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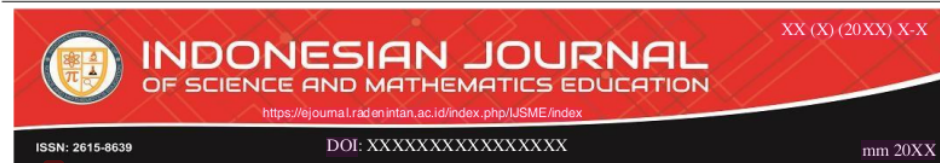
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## STUDENTS' CONCEPT MASTERY WITH THE WEB INQUIRY ENVIRONMENT

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### ABSTRACT

Technology has a vital role in the field of education. The educational system has evolved since the COVID-19 epidemic. There is a need for an online platform that allows students to perform investigations so that plans may be adjusted as needed to reflect changes in the classroom environment and to prevent student passivity. The purpose of the study was to ascertain the students' conceptual understanding of Archimedes' Law. The participants involved consisted of 53 grade 7 junior high school students. The method used was descriptive quantitative to investigate students' inquiry abilities and determine their understanding of concepts. The research on concept mastery shows a significant difference in using web inquiry environment after the treatment. Therefore, the web inquiry environment is essential to improve students' concept mastery. Implementing the web inquiry environment is recommended to consider topics with experiments to ensure that all inquiry processes can be carried out efficiently.

## PENGUASAAN KONSEP SISWA DENGAN IMPLEMENTASI WEB INQUIRY ENVIRONMENT

### ABSTRAK

#### Kata Kunci:

Penguasaan konsep

Kemampuan inkuiri

Web inquiry environment

Teknologi memainkan peran penting dalam bidang pendidikan. Sejak pandemi COVID-19, sistem pembelajaran menjadi lebih fleksibel. Untuk membuat pengaturan sesuai dengan perkembangan situasi di kelas dan menghindari kepasifan siswa, diperlukan platform online yang melibatkan siswa melakukan penyelidikan. Tujuan dari penelitian untuk mengetahui kemampuan inkuiri siswa dalam memahami Hukum Archimedes. Partisipan yang terlibat terdiri dari 53 siswa kelas 7 SMP. Metode yang digunakan adalah deskriptif kuantitatif untuk mengetahui kemampuan inkuiri siswa dan mengetahui pemahaman konsep siswa. Hasil penelitian menunjukkan perbedaan penguasaan konsep yang signifikan dalam penggunaan web inquiry environment setelah perlakuan. Oleh karena itu, web inquiry environment sangat penting untuk meningkatkan penguasaan konsep siswa. Penerapan web inquiry environment disarankan untuk mempertimbangkan topik yang memiliki eksperimen, hal ini untuk memastikan semua proses inquiry dapat dilakukan dengan mudah.

## 1. INTRODUCTION

The involvement of technology plays a vital role in academic life, especially in the field of science. Technology's critical part is to develop character, improve quality of life, and sharpen people's knowledge. Therefore, students and teachers must be familiar with technology to help support their learning [1]. Technology integration in education increases student interest and innovates teacher-learning practices. The concept of science education, described theoretically, shows that appropriate learning media is needed to help clarify abstract concepts so students can easily understand them. Technology and science collaboration can support students to learn independently because it makes human work more accessible and saves time more efficiently [2].

After the pandemic caused by the coronavirus, the use of technology demands a more significant role in the learning process. This is because it minimizes direct student interaction activities by staying connected using an online system. Teachers must determine the right strategy to regulate their learning patterns to create a lousy interaction effect and low learning investment [3]. Therefore, the process that needs to be used during online learning by involving students during learning activities makes students the dominant subject, allowing students to gain more profound learning abilities and improve the quality of education [4]. However, most students in online courses are passive and rely on the instructor, and they only take in the instructor's explanations. This predicament arises due to screen devices' limitations on teacher–student contact [5].

The science education system aims to strengthen students' capacity for knowledge acquisition while decreasing their reliance on instructor input [6]. An inquiry-based learning approach is utilized to help students participate in activities. In inquiry-based learning, the focus is on the student, and the teacher acts as a guide while actively working with them to gather data to support their investigative efforts. Students created a more memorable learning environment because of the inquiry [7]. To work methodically through gathering facts and factual evidence, as scientists do, inquiry learning gives students the chance and motivation to do so [8]. As a result, inquiry-based learning was selected as the methodology, stressing student activities to actively gather knowledge under the instructor's guidance. The practice of the science learning process is achieved by mastering scientific inquiry skills and subject expertise [9]. Scientific inquiry abilities are crucial for helping students develop 21st-century skills and comprehending the nature of science through practical approach and problem-solving approaches [10]. Scientific inquiry abilities are essential for helping students develop 21st-century skills by assisting them to grasp the nature of science through a hands-on approach and a method for addressing problems [11]. Nonetheless, even in the first year of high school, many students in one study still lacked the scientific inquiry abilities to support their understanding of substantive topics [12].

Strategies to achieve goals when students can understand a concept from the material taught. It indicates that the learning process is successful if differences exist before and after students learn the problem topic [13]. The ability of instructors and students to grasp a concept is essential because it serves as the starting point for many mental processes, such as formulating generalizations and principles [14]. The capacity to recognize and put into practice the advantages of learning in daily life is referred to as mastery of student concepts. Ibrohim said pupils' conceptual understanding had poor results because they needed help learning [15]. One of the most crucial methods for evaluating scientific learning success is idea mastery in the form of cognitive performance. Students' ability to condense abstract information and make it simpler to grasp, perceive, and use daily will determine how effective the science concept learning technique is [16].

Online learning media is one solution to overcome these problems. Learning Management systems such as Google Classroom and Moodle are also used in several schools. Still, these platforms have yet to integrate an inquiry-based approach because it does not contain steps appropriate to the actions of investigation activities [17], [18]. Hence, the media needs to engage kids' thought processes. Implementing a web-based inquiry that aids in learning activities incorporating student actions via the website is one way to address this issue. Web Inquiry Environment provides opportunities for students to investigate science teaching scientifically. Investigations can be carried out through the website. Students can collaborate on inquiry-based scientific projects utilizing data and tools from internet sources in the web inquiry environment. Because the information is successfully implemented, simple to use, and well-liked by students, web-based guided inquiry has shown to be an effective intermediary medium [19]. Collaborative idea mapping on the web can facilitate group engagement in a learning setting [20]. So it is expected that students' knowledge integration will increase significantly after implementing web-based inquiry [21].

In contrast to the research that has been done, this research provides inquiry learning that is developed according to the sequence of inquiry activities. Even though there are many interactive learning applications, such as zoom or google meet, these applications have yet to be able to package actual inquiry learning. This is a novelty in this research because it presents web-based science learning media, which is packaged visually and makes it easy for students to take part in inquiry classes anywhere. Understanding that is packaged virtually focuses on students' scientific inquiry skills in conducting scientific investigations, such as mastering the concept of Archimedes' Law for this research. Therefore, this research can be a reference for online learning, especially in science subjects.

## 2. METHOD

The purpose of this study was to determine students' scientific inquiry skills and students conceptual mastery of the impact of web-based inquiry. This study used descriptive and experimental methods with a pre-experimental design. In this study, data collection, compilation, analysis, and interpretation were carried out on the application of inhibiting variables or predicting research results. This descriptive study is used to determine the profile of science inquiry skills carried out by students (Figure 1). At the same time, the pre-experimental method aims to determine the possible causes and effects of the independent and dependent variables. To explain the research chronology, the research program's description must be supported by references to accept the explanation scientifically.



Figure 1. Research steps

This study aimed to determine students' scientific inquiry skills and mastery of Archimedes' law concepts on the impact of the web inquiry environment. This study used descriptive and experimental methods with a pre-experimental design. The design of this research is shown in Table 1

**Table 1. Pre-Experimental Pretest-Posttest Design**

<b>O<sub>1</sub></b>	<b>X</b>	<b>O<sub>2</sub></b>
Pre-test	Treatment	Post-test

In this study, data interpretation was carried out on the application of inhibiting variables or predictions of research results [22]. The pre-experimental method aims to determine the possible causes and effects of the independent and dependent variables [23]. To explain the research chronology, the research program's description must be supported by references to accept the explanation scientifically.

### 3. RESULTS AND DISCUSSION

In science learning, the main thing is student involvement in investigation activities and following procedures to find a concept. Students actively build their knowledge through inquiry activities and participate directly in real-life challenges in inquiry learning activities. The primary goal of science education is to encourage students to think scientifically. Teachers are urged to engage students in inquiry-based activities and process their cognition like scientists when conducting research.

Students in an inquiry-based learning setting explore the natural world, make inquiries about their findings, and look for data to support their hypotheses. Inquiry is used as the main instrument for teaching and learning in this process, which is an educational method. Students are encouraged to apply and enhance their inquiry abilities during this process, including making observations, posing questions, formulating hypotheses, planning research, creating outcomes based on evidence, and creating communications. Inquiry-based learning is a useful strategy for improving inquiry abilities. This strategy incorporates crucial activities including research, problem-solving, and project development. The kids work together to solve an issue, develop their problem-solving abilities, and expand their learning potential.

A series of technical processes are used in scientific investigation. To help students develop their knowledge and use it to predict and explain events in the natural world, inquiry learning involves involving them in scientific processes like orientation, developing a hypothesis, designing and carrying out experiments to test the theory, gathering and analyzing data, and drawing conclusions. A group of skills known as scientific inquiry skills, sometimes known as science process skills, are used by scientists in a variety of scientific domains. The two types of science inquiry skills are fundamental and interconnected. In the teaching and learning of science, students develop scientific inquiry skills via involvement in hands-on investigations that enable them to do tasks that test hypotheses about observable phenomena.

The involvement of students in science learning is the main thing to build knowledge in inquiry activities. In addition, the role of the teacher contributes to the process of student cognition so that their investigation activities are by the procedure [24]. Students improve their inquiry abilities, such as making observations, posing questions, formulating hypotheses, planning research, producing results that are supported by evidence, and developing communication, based on the deployment of a web-based inquiry environment. To strengthen their capacity for learning and to build their problem-solving and inquiry skills, students collaborate in teams [25]. It broadens their knowledge and puts it to use by helping them predict and understand natural phenomena [26].

Learning strategies affect the idea of mastery of concepts. The right system can help students hold on to concepts for long-term memory [27]. Therefore, further research by applying the Web Inquiry Environment to students' conceptual mastery is analyzed to find out the differences before and after treatment using Web Inquiry Learning. An objective test was used with 26 multiple-choice questions to analyze the data. There are 53 samples of 7th-grade students: 33 females and 20 males. To determine if there was a significant change between the pre-test and post-test scores, the data gathered from the objective tests were statistically analyzed using IBM SPSS Ver.25. Figure 2 displays the difference between the pre-test and post-test data values.

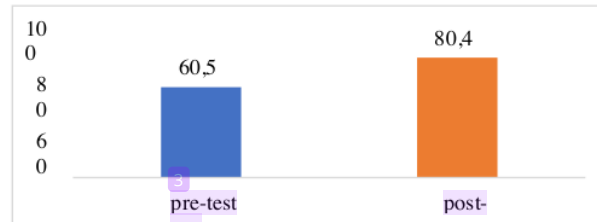


Figure 2. The Average Score for Pre-Test and Post-Test of Students' Concept Mastery

The image illustrates the stark differences between the pre-and post-test results. The difference between the pre-test and post-test scores for the students was 19.86 points, with an average improvement of 60.55 on the pre-test and an average score of 80.41 on the post-test. For a more extensive investigation, the data were examined using SPSS, which also included descriptive statistical analysis, a normality test, a paired sample t-test, and homogeneity. The results of the conceptual mastery objective test are listed in Table 2.

**Table 2.** The Summary of the Concept Mastery Objective Test

Component	Pre-test	Post-test
Participant	53	53
Average Score	60.55	80.41
Standard deviation	19.94	16.58
Maximum Score	24	36
Minimum Score	82	100
Normality Test	0,20	0,08
Homogeneity Test	0,16	
Paired Sample T-Test	Sig. (2-tailed) = 0,00 There is a significant Difference H <sub>0</sub> is rejected, and H <sub>1</sub> accepted	

The same person, 29 pupils, served as the sample for both the pre-test and the post-test. The distribution of the students' concept mastery scores on the objective exam is shown in the table above as regularly distributed. The pre-test and post-test normalcy data scores are 0.20 and 0.08, respectively. The fact that the sig. A value greater than 0,05 indicates that the data is regularly distributed.

The homogeneity test is an additional analytical technique employed in this study. If the sig value is higher than 0.05, the data were homogeneous, as indicated in the table. The homogeneity test is an additional analytical technique employed in this study. The data were homogeneous if the sig value was higher than 0.05, as indicated in the table. The paired sample t-test requires the usual data analysis and homogeneity as a prerequisite. The requirement for the paired sample t-test was satisfied by the study. Thus, paired sample t-test was employed to assess the significant difference. The paired sample t-test yielded a result of 0.00. When H<sub>0</sub> was disproven, and H<sub>1</sub> was shown to be accurate,

there was a clear difference in how well students understood the notion of coordination and reaction to treatment when utilizing web-based inquiry.

The three principles of Archimedes' Law, learning buoyancy requires students to have accurate concepts about mass, volume, and density to develop and calculate formula values fully. These terms are interrelated and dependent on each other [28]. Buoyancy is the upward force acting on an object in a fluid and determines whether the thing will rise, sink or remain static [29]. Buoyancy is defined as a dimension to understanding why objects float and sink. Part of the principle of Archimedes' law, this virtual-based investigation is analogous to placing a weight into a boat and seeing how deep the ship falls into a liquid tank. The boat's depth and the amount of fluid displaced can be measured. The boat's dimensions and the liquid's density can be adjusted. Next, students see how much weight the ship can hold before sinking deeper. The research activities shown are shown in Figure 2 that students must follow the teacher's direction to set the Width (Width), Length (length) to 5.0 cm, and Height (height) to 10.0 cm, then change the Liquid density sequentially to 0, 5 g/mL, 1.0 g/mL, 2.0 g/mL. Based on the results of the investigation skills carried out by the experimental student examples, they were able to collect and interpret data appropriately to avoid errors due to their low ability in data analysis [30].

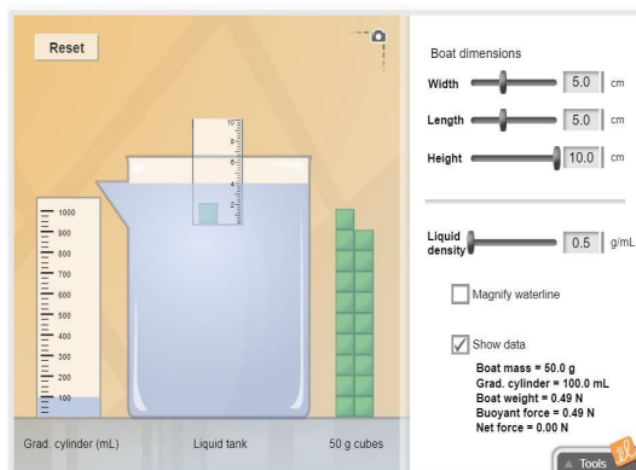


Figure 3. Virtual Lab Theme of Archimedes' Law

Students can find a virtual lab-based investigation for the theme of Archimedes' legal principles to explore conducting studies on the link <https://www.explorelarning.com/index.cfm?method=cResource.dspView&ResourceID=603>. The two measurable variables can be observed in the virtual lab visualization if given a mass of 5.0 g; for that, students must understand the provisions of the investigation so that the ability to analyze the theme of Archimedes' Law principles is successful. Examples of data and scientific evidence that students have successfully collected through Table 3.

4

**Table 3.** Obtained Results of Student Investigations

Boat Mass	Liquid Density	Depth (cm)	The Volume of Fluid Displaced (mL)
50 g	0.5 g/mL	4 cm	100 mL
50 g	1.0 g/mL	2 cm	50 mL
50 g	2.0 g/mL	1 cm	25 mL

4  
Table 3 identifies that if the density of the liquid is small, the depth and volume of the fluid displaced are more significant, and if the thickness of the liquid is large, the fluid displaced will be smaller. The density of a substance is affected by the pressure experienced by the importance. In line with these results, that web-based science learning provides students with the ease of learning and expands student activity space to enrich their learning experience. In practice, the teacher's direction to explain is the key to students' success in understanding the learning material. The teacher approaches directly impact students' knowledge integration gains, particularly when implementing web-based inquiryteaching strategies. The capacity of teachers to empower scientific thinking skills is an advantage of guided inquiry. The teacher provides direction, instruction, and planning during implementation. To help pupils better build a comprehensive grasp [31]. Students become more curious when learning tactics that focus on investigative activities to find answers to the issues that experiments provide to prove solutions and draw conclusions about experimental outcomes [25].

#### 4. CONCLUSION

The findings from studies on students' science inquiry abilities using a Web Inquiry Environment indicate an average high level of interpretation. This study demonstrates how using technology to do research helps students develop their scientific inquiry abilities. According to concept mastery studies, using the Online Inquiry Environment following therapy differs significantly. Therefore, the Online Inquiry Environment enhances students' idea mastery. If more study is done to create this Online Inquiry Environment, capabilities like uploading worksheet slots and column chat may be included. This is done to streamline the teaching process so that both the instructor and the students may concentrate only on utilizing the Online Inquiry Environment to complete the entire task without using other tools, like Google Classroom.

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