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Contextual Teaching Learning: Improve Critical Thinking Skills in Ship Stability

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A B S T R A C T

This research aims to improve students' critical thinking skills through a contextual teaching-learning model in a ship stability course. This qualitative study employs a case study approach to deeply understand the application of contextual teaching in ship stability courses. The data collection method uses written tests and interviews. The subjects are all 38 third-semester Ship Operation Engineering Technology Study Program students in the 2023/2024 academic year. Tests were conducted twice: pre-test and post-test. The average pre-test score for critical thinking was 52.38, and the post-test average was 82.45, categorized as very good. The analysis concluded that students' scores were shallow before contextual learning but improved significantly to an excellent category after the application

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INTRODUCTION

Ship stability has a critical role in shipping safety. The ship has good stability and will be able to return to its original position after getting force from the outside so that it can prevent the vessel from capsizing. Several ship accidents occurred, such as the capsizing of the MV Estonia in 1994. The MV Estonia capsized and sank in the Baltic Sea because the ramp door could not be closed, so water entered the car deck. The water entry caused the ship to lose stability, so it finally capsized and caused 852 casualties (Fid Backhouse and others, 2024). National Committee for Transportation Safety (KNKT) said that from 2020 to 2023, several ship accidents were caused by ship stability. In 2023, there will be six shipping accidents in Indonesia. For example, the burning of the Labuan Bajo ship in December 2023 (Komite Nasional Keselamatan Transportasi, 2023).

Ship stability is one of the courses that Ship Operations Engineering Technology students must take as prospective seafarers. As stated in the STCW (2011), all prospective seafarer students are required to show competence in carrying out duties in the operation of the ship for which they are responsible, including maintaining the seaworthiness of the vessel. This is in line with what was conveyed by the International Maritime Organization (IMO) that the achievement of the ship stability course is that students can assess the stability of ships in various conditions, both in the state of empty vessels, fully loaded, in damaged conditions, and bad weather conditions (STCW, 2011). The stability of the ship dramatically affects its safety of shipping. The problem of ship stability is complex, so critical thinking is needed to solve it.

Critical thinking is a thinking skill related to cognitive processes that make students think according to their abilities and the problems they face. Critical thinking is a skill in interpretation, analysis, inference, evaluation, explanation, and self-regulation (Facione, 2011). When students think critically, they will exert all their knowledge and skills in solving problems that arise, analyzing, processing information well, and making decisions. Students with critical thinking skills can ask the right questions, provide effective and efficient information, have reasonable reasoning, make decisions, and have consistent and accountable conclusions (Bustami et al., 2018; Facione, 2011). So, there needs to be efforts and strategies to improve students' critical thinking skills in solving ship stability problems to support the creation of shipping safety.

Given the importance of producing graduates who can think critically so that graduates have global competitiveness, learning must be designed in such a way as to spur students to think critically. Learning must be carried out with a suitable model for each competency and subject. One way is to use contextual learning. Because with the contextual learning model, students will be able to be more active in learning (Setiawan & Sudana, 2018). Contextual learning allows students to relate lecture materials to the context of daily life. In contextual teaching and learning, students can discover concepts and affirm that knowledge and skills are not the result of memorization. In addition, in contextual learning, students will get used to asking questions (Bustami et al., 2018; Gayatri et al., 2018; Tarwi & Naimah, 2022), so that students are more active and can improve their thinking skills.

LITERATURE REVIEW

Ship Stability

Ship stability refers to a ship's capacity to restore its initial position following a tilt caused by an external force (Barrass & Derret, 2006). Stability is divided into three types: positive, neutral, and negative. When the ship has negative stability, it will tend to continue to move obliquely when waves, wind, and currents influence it.

The stability of a ship is determined by three key factors: the Centre of Gravity (G), the Centre of Buoyancy (B), and the Metacentrum (M). The G-point is the centre of all downward forces. Point B is the central point of all forces working upwards. Point M is the centre of the ship's cleanliness, with a slight inclination angle. Point M should not be exceeded by point G to keep stability positive (Moore & Paulling, 2022).

Critical Thinking Skills

Critical thinking is a cognitive process characterized by logical and contemplative thinking that prioritizes making informed choices on beliefs and actions (Tari & Rosana, 2019). Students with critical thinking skills can ask the right questions, provide effective and efficient information, have reasonable reasoning, make decisions, and have consistent and accountable conclusions (Bustami et al., 2018; Facione, 2011). Facione (2011) explains that critical thinking is a skill in interpretation, analysis, inference, evaluation, explanation, and self-regulation. When students think critically, students will exert all their knowledge and skills in solving problems that arise, analyzing, processing information well, and making decisions.

Contextual Teaching Learning

Contextual teaching-learning is a Contextual teaching-learning is a comprehensive approach that seeks to facilitate students' comprehension of subject matter by relating it to real-life situations. So that students have dynamic and flexible knowledge and skills to actively build understanding (Bustami et al., 2018). Contextual teaching learning allows students to relate course material to the context of everyday life. In contextual teaching and learning, students can discover concepts and affirm that knowledge and skills are not the result of memorization. In addition, in contextual teaching and learning, students will be accustomed to asking questions (Bustami et al., 2018; Gayatri et al., 2018; Tarwi & Naimah, 2022).

The conceptual framework of this research is as follows:

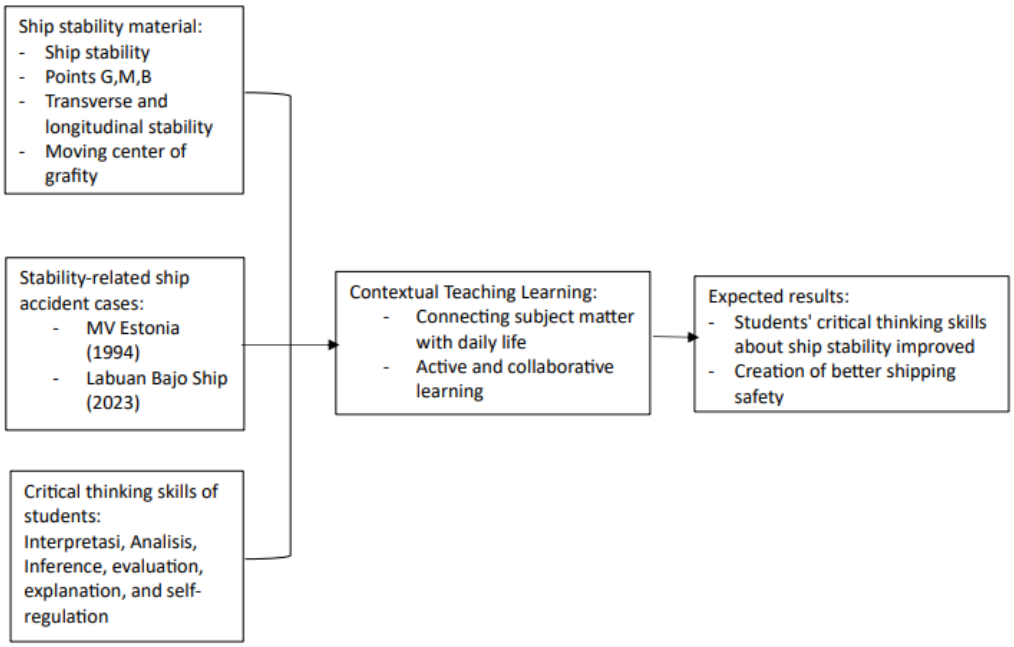

Figure 1. Conceptual Framework

METHODOLOGY

This research is qualitative research with a case study approach. Qualitative case study research is a method employed to thoroughly investigate a phenomenon, individual, group, organization, or scenario within an authentic setting. This research typically concentrates on one or a few particular situations that are intentionally chosen to offer a more profound understanding of the problem under investigation.

Qualitative research was chosen to understand more deeply the application of contextual teaching learning in ship stability courses. To obtain comprehensive data, all students of the Ship Operation Engineering Technology Study Program in the third semester of the academic year 2023/2024 totalled 38, consisting of 4 women and 34 men, as subjects in this study. All of these students have agreed to be the subject of research. Their ages range from 21 to 23 years. Third-semester Ship Operation Engineering Technology students were chosen as research subjects because they were studying ship stability courses. Ship Stability is one of the core competencies of the Ship Operation Engineering Technology study program. The sampling technique used in this study was purposive sampling.

The data collection methods used in this study were test methods and interviews. Written tests are used to measure students' critical thinking skills. Indicators of critical thinking skills are used based on Facione (2011), namely interpretation, analysis, inference, evaluation, explanation, and self-regulation. The test given to students is in the form of description questions that include ship stability material, as stated in STCW (2011). Test questions include determining GM, trim, and list. A team of experts has validated the test questions and have

been tested to determine their validity and reliability. The test is carried out twice, namely, pre-test and post-test. Pre-tests are conducted before students are treated with contextual teaching-learning. At the same time, the post-test is carried out after students are given contextual teaching learning treatment in ship stability courses.

RESULTS

Implementation of Contextual Learning

For the application of contextual learning to run smoothly and more meaningfully, lecturers carry out the following steps:

1. Modelling

At this stage, lecturers have already delivered the learning outcomes of ship stability courses, provided guidance, and motivated students. Lecturers instil a mindset in students to better understand the lessons offered by learning, find solutions to problems, and construct ideas independently.

2. Inquiry

This stage consists of students carrying out identification, analysis, observation, and hypothesis testing. Lecturers have already guided students through this stage and made them think critically.

3. Questioning

At this stage, lecturers assist students in directing, exploring, and evaluating the information they obtain. Students are also spurred by curiosity, so they ask.

4. Learning Community

At this stage, the lecturer invited students to form groups. Students are asked to work together and conduct various activities and research in the study group.

5. Constructivism

At this stage, lecturers invite students to make definitions independently from previous activities they had done. In addition, students also made synthesis, theoretical construction, and understanding of experiences they already understand.

6. Reflection

At this stage, the lecturer asked the students to reflect on the activities that had been carried out. Students are asked to review and summarize the material that has been learned and follow up on what has been reflected.

7. Authentic Assessment

This stage is the last in contextual teaching-learning. At this stage, lecturers assess students to determine their achievement of learning competencies. The assessment is conducted by administering exams in the form of questions that describe the ship's stability.

Critical Thinking Skills Test Results

The researcher evaluates the outcomes of the critical thinking skills exam by utilizing the critical thinking skills evaluation rubric that they have created.

The rubric is adapted to indicators of critical thinking skills adapted from Facione (2011), as Table 1 follows:

Table 1. Critical Thinking Skills Indicators

Indicator	Sub-Indicators
Interpretation	Comprehend the situation by accurately documenting the given information and the desired outcome stated in the question.
Analysis	Determine the correlation between the assertions and the facts in the questions by constructing an accurate mathematical model and offering a precise explanation.
Evaluation	Employing an effective approach to solve problems thoroughly and accurately when performing calculations.
Inferences	Formulate conclusions based on statements that are unambiguous and logically connected to the topic at hand.

Facione Adaptation (2011)

The written test is in the form of a description question, which spurs students to complete it. The form of the question is as follows:

A cargo ship had an accident at sea, capsizing after loading cargo at the Port. Based on the following data:

- Light ship = 8,000 tons
- Load weight = 10,000 tons, evenly loaded across the hatch
- KG of ship before loading= 4 meters
- The payload is placed at 9 meters above the keel
- KM= 10 meters

Question:

1. Calculate the KG of the ship after loading
2. Calculate the GM value and analyze whether the ship is in a stable state?
3. Identify and explain the factors that caused the ship to capsize!
4. Recommend preventive measures that should be taken so that similar incidents do not happen again!

Figure 2. Test Questions

The test results are subsequently examined utilizing the formula:

$$Persentage = \frac{Score\ obtained}{maximum\ score} x\ 100\%$$

The percentage value of critical thinking skills obtained from the calculation is then categorized according to Table 2 below (Bustami et al., 2018):

Table 2. Range of Critical Thinking Skills

Number	Range	Category
1	80-100	Excellent
2	70-79	Good
3	60-69	Enough
4	50-59	Low
5	≤ 49	Very low

Adoption of (Bustami et al., 2018)

The post-test results indicated a rise in the mean score of students' critical thinking abilities in the stability course. The enhancement of students' critical thinking abilities in stability courses is depicted in Figure 3, both before and after the assessment.

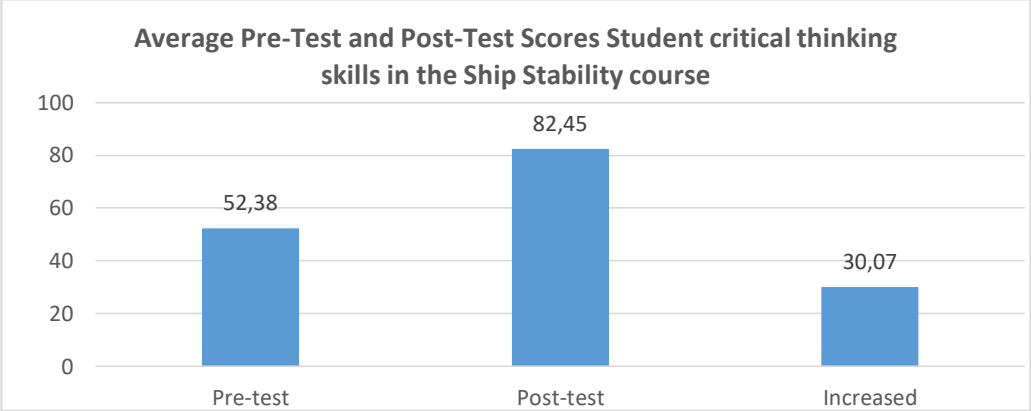

Figure 3. Pre-Test and Post-Test Average Scores

The study of Figure 3 revealed a significant rise in the average score of students' critical thinking skills following the implementation of contextual teaching-learning treatment. The mean score of students' critical thinking abilities during the pre-test was 52.38, but the mean score during the post-test was 82.45, indicating a high level of performance. The use of a contextual teaching-learning methodology resulted in a significant 30.07% improvement in students' critical thinking abilities.

Based on the interview results, it is known that contextual learning makes it easier for students to understand the basic concepts and the application of ship stability, increasing their ability to interpret. Through discussions, students can identify problems and find ideas for solving them. Students can jointly make the right conclusions through presentations in front of the class.

DISCUSSION

The study demonstrated that the implementation of contextual teaching and learning had a positive impact on students' ability to think critically. The findings of this investigation are consistent with the research carried out by (Bustami et al., 2018), which explains an increase in students' critical thinking skills. The contextual teaching-learning process requires students to play an active role in expressing opinions, and honing students' critical thinking skills. Therefore, the implementation of contextual teaching and learning has the potential to enhance students' comprehension of concepts by fostering the development of their critical thinking abilities. As stated by (Tari & Rosana, 2019), contextual teaching-learning makes students more productive and strengthens their conceptual understanding because students are invited to find their knowledge.

The stages of contextual teaching learning made it possible to encourage critical thinking skills. The inquiry and questioning stages motivate students to express their initial opinions in groups so that they will practice giving their opinions on the material studied. Students frequently engage in the sharing of ideas and information, as well as engage in arguments, in order to cultivate their critical thinking abilities. Furthermore, the steps of reflection and authentic assessment necessitate students to carry out studies collectively. At this stage, encourage students to be cooperative in conducting investigations so that they can solve the problems given. The reflection stage prompted pupils to understand, analyze, and infer from preexisting data. Skills in interpretation, analysis, inference, and deduction are key attributes of critical thinking. During the Authentic Assessment stage, students receive instruction on how to make informed decisions and derive logical conclusions.

Contextual learning offers students the chance to enhance, broaden, and utilize their knowledge and abilities in a range of campus activities and everyday situations. This can be seen from the results of the interview that by being given stability problems related to daily life, students can quickly identify issues because the problems presented are given an authentic context. The ability of students to understand problems can train students' critical thinking skills. This is conveyed by Tari & Rosana (2019), who state that contextual learning can train students to think critically. Contextual teaching learning emphasizes higher-order thinking by interpreting, analyzing, inference, evaluating, explanation, and self-regulation. Contextual teaching requires students to experience, not memorize, feel, and be active. Thus, students could construct knowledge based on their own experience. The increase in students' critical thinking skills in solving ship stability problems can have an impact on improving shipping safety when they work.

CONCLUSIONS AND RECOMMENDATIONS

According to the findings and conclusions from the study and discussion, the study determined that the mean score of students' performance was critical thinking skills in the stability course before the application of learning was meagre. However, after students carry out contextual learning, their stability course scores have improved to the excellent category. Thus, contextual learning is one of the learning models that can improve students' critical thinking skills, especially in ship stability courses. The increase in students' critical thinking skills in solving problems related to ship stability and shipping safety at the time of sailing can be improved.

FURTHER STUDY

This study exclusively examines the utilization of contextual teaching and learning in ship stability courses with the aim of enhancing students' critical thinking abilities and promoting safety in the shipping industry. Researchers should investigate the implementation of contextual teaching and learning in various courses to enhance the proficiency of sailors.

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