—such as floating ships, submarine operations, or diving pressure—can bridge students' experiential knowledge with scientific reasoning. Learning models such as Contextual Teaching and Learning (CTL) and Problem-Based Learning (PBL) can serve as effective approaches for contextual General Physics instruction to enhance students' conceptual understanding.

CONCLUTIONS

This study revealed that first-year students still face substantial difficulties in understanding the basic concepts of static fluids - density, hydrostatic pressure, and buoyant force - even though these concepts are strongly related to the maritime context of their everyday lives. Students' misconceptions included difficulties in distinguishing between mass and density, misunderstanding the factors affecting hydrostatic pressure, and failing to explain how the buoyant force acts on submerged objects. These findings highlight the novelty of this study: living in a maritime environment does not automatically promote scientific understanding, suggesting that contextual familiarity must be supported by explicit conceptual instruction. The study contributes to physics education research by emphasizing that initial understanding and conceptual change should be examined within students' sociocultural and environmental contexts, particularly in maritime regions. Pedagogically, the results call for context-based General Physics instruction that explicitly integrates maritime phenomena—such as floating ships, diving, and submarine operation - into classroom learning. Such approaches are expected to bridge students' experiential knowledge and scientific reasoning, thereby strengthening their conceptual understanding of static fluids.

Future research could further explore the effectiveness of maritime-context learning interventions in promoting conceptual change and long-term understanding among university students.

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