Analysis of Chemistry Education Students' Level of Understanding of the Basic Concepts of Science Education in the Perspective of Sustainable Maritime Education

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Abstract. The Basics of Science Education course plays an important role in equipping prospective teacher students with basic concepts of Natural Science which build their understanding of nature and scientific principles. In an effort to support the sustainability of the coastal environment, the integration of sustainable maritime education in learning is an innovative approach. This research aims to analyze the level of understanding of undergraduate students in chemistry education regarding the basic concepts of science education from the perspective of sustainable maritime education. The type of research used was quantitative descriptive with data obtained through the Mid-Semester Examination in the form of 30 multiple choice questions, which were taken by 28 students. Based on the results of data analysis, the average score obtained by students was 19.36 out of a maximum score of 30, with a median score of 19, and the range of student scores was between 7 and 26 points. These findings indicate variations in the level of student understanding of the basic concepts of science education in the context of relevant and sustainable maritime education. The results of the research show that student teacher candidates have varying understandings of the topics taught. This analysis provides insight that efforts are needed to prepare prospective teachers who not only master the basic concepts of science material, but are also able to apply them in the context of sustainable maritime education.

1 Introduction

As the largest archipelagic country in the world, Indonesia has extensive maritime wealth and plays an important role in various sectors, including education. In the Riau Islands Province, which is dominated by water areas, maritime education is very relevant for the sustainability of coastal ecosystems and the empowerment of communities living around it. Maritime education aims to increase literacy about the sea and its resources, foster a love of the sea and be responsible for marine conservation [1]. The importance of maritime understanding needs to be instilled from an early age, including in the education of prospective teachers at universities, so that they can become agents of change who are able to teach marine environmental care to future generations.

Students of the Chemistry Education undergraduate study program, as prospective educators, are required to take the Basics of Science Education course as a basis for mastering natural sciences. It is important for students to understand science concepts so that students do not experience difficulties in the learning and teaching process [2].This course covers various important concepts, such as the nature of science, the differences between science and other scientific disciplines, the role and characteristics of a science teacher, mastery of learning theories, such as behaviorism, cognitivism, and constructivism, which underlie effective teaching strategies, and other important concepts. Students who study the Basics of Science Education course will show more scientific competence and new knowledge about prospective science teachers [3]. With a curriculum that integrates

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sustainable maritime education, students not only gain an understanding of the basic concepts of science, but also understand how this knowledge can be applied in real life contexts, especially related to preserving the marine and coastal environment.

This research aims to analyze the level of student understanding of the Basics of Science Education course which has been integrated with sustainable maritime education. Using the Mid-Term Examination in the form of a multiple choice test with 30 questions as an evaluation tool, this research measures students' understanding of various aspects taught in the course, including material related to the maritime environmental context. Learning related to the original context will have a positive impact on the student learning process [4]. It is hoped that the results of this research will provide an overview of the effectiveness of learning approaches that are relevant to the characteristics of the archipelagic region and provide input for developing a contextual and sustainable curriculum for prospective teacher education in the Riau Islands. Learning activities that are carried out contextually and adaptively can make students have individual differences [5].

2 Research Methods

2.1 Research Design

This research uses a descriptive quantitative approach. Quantitative descriptive design is a research design that analyzes situations and presents research results with descriptions and numerical data forms [6]. The purpose of the research to analyze the level of student understanding of the basic concepts taught in the Basics of Science Education course integrated with sustainable maritime education concepts based on the results of the Mid-Semester Examination. It is hoped that the results of this Mid-Term Examination will illustrate their understanding of concepts including the nature of science, the nature of science teachers, elements of science learning, and learning theories, as well as integrating maritime education in science learning.

2.2 Research Subjects

The research subjects were students in the 1st semester of the Chemistry Education undergraduate study program who were taking the Basics of Science Education course. The number of participants was 28 students. The selection of this subject was carried out by total sampling, considering that all students who take this course are required to take the Mid-Term Examination as part of the academic evaluation.

2.3 Research Instruments

The instrument used in this research was a multiple choice test consisting of 30 questions, which was designed to measure students' understanding of key materials in the Basics of Science Education course. The reason the multiple choice test was used in this research is because it has advantages including wider material coverage, easier work and easier and more effective measurement processes [7].

2.4 Data Collection Techniques

Research data was collected through Mid-Term Examination which was carried out

online via the Google Form platform using multiple choice questions. The Google Forms platform has the advantages of being effective, efficient and easy to use [8,9]. Each question

represents a different topic in the course. Each correct answer gets a score of 1, while an incorrect answer gets a score of 0. The maximum score is 30, which shows the level of full understanding of the material being tested.

2.5 Data Analysis

Test result data is analyzed quantitatively by calculating the average, median, and range of scores to assess students' overall level of understanding. In addition, percentage analysis is used to identify the percentage of students who reach high, medium or low comprehension categories. The data obtained is then interpreted to assess the extent to which students understand the material that has been taught and to identify areas of material that require increased understanding.

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Analysis is carried out in the following stages:

1. Calculate the values from students' conceptual understanding test results.
2. Determine the category of students' level of understanding of concepts. Guidelines for determining categories of students' level of understanding of concepts according to Arikunto (1995: 57) can be seen in Table 1.

Table 1. Level of Understanding.

Range	Categories
$80 < N \leq 100$	Very High
$60 < N \leq 80$	High
$40 < N \leq 60$	Sufficient
$20 < N \leq 40$	Low
$0 < N \leq 20$	Very Low

3. Calculate the percentage of students who have a certain level of understanding of theconcept. Calculations are carried out using the following formula:

$$t = \frac{x}{n} x\ 100\% \quad (1)$$

Information:
t = percentage of students who have an understanding of the concept in a particular category
x = the number of students who have an understanding of the concept in a particularcategory
n = the number of students who took the test

3 Research Result

This research evaluates the level of understanding of undergraduate students in the

Chemistry Education Study Program regarding the Basics of Science Education course which is integrated with sustainable maritime education. Data was obtained through the Mid-Semester Examination in the form of a multiple choice test with 30 questions covering several main concepts: the nature of science, the difference between science and other sciences, the nature of science teachers, learning theories (behavioristic, cognitive and constructivist). All of these concepts are applied in sustainable maritime education that is relevant to coastal areas. The following are the results of the analysis of each topic tested:

3.1 The Nature of Science

Students show a very good understanding of the basic concepts of the nature of science, with an average score of 20.13. Students' understanding of this topic reflects mastery of the definition and nature of science, the difference between science and other sciences, ways of thinking in science, and ways of investigating science. Almost all students (93%) were able to determine a suitable learning approach to teach cases relevant to the maritime environment around students based on the nature of science. However, the majority of students (82%) have difficulty determining appropriate learning activities to help students understand the importance of science learning. Prospective teacher students must be more creative and able to develop their own skills related to everyday life [10, 11, 12].

3.2 The Nature of Science Teachers

On this topic, the average student score was quite good, namely 17.4. The majority of students (93%) know the competencies that science teachers must have, especially in the context of sustainable maritime education. However, most students (93%) do not know what the main responsibilities of science teachers are in project learning.

3.3 Elements of Science Learning

The level of student understanding on this topic shows an average score of 15.29. Students generally understand the elements of science learning, the depth dimensions of science, and science as a body of knowledge.

3.4 Behavioristic Learning Theory

Students achieved an average score of 18.67 in understanding Behavioristic learning theory material. The majority of students can relate this theory to appropriate learning strategies, especially related to maritime contextual learning.

3.4 Cognitivistic Learning Theory

Students achieved an average score of 19.67 on Cognitivistic learning theory material. Almost all students know the relevance of this learning theory in selecting suitable learning strategies, especially in the application of maritime contextual learning.

3.5 Constructivistic Learning Theory

Students achieved an average score of 18 on Constructivist learning theory material. The average score obtained in this theory is not much different from the average score obtained in the other two theories. Almost all students can differentiate the basic concepts of each theory, and are able to connect these learning theories with the selection of appropriate learning strategies, especially in implementing learning by integrating

sustainable maritime education.

Below are presented statistical values from the calculations of the data that has been collected.

Table 2. Statistics Value.

Statistics	Value
Average Score	19,36
Median	19
Lowest Score	7
Highest Score	26

Overall, the distribution of scores that have been converted into grades is presented in the Table 3. This distribution shows variations in the level of student understanding in the Basics of Science Education course from a sustainable maritime education perspective.

Table 3. Distribution of Levels of Understanding.

Categories	Range	Number of Students	Percentage (%)
Very High	$80 < N \leq 100$	2	7
High	$60 < N \leq 80$	16	57
Sufficient	$40 < N \leq 60$	8	29
Low	$20 < N \leq 40$	2	7
Very Low	$0 < N \leq 20$	0	0

From the results obtained, several factors are likely to influence student understanding, including background in gaining conceptual understanding [13], lack of interactive media, even though the use of media is very beneficial for students in improving learning achievement [14], as well as the need for more contextual teaching [15] related to their daily life in the coastal environment. This indicates that a more applicable and visual approach may be needed to strengthen students' understanding, especially in maritime aspects.

4 Discussion

The results of the Mid-Semester Examination data analysis for the Basics of Science Education course show a picture of the level of student understanding of the material being taught. The average score of 19.36 from a total of 30 questions shows that the majority of students have good understanding, but there are still variations in the level of concept mastery. A median score of 19 indicates that the student's mean score is in a category that isclose to the average, reflecting a relatively normal distribution of scores.

From the results of the level of understanding categorization, the majority of students (57%) were in the high level of understanding category. This shows that the majority of students have understood the core material such as the nature of science, the nature of science teachers, the elements of science learning, and learning theories (cognitivist, constructivist, and behaviorist). However, there are 7% of students in the very high level of understanding category, which shows extraordinary mastery of the material, and 7% in the low level of understanding category, which is a concern for improvement. There are differences in student achievement in understanding the concepts of the material, this is due to differences in students' learning styles. Based on previous research, motivational factors and student learning styles can influence student understanding [5, 6].

The presence of 29% of students in the sufficient level of understanding category also shows that even though they understand the basics of the material, there is a possibility that certain aspects, such as the integration of continuous maritime education in science learning, still require further deepening. This is relevant considering that sustainable maritime education requires an understanding not only of science learning theory, but also the application of these concepts in local contexts that are relevant to the conditions of coastal areas. This is reinforced by research results which show that the level of student understanding is still low, so there is a need for a strategic design to increase student understanding in the lecture process [18].

The distribution of scores from 7 to 26 indicates that there is a disparity in understanding among students. Students with low scores may face difficulties in understanding abstract concepts, such as differences in learning theories or their application in science learning. On the other hand, students with high scores demonstrate good analytical and conceptual skills in relating material to learning practices. Based on the research results obtained, it is necessary to develop self-competence for students on an ongoing basis to achieve learning goals [19].

The importance of a contextual approach in science learning, such as through continuous maritime education, can be an effective strategy for increasing student understanding, especially in the sufficient and low categories. The emphasis on local relevance, such as coastal resource management, not only helps students understand the material better but also equips them with the skills to become competent teachers in the context of Indonesiaas a maritime country.

Apart from that, strengthening learning strategies based on cognitive and constructivist theories can be maximized. For example, through problem-based learning (Problem-Based Learning) which integrates maritime issues or collaborative projects involving exploration of the coastal environment. Project learning can make students more creative [20]. This step is expected to increase student involvement, especially those in the sufficient and low levels of understanding, to be more active in the learning process.

Overall, the results of this midterm exam provide important insights regarding the effectiveness of the teaching methods that have been implemented. In the future, optimizing learning media that supports the integration of a sustainable maritime context, accompanied by regular evaluation of students' level of understanding, will be the key to improving the quality of learning in the Basics of Science Education course.

References

1. S. N. Hidayati, M. K. Muazzah, and H. Subekti, J. Penelit. Pendidik. IPA **7**, 10(2022)
2. Hasnawati, M. Syazali, and A. Widodo, J. Pendidik. Dan Konseling **5**, 1607

(2022)
3. F. Aldresti, E. Erviyenni, and S. Haryati, PENDIPA J. Sci. Educ. **5**, 292 (2021)
4. S. Supriyadi and E. Nurvitasari, Edu Sains J. Pendidik. Sains Mat. **7**, 10 (2019)
5. N. Arifin, J. Jihan, M. Edy Nurtamam, A. Cendrawati Ramli, W. Wonmaly, and J.Pabisangan Tahirs, J. Educ. **6**, 3500 (2023)
6. Rusandi and Muhammad Rusli, Al-Ubudiyah J. Pendidik. Dan Stud. Islam **2**, 48(2021)
7. M. Yuniar, C. Rakhmat, and Saepulrohman, J. Ilm. Mhs. Pendidik. Guru Sekol.Dasar **2**, 187 (2015)
8. A. Y. Aina and A. A. Ogegbo, J. Educ. e-Learning Res. **8**, 408 (2021)
9. C. Suryanovika, E-Structural **2**, 140 (2020)
10. A. R. Sinensis and T. Firdaus, Titian Ilmu J. Ilm. Multi Sci. **16**, 61 (2024)11. S. Singgih, J. Educ. **6**, 19438 (2024)
12. S. N. Sum, Syahriani Yulianci, Adi Apriadi Adiansha, Nurjumiati, and Asriyadin, J.Pendidik. Mipa **10**, 12 (2020)
13. O. B. Timothy, Int. J. Theory Appl. Elem. Second. Sch. Educ. **3**, 15 (2021)
14. R. A. Liliana, W. Raharjo, I. Jauhari, and D. Sulisworo, Univers. J. Educ. Res. **8**, 59(2020)
15. P. Y. A. Dewi and K. H. Primayana, Int. J. Educ. Learn. **1**, 19 (2019)
16. R. Annisa, B. Astuti, and B. N. Mindyarto, J. Pendidik. Fis. Dan Keilmuan **5**, 25(2019)
17. L. A. Didik, M. Wahyudi, and M. Kafrawi, J. Nat. Sci. Integr. **3**, 128 (2020)
18. R. Hayati and D. N. Asmara, J. Basicedu **5**, 3027 (2021)
19. N. Jaakkola, M. Karvinen, K. Hakio, L. A. Wolff, T. Mattelmäki, and M. Friman,Front. Educ. **7**, (2022)
20. S. Indrawijaya and A. P. Siregar, J. Ilm. Dikdaya **12**, 268 (2022)