

Exploration of Fluid Physics Concepts into Local Wisdom *Petik Laut* Lamongan: Cultural and Scientific Perspectives

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Article Info	Abstract
Article history: Received: June 20, 2025 Accepted: July 25, 2025 Published: November 3, 2025 Keywords: Local wisdom <i>Petik Laut</i> Lamongan Physics concept This article is licensed under a creative commons attribution-share alike 4.0 international license © 2025 Jurnal ilmiah Pendidikan Fisika	Physics learning based on local wisdom integrates everyday phenomena directly into students' learning experiences, thereby creating a more meaningful physics teaching and learning process. <i>Petik Laut</i> is a tradition carried out by fishermen as a sign that they stop fishing during the west season because this condition is considered dangerous for fishermen, and as an expression of gratitude for the abundant sea products by throwing offerings into the sea. This <i>Petik Laut</i> tradition can be linked to the study of physics, especially fluids, because if we carry out a more in-depth analysis, this activity involves various physics concepts. Therefore, this research aims to explore the concept of fluid physics in the local wisdom of <i>Petik Laut</i> Lamongan. This research uses a qualitative research method that is oriented towards exploration with stages of data collection, data reduction, data display, and drawing conclusions. Data collection used three methods, namely observation, interviews, and documentation. Data will be analyzed descriptively. The results of the research show that the physics concepts contained in the local wisdom of <i>Petik Laut</i> Lamongan are three physical concepts that can be explored, namely Bernoulli's Law, Archimedes' Law, and hydrostatic pressure. In practice, these findings can be used as a source of material for the development of media and learning resources based on local wisdom, which not only enrich physics teaching materials but also encourage cultural preservation through integration into the education curriculum.
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INTRODUCTION

Local wisdom includes values, norms, ethics, beliefs, traditions, laws, and special regulations that apply in a society ([Agustinaningrum & Deta, 2025](#); [Fitriah et al., 2021](#); [Masyhadi, 2023](#); [Susanto, 2024](#); [Misbah et al., 2020](#)). Local wisdom is a cultural element of a society that cannot be separated ([Fitrianto & Farisi, 2025](#); [Salim & Aprison, 2024](#); [Sihombing, 2025](#)). However, students often ignore the values of local wisdom held by local communities ([Arjaya et al., 2024](#); [Juliani et al., 2024](#); [Wati et al., 2020](#); [Zainuddin et al., 2018](#)). If such neglect continues, the local excellence and wisdom that is characteristic of each region could become extinct and forgotten ([Maulida & Sunarti, 2022](#); [Rummar, 2022](#); [Uge et al., 2019](#)). One way to maintain local wisdom so that it is not eroded by the progress of time and foreign culture is through learning based on local wisdom ([Hidayati et al., 2020](#); [Natasah et al., 2024](#); [Verawati & Wahyudi, 2024](#)).

Learning that is based on regional characteristics, including local culture or traditions,

is regulated in Indonesian Government Regulation Number 4 of 2022 concerning National Education Standards. Clause 40 (1) point (e) states that curriculum development in schools must consider education based on local potential that exists in each region ([PP RI, 2022](#)). One approach to learning based on local potential is to integrate local wisdom in the learning process ([Afnan et al., 2024](#); [Laos & Tefu, 2019](#); [Ristiana, 2024](#)).

Physics learning based on local wisdom is interesting because it applies everyday phenomena directly, so that the physics learning process becomes more meaningful ([Maulida & Sunarti, 2022](#); [Murti & Sunarti, 2021](#); [Susanto et al., 2023](#)). Based on this, there is a need for contextual applications in everyday life in physics learning, one of which is through local wisdom ([Husna & Kuswanto, 2018](#); [Laos & Tefu, 2019](#); [Susanto, 2024](#)).

Lamongan is a district in East Java, which is located along the northern coastline, with a coastline of 47 km covering the Paciran and Brondong subdistricts ([Situmorang & Nugroho, 2020](#); [Zikra & Suntoyo, 2017](#)). One of the common cultural activities in this coastal area is *Petik Laut* ([Fahimah & Joeha, 2023](#); [Ikhwan, 2022](#); [Juliana et al., 2023](#)).

Petik Laut is a tradition carried out by fishermen and coastal communities as a sign that they stop fishing activities in the western season because this condition is considered dangerous for fishermen, and as an expression of gratitude for the abundant marine products by placing offerings into the middle of the sea ([Addini, 2016](#); [Fahimah & Joeha, 2023](#); [Juliana et al., 2023](#)). *Petik Laut* tradition can be linked to the study of physics, especially fluids such as hydrostatic pressure and buoyancy ([Safitri & Salma, 2023](#)). The connection between physics material and the tradition of *Petik Laut* can support learning related to local wisdom, allowing students to understand physics concepts through the cultural context that exists in their environment ([Maulida & Sunarti, 2022](#); [Sefanda et al., 2023](#); [Umam, 2021](#)).

The study conducted by [Pambudi \(2025\)](#) highlights the role of local wisdom in social studies education, particularly in enhancing students' understanding of geography and history. While it contributes to the preservation of cultural values, the research has not yet explored the domain of exact sciences such as physics. In addition, previous research conducted by [Safitri & Salma \(2023\)](#) showed that the *Petik Laut* tradition can be used as a source of learning physics by connecting several physics concepts with the *Petik Laut* tradition, which produces the concepts of pressure, force, and waves. However, it has not examined in depth the relationship between the implementation time in physics, the concept analysis in each activity in physics, and it has not focused on the concept of static and dynamic fluids. Therefore, this study presents a novelty by integrating static and dynamic fluid concept analysis into the local wisdom of *Petik Laut*. This study explains a more detailed and structured exploration of physics principles such as hydrostatic pressure, buoyancy, Bernoulli's principle, and fluid flow embedded in each activity. This study provides a comprehensive understanding of physics concepts that align with the actual time of the tradition. It analyzes physics concepts according to the sequence of activities in local wisdom, thus bridging the gap between cultural practices and scientific learning.

The application of local wisdom about *Petik Laut* can be aligned with the physics learning process, especially in fluids, because if a more in-depth analysis is carried out, this activity involves various physics concepts ([Safitri & Salma, 2023](#)). Based on the above, the research problem can be formulated as follows: "How are the concepts of fluid represented in the activities of the *Petik Laut* Lamongan?" Accordingly, this research aims to explore and analyze physics concepts, especially those related to static and dynamic fluids, that are embedded in the local wisdom of *Petik Laut*, to systematically map these concepts to support contextual physics learning.

METHODS

This study used qualitative research methods. The method used is exploratory research, which aims to explore new ideas or perspectives regarding phenomena in depth ([Zellatifanny & Mudjiyanto, 2018](#)). Figure 1 illustrates the research stages by [Miles & Huberman \(1994\)](#).

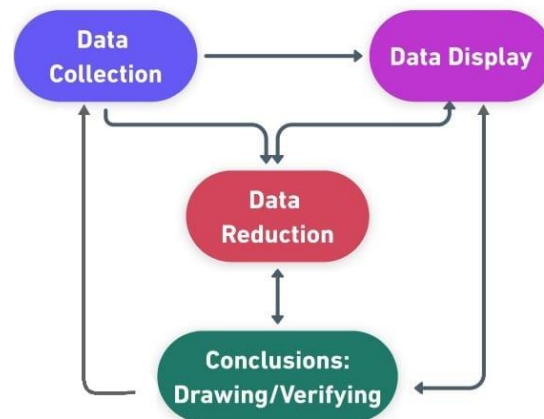


Figure 1 Research stage

Data was collected through observation, interviews, and documentation. Observations were used to observe *Petik Laut* activities, while interviews were carried out using purposive sampling techniques to select samples based on certain considerations ([Sugiyono, 2017](#)). These considerations were adjusted to the research objectives, where two local fishermen who were active in organizing *Petik Laut* activities were selected as key informants. Data was collected through an interview process with samples regarding the background of this culture, the stages of the *Petik Laut* tradition, and its distinctive characteristics. The results of interviews and observations were recorded, documented, and analyzed to identify the relationship between physics concepts in the local wisdom tradition of *Petik Laut*.

The data that has been collected at the data collection stage is then processed through the data reduction stage, where some of the data is reduced by focusing on the research objectives and selecting the most important and relevant elements. Meanwhile, some other data can be directly displayed at the data display stage, such as the results of visual documentation in the form of a boat from initial observations, which is used to describe the forces at work. This presentation aims to simplify the analysis process of the physics concepts contained in the local wisdom of *Petik Laut*. If deficiencies or discrepancies are found in the data presentation process, the data can be returned to the reduction stage to be readjusted. In this research, the data obtained is focused on the community's cultural perspective regarding the background or history of the *Petik Laut*, as well as on the stages of activities that can be analyzed scientifically, especially in the context of physics concepts. The data is then presented in the form of a systematic narrative and reinforced with pictures, in order to provide a clear picture of the research results. After that, conclusions are drawn from the results of the analysis. If clarification or strengthening of the conclusions is needed, the process can return to the initial data collection stage to obtain additional relevant information.

RESULTS AND DISCUSSION

Petik Laut Local Wisdom

Petik Laut local wisdom in Lamongan not only holds deep cultural and spiritual significance but also offers considerable potential as a contextual learning resource, particularly in physics education. This tradition contains elements that can be interpreted through physics concepts, making it highly relevant for instructional approaches that connect scientific content with students' real-life experiences. This aligns with findings from ([Susanto et al. 2023](#)), who stated that integrating local cultural elements such as traditional practices, beliefs, and heritage into physics learning enhances students' understanding and engagement across various cognitive domains as outlined in Bloom's Taxonomy, while also fostering 21st-century skills such as critical thinking and problem solving.

.Based on the results of interviews conducted with several members of the Fishermen's Association in Paciran and Brondong Districts, who are the organizing committee for *Petik Laut* activities, information was obtained that this tradition was motivated by victims of previous ancestors when fishermen went to sea in the western season, so that the fishermen believed that when entering The western season, it is a dangerous season for fishermen, so fishermen decide to stop fishing by holding the *Petik Laut* tradition (Local Fisherman, interview, March 03, 2024) . Figure 2 illustrates the *Petik Laut* tradition carried out by the residents of Paciran, Lamongan.



Figure 2 *Petik laut* activities
[Pemkab Lamongan \(2022\)](#)

The initial name of this tradition was "*Tutup Playang*." However, because there is no term for "Buka Playang", the name was changed again to "*Petik Laut*", which signifies the end of the fishing season due to the arrival of the western season, which is potentially dangerous for fishermen. The *Petik Laut* tradition is carried out as an effort to cover the current fishing season and in preparation for the next fishing season, with the hope of getting safety and abundant results. The name *Petik Laut* remains today (Local Fisherman, interview, March 03, 2024).

Petik Laut is carried out once every year during the western season, which usually occurs between December and March. The westerly season is characterized by strong westerly winds and large waves in the waters, so *Petik Laut* activities are carried out during this period before fishermen return to sea in safer seasons. *Petik Laut* activities usually last three days, this varies for each organizing committee. Pre-event activities included prayer, shadow puppetry, and fishing competitions. The core activity of *Petik Laut* is a boat parade out to sea, followed by offerings. When the offerings have been floated into the sea, fishermen will throw themselves into the sea to fight to get the produce from the offerings that have been floated. Thus, fishermen have to swim, and some even dive into the sea.

There are no specific rules for the boats used for processions out to sea. The boats typically have a wide bottom, with the front curving upward and tapering forward to form a V shape. In addition, there is a *tanggal* section at the bottom of the boat, which is shown in Figure 3.



Figure 3 *Tanggal*

Based on traditions that fishermen have carried out for generations, they believe that this line is the limit for the sinking of the boat's body. Before the boat parade and offering process took place, residents boarded the boats that had been provided. The boat used has a berm at the bottom (yellow and brown paint), which functions as a water barrier or sinking point for the boat body. When the *Petik Laut* is carried out, residents board the boat in stages until the brown part starts to dip into the seawater. As the weight of the boat increases, over time the yellow part of the boat will be dipped too. If the yellow part has dipped, it indicates that the boat load is heavy and maximum (Local Fisherman, interview, March 03, 2024).

Results of Exploration Local Wisdom of *Petik Laut* and Perspective in Physics Concepts

Based on the results of the interviews that have been obtained, a study and analysis of physical concepts in the *Petik Laut* tradition can be found as shown in Table 1, which shows that three physics concepts, especially fluids, that can be explored are Bernoulli's Law, Archimedes' Law, and Hydrostatic Pressure.

Table 1 Results of the exploration of physics concepts

Cultural Content	Physics Concept
Implementation Time (Western Season)	Bernoulli's Law
Residents take turns boarding the boat (change of <i>tanggal</i>)	Archimedes' Law
Boats can float on the surface of the sea	Archimedes' Law
Changes in the speed of sea water flow around and outside the boat when sailing.	Bernoulli's Law
Some offerings float and sink	Archimedes' Law
Fishermen swim and dive into the sea	Hydrostatic Pressure

Bernoulli's Law

The concept of Bernoulli's law in the *Petik Laut* local wisdom was implemented at the time. This *Petik Laut* tradition is carried out during the west season, because fishermen believe that the west season is a dangerous season for them at sea. Therefore, in the west season, the fishermen stop going to sea and carry out the *Petik laut* tradition. The westerly season can endanger fishermen at sea because it causes high rainfall in Indonesia. In a scientific context, the westerly season is called the west monsoon. Figure 4 illustrates the movement of air considered as a fluid in the context of the West Monsoon wind.

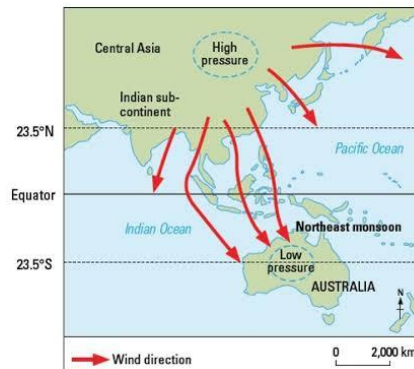
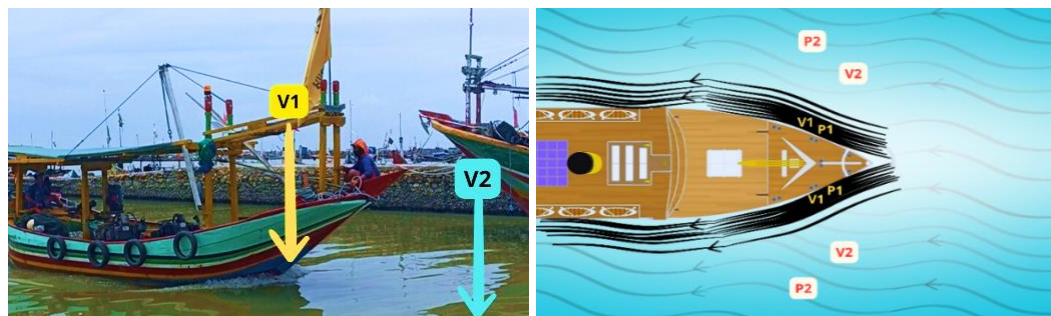


Figure 4 West monsoon wind (Setiawan 2020)

In this situation, the sun is near the southern equinox at 23.5 degrees South latitude (Setiawan, 2020). As a result, the Australian continent experiences very high temperatures because it receives maximum sunlight, while temperatures in the Asian region are lower (Rugoyah et al., 2023). At low temperatures, the movement of air molecules slows down, causing the air to become denser and creating high air pressure. In contrast, at high temperatures on the Australian continent, the movement of air molecules is faster, making the air less dense and creating low air pressure (Rugoyah et al., 2023). Thus, there is a flow of air from Asia (high-pressure area) towards Australia (low-pressure area) (Wahid, 2020). This wind passes through the Indian Ocean and South China Sea, thus carrying large amounts of water vapor, which results in high rainfall, especially in Western Indonesia (Rugoyah et al., 2023). Therefore, this will be dangerous for fishermen if they continue to go to sea. For this reason, fishermen in Lamongan hold the tradition of *Petik Laut* to end their fishing season and express their gratitude for the fish they have obtained.

The movement of air from areas of high pressure to low pressure is included in the study of dynamic fluid materials. In the context of fluid dynamics, the basic law that explains the movement of fluids from areas of high pressure to areas of low pressure is called Bernoulli's law. Bernoulli's law states that in a fluid flow, if the fluid speed increases, the pressure will decrease, and conversely, if the fluid speed decreases, the pressure will increase (Abdullah, 2016). Thus, when the temperature in Asia drops, this causes the movement of air molecules to slow down and produces an area of high pressure in the region. On the other hand, high temperatures in Australia cause the movement of air molecules to become faster, thus creating a low-pressure area in the region.

Apart from that, the concept of Bernoulli's law is found in boat parade activities, specifically in the speed of fluid flow around (v_1) and outside the boat (v_2), as shown in Figure 5.



(a) (b)
Figure 5 (a) Sea water flows on a boat and (b) Fluid flow

When the boat is moving, the front of the boat cuts through the water and creates a fluid flow around it. The front of the boat helps break up the water flow so that the fluid flows into two parts on either side of the boat. This causes the water around the boat to move faster, resulting in a greater fluid flow speed around the boat than outside the boat ($v_1 > v_2$) (Halliday, Resnick, & Walker, 2021). In accordance with Bernoulli's principle, when the flow speed around the boat increases, the pressure around the boat will be lower. This is because the movement of water increases when it is broken by the front ridge, which causes the fluid flow speed to increase, so that the pressure around the boat becomes lower. ($P_1 < P_2$). On the other hand, the flow velocity in areas not reached by the boat is lower, and the pressure is greater than in the area around the boat (Abdullah, 2016).

Archimedes' Law

The physics concept of Archimedes' law in the local wisdom of *Petik Laut* Lamongan is that when residents board the boat gradually until the brown part begins to dip into sea water, the more the weight of the boat increases, the yellow part of the boat will eventually be submerged too. This can be explained through the concept of physics, namely buoyancy force. When residents ride a boat, the total weight of the boat and the residents in the boat is still less than the buoyant force exerted by the water. So that the boat floats in a balanced state. However, if the load increases and the boundary line (*tanggol*) begins to dip deeper into the seawater, this indicates that there is an increase in the load. If the load continues to increase, it can cause the weight force to be greater than the buoyancy force produced by the boat, and can cause the boat to sink. Therefore, several boats are provided during the *Petik Laut* activity. When the *tanggol* is completely submerged, residents are directed to change or board the next boat. The physics concept of Archimedes' law is also found in boat parades, namely when boats can float on the surface of seawater and not sink even though they have a heavy load. Figure 6 illustrates the forces exerted on the boat.

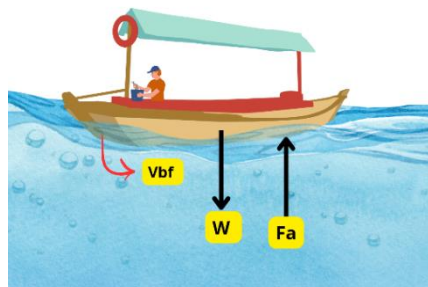


Figure 6 Forces on the boat

When the boat carries residents and several offerings with a certain mass, the boat can float on the surface of the sea and not sink. This is explained using a physics concept, namely Archimedes' law. Archimedes expressed this in his law, which states, "the buoyant force acting on an immersed object is equal to the weight of the displaced fluid." If the bottom surface of the boat is in a fluid, then a volume of liquid is displaced equal to the volume of the part of the object that is in the liquid. If the volume of the boat submerged in fluid is V_{bf} and the density of the fluid is ρ_f , then the mass of fluid displaced is: (Abdullah, 2016; Halliday et al., 2021).

$$\begin{aligned} m &= \rho_f V_{bf} \\ W &= mg \\ W &= \rho_f V_{bf} g \end{aligned}$$

According to Archimedes' principle, the magnitude of the buoyancy force on a boat is:

$$F_A = W$$

$$F_A = \rho_f V_{bf} g$$

With F_A is the upward pressure or buoyant force of the boat.

Apart from that, when offerings are thrown into the sea, many types of offerings are thrown away under different conditions. Some offerings are still floating, and some have sunk to the bottom of the sea, as shown in Figure 7.

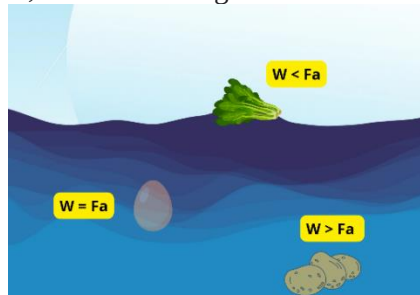


Figure 7 Offerings in sea water

Offerings that sink, float, and levitate are influenced by buoyancy force and gravity of the offering; apart from that, it is also influenced by the density of the object and the density of the fluid ([Abdullah, 2016](#); [Halliday, Resnick, & Walker, 2021](#)).

$$w > F_A \text{ \& } \rho_b > \rho_f \rightarrow \text{sink}$$

$$w = F_A \text{ \& } \rho_b = \rho_f \rightarrow \text{levitate}$$

$$w < F_A \text{ \& } \rho_b < \rho_f \rightarrow \text{floating}$$

Hydrostatic Pressure

When the offerings have been floated into the sea, fishermen will throw themselves into the sea to fight to get the produce from the offerings that have been floated. So fishermen have to swim, and some even dive into the sea. Fishermen who engage in swimming and diving activities in the sea are subjected to hydrostatic pressure, as illustrated in Figure 8.

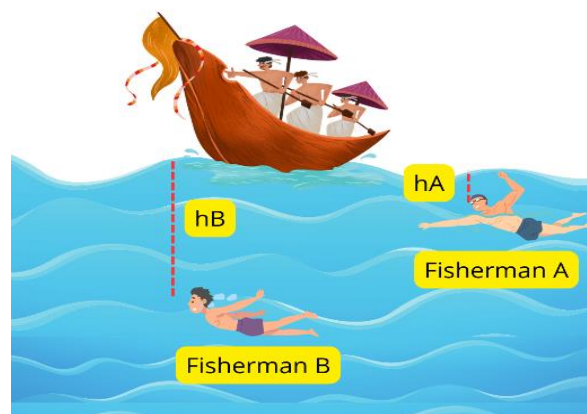


Figure 8 Fisherman swimming

Hydrostatic pressure is the pressure caused by the force that exists in a liquid against a surface. Fishermen will feel greater hydrostatic pressure when they dive deeper. The hydrostatic pressure of fishermen who only swim on the surface of the sea will be smaller than the hydrostatic pressure of fishermen who dive deeper to the seabed. In Figure 8,

fisherman A will feel less hydrostatic pressure than fisherman B. Because hydrostatic pressure is influenced by the depth of an object and the density of the liquid, the deeper the object, the greater the hydrostatic pressure will be. The hydrostatic pressure for the two fishermen can be written as follows ([Abdullah, 2016](#); [Halliday et al., 2021](#)).

$$P_h \text{ Fisherman A} = P_0 + \rho gh_1$$

$$P_h \text{ Fisherman B} = P_0 + \rho gh_2$$

CONCLUSION

Based on the results of the exploration and analysis that have been carried out, it can be concluded that the culture of the community, such as the local wisdom of *Petik Laut* in Lamongan, can be studied from a scientific perspective, especially reviewed through the concepts of fluid physics, such as Bernoulli's Law, Archimedes' Law, and hydrostatic pressure. Therefore, physics learning based on the local wisdom of *Petik Laut* has the potential to be applied in physics learning in schools. However, this study has limitations in terms of the scope of the physics concepts studied, because it only focuses on the fluid aspect and has not explored other physics concepts that may be relevant. In addition, the approach used is exploratory and descriptive, so it has not reached the stage of implementation or testing effectiveness in the context of physics learning in the classroom. Then, the suggestion for future researchers is to analyze the relevance between physics concepts in the *Petik Laut* tradition and learning outcomes in the applicable curriculum, as well as to develop learning media based on local wisdom. The suggested next step is to test the implementation of physics learning based on the local wisdom of *Petik Laut* so as to make learning more meaningful.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS STATEMENT

This article was developed through the collaboration of two authors. The student (first author) was responsible for conducting the field study, collecting data, analyzing the data, and drafting the initial manuscript. The supervisor (second author) provided guidance in developing the research framework, refining the analysis, and reviewing the manuscript to ensure academic quality and alignment with scientific standards.

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