EVALUATING THE EFFECTIVENESS OF A PBL-BASED ESP MODULE FOR NAVAL ARCHITECTURE STUDENTS

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Abstrak

Penelitian ini bertujuan untuk mengeksplorasi efektivitas modul English for Naval Architecture berbasis Problem-Based Learning (PBL) dalam meningkatkan keterampilan bahasa Inggris mahasiswa di bidang arsitektur kapal. Modul ini dirancang untuk memenuhi kebutuhan bahasa Inggris teknis yang spesifik bagi mahasiswa di bidang teknik, khususnya di arsitektur kapal. Penelitian ini menggunakan desain pre-eksperimental dengan pretest-posttest pada satu kelompok. Data dikumpulkan melalui tes untuk mengukur efektivitas modul dan kuesioner untuk memperoleh umpan balik mahasiswa. Sebanyak 17 mahasiswa arsitektur kapal mengikuti penelitian ini dan menggunakan modul berbasis PBL selama satu semester. Hasil analisis N-Gain menunjukkan adanya peningkatan moderat dalam keterampilan bahasa Inggris mahasiswa, dengan skor 0,46, yang mengindikasikan adanya perkembangan walaupun tidak signifikan. Umpan balik mahasiswa menunjukkan bahwa mereka memberikan respons positif terhadap kualitas dan relevansi modul. Sebagian besar mahasiswa merasa modul ini efektif dalam meningkatkan keterampilan mereka, terutama dalam hal pemecahan masalah, penggunaan bahasa Inggris teknis, dan kemampuan berpikir kritis. Pendekatan PBL dalam modul ini juga berhasil menarik minat mahasiswa, karena kegiatan pemecahan masalah yang relevan dengan dunia nyata memberikan pengalaman belajar yang lebih mendalam dan aplikatif. Meskipun peningkatan kemampuan bahasa Inggris terbilang moderat, penerapan PBL terbukti efektif dalam meningkatkan kemampuan mahasiswa untuk menerapkan keterampilan bahasa dalam konteks profesional dan teknis. Oleh karena itu, modul English for Naval Architecture berbasis PBL ini dapat menjadi alternatif yang efektif untuk pengajaran bahasa Inggris di bidang teknik, serta dapat dijadikan model untuk pengembangan kurikulum di disiplin serupa.

Kata kunci*: esp, efektifitas, modul, pbl, teknik perkapalan*

Abstract

This study explores the effectiveness of the English for Naval Architecture module based on Problem-Based Learning (PBL) in improving students' English proficiency in the context of naval architecture. The need for a specialized English module in this field arises from the specific language requirements faced by students in technical disciplines such as naval architecture. The research aims to assess how PBL-based instruction impacts students' language skills, particularly in their ability to understand and apply technical English in real-world naval engineering scenarios. A pre-experimental with one group pretest - posttest research design was utilized. The data were collected through test to seek for the module's effectiveness meanwhile questionnaires were employed to gather students' feedback. The study involved 17 naval architecture students who used the PBL-based module over a semester. The effectiveness of the module was evaluated using N-Gain analysis, which revealed a moderate improvement in students' English proficiency with a score of 0.46. Additionally, student feedback indicated positive responses regarding the module's structure, relevance, and its influence on skill development, especially in problem-solving, technical English usage, and critical thinking. While the improvement in English proficiency was moderate, the PBL approach significantly enhanced students' ability to apply language skills in professional and technical contexts. Students also appreciated the module's alignment with their field of study, and its real-world problem-solving activities engaged their interest. In conclusion, the English for Naval Architecture PBL module is an effective tool for teaching English in technical fields, offering a valuable model for future curriculum development in similar disciplines.

1. INTRODUCTION

Developing human resources is crucial for enhancing societal well-being through education, especially in Indonesia's maritime context (Wibowo, 2023). Each Indonesian archipelago holds substantial economic growth potential when managed effectively, contributing significantly to the national economy. Prioritizing coastal ecosystem health and maritime resource management is key to maximizing benefits for communities and driving economic development.

One of the strategic steps to optimize Indonesia's naval potential is through improving the quality of human resources with education focused on specific naval fields, such as nautical science, commercial shipping management, ship engineering, and naval architecture. Additionally, English language proficiency tailored to maritime fields (English for Specific Purposes/ESP) is a crucial supporting factor in developing this potential, given that English is the primary language of international communication (Simbolon, 2021). Mastery of ESP enables naval professionals to interact effectively in a global context, expand their networks, and access the latest information and technology relevant to the advancement of the shipping industry. Therefore, enhancing naval education integrated with specialized English language proficiency is a fundamental requirement for advancing the national maritime sector.

In addition, to support the success of ESP-based maritime education, the development of specific teaching materials relevant to the maritime industry is required. Effective ESP teaching materials should be designed to align with the specific context and terminology used in nautical science, shipping management, and ship engineering (Boeru & Cizer, 2017). With the right teaching materials, students will not only understand general English but can also master the technical vocabulary and communication skills relevant to their professional needs.

To achieve this goal, it is essential to have ESP teaching materials specifically designed to meet the communication needs of the shipping and maritime industries (Alibakhshi et al., n.d.). These materials should include relevant terminology, concepts, and work scenarios, such as using navigational equipment, writing technical reports, and understanding international safety standards. Additionally, ESP materials should be structured to help students practice English in realistic situations they may face in the workplace, both domestically and abroad. Well-designed materials will enable students to understand technical language and improve their ability to negotiate, collaborate, and communicate effectively (Giannarou, 2021). Therefore, providing comprehensive ESP materials is vital in naval education to enhance graduates' competitiveness in the global job market.

The integration of English for Specific Purposes (ESP) within technical disciplines has gained significant attention, particularly in the field of naval architecture. As the language of global communication and the maritime industry, proficiency in English is essential for future professionals in this sector. However, traditional language learning methods may not be sufficient to prepare students for the specific linguistic demands they will face in their careers. To address this, the implementation of Problem-Based Learning (PBL) in ESP modules offers a more practical and engaging approach to language acquisition (Burns & García, 2022).

Problem-Based Learning is an instructional method that focuses on students working through real-world problems, promoting critical thinking, collaboration, and self-directed learning

(Gunawan et al., 2022). By using PBL, students engage in tasks that are directly related to the technical and professional language skills they will use in the field. In the context of naval architecture, these tasks could include understanding technical reports, communicating design specifications, or interpreting research papers related to maritime engineering. The hands-on, problem-solving nature of PBL encourages students to apply their language skills in practical, realistic scenarios, which is a crucial aspect of ESP(Hadi & Izzah, 2018).

Several research has been done to emphasize the implementation of PBL in English classroom and ESP classroom. The first research is done by Trullàs et al. (2022) that stated PBL is an effective approach to medical education that can enhance both knowledge acquisition and professional competencies among medical students. This research talks about the use of PBL for medical students. Another study is done by Lytovchenko et al (2022) who reported that using PBL for improving students vocabulary for technical university students had granted good effect since it can boost their motivation and self-directing. Aliyu et al (2020) also reports that students had positive experiences with PBL in English writing classes, particularly in terms of engaging with ill-structured problems, the facilitation process, and problem-solving strategies. This research is done in English classroom not in English for Specific Purposes class. Since there is no research about the implementation of PBL-based ESP module for naval major, the researchers are interested to do the research in that field.

This study aims to evaluate the effectiveness of a PBL-based ESP module specifically designed to enhance the English language competence of naval architecture students at Politeknik Negeri Bengkalis and also to find out the students' response after using the module. By focusing on real-world, industry-specific challenges, this module seeks to bridge the gap between theoretical language learning and the practical linguistic demands of the naval architecture field. Through this evaluation, the study assesses how well the module supports students in developing relevant language skills, contributing valuable insights into ESP teaching methodologies. It is hoped to provide guidance for curriculum developers aiming to enhance language education in technical disciplines, ultimately helping students become better prepared for their professional roles.

2. METHODS

2.1 Research Location and Time

This research was done in Politeknik Negeri Bengkalis majoring at Naval Architecture department. It was also done at September to October, 2024 or it was done for nine meetings.

2.2 Population and Sampling

According to Sugiyono (2011), a population is a generalization area consisting of objects or subjects with certain qualities and characteristics determined by the researcher to be studied and to draw conclusions. The population in this research includes second-semester students of the Naval Architecture Study Program and third-semester students of the Naval Architecture Engineering Technology Study Program at Politeknik Negeri Bengkalis, totaling 65 students. Meanwhile, a sample, as defined by Sugiyono, (2011) and Yusuf (2016), is a subset of the population that shares its characteristics. The sampling technique used in this study is purposive sampling, which involves selecting samples based on specific considerations made by the researcher rather than random selection. In this research, the sample consists of 17 third-semester students from the Naval Architecture Engineering Technology (TRAP) Study Program, chosen deliberately by the researcher.

2.3 Research Methodology

The experimental method is a research approach used to examine the effect of a specific treatment on another variable under controlled conditions(Sugiyono, 2011). This aligns with the focus of this study, which aims to investigate the impact of using the English for Naval Architecture module based on Problem-Based Learning (PBL) on students' learning outcomes. Specifically, the study seeks to evaluate the improvement in students' English proficiency as a result of implementing this module.

2.4 Research Design

The experimental research method employed in this study is a *Pre-Experimental Design*. This type of experimental research involves using a single group without a control group (Yusuf, 2016). Specifically, the study adopts a *One Group Pretest-Posttest Design*, where a pretest is administered before the treatment, followed by a posttest after the treatment is applied. The collected data are then analyzed to determine the impact of using the *English for Naval Architecture* module, based on *Problem-Based Learning (PBL)*, on improving students' English proficiency. The structure of this research design is illustrated in Figure 1 below;
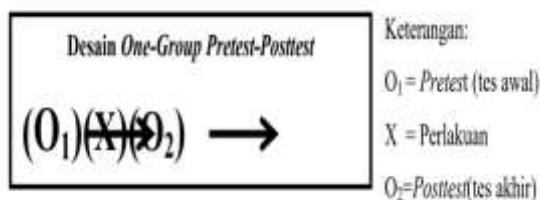

Figure 1. One Group Pretest-Posttest

2.5 Data Collection

The data collection techniques used in this study involve tests and questionnaires. The learning outcome test consists of a series of questions designed to measure students' mastery of the material, focusing on their cognitive learning outcomes to assess their progress and the extent of their understanding of the subject being taught (Arikunto, 2021). Learning outcome tests can be utilized to evaluate academic progress and identify learning difficulties. In this study, the learning outcome tests are conducted in the form of pre-tests and post-tests. The test consisted of 40 multiple choices questions.

The questionnaire was administered at the end of the sessions, allowing students to provide feedback based on their experiences with the implementation of the *English for Naval Architecture* module utilizing the Problem-Based Learning (PBL) approach.

2.6 Data Analysis

Data analysis techniques are essential steps used to simplify and interpret the collected data accurately. In this study, the data consist of quantitative results derived from tests and questionnaires. The quantitative test data include pre-test and post-test results, which are analyzed by calculating the average scores of both tests in the experimental class. After calculating the averages, the data are further analyzed using normality tests such as Saphiro Wilk test and N-gain tests.

3. RESULTS AND DISCUSSIONS

3.1 Effectiveness of English for Naval Architecture Module

This study is an experimental research involving 17 students as the subjects. Prior to the implementation of the *English for Naval Architecture* learning module, the students' English proficiency in the context of English for Specific Purposes (ESP) for Naval Engineering was assessed through a pre-test. The assessment instrument used was a multiple-choice test consisting of 40 questions, specifically designed to evaluate students' understanding of technical English terminology and concepts related to the field of naval architecture.

The pre-test results served as a baseline to evaluate the effectiveness of the *English for Naval Engineering* module in enhancing students' English proficiency, particularly in mastering specialized materials relevant to their profession. Following the module's implementation, a post-test was conducted to measure students' abilities after using the Problem-Based Learning (PBL) approach integrated into the module. The comparison of pre-test and post-test results provided insight into the module's impact on improving students' technical English skills in the field of naval architecture.

The implementation of the *English for Naval Engineering* module was conducted over five meetings, covering the topics *Types of Ships*, *Parts of Ships*, *Ship Materials*, and *Ventilation and Coating Systems*. The module was applied within this limited time frame due to constraints in the research schedule. Each meeting was designed to focus on a specific topic, ensuring that students could comprehensively engage with the technical materials presented in the module. The selection of these topics was based on their relevance to the field of naval architecture and their potential to enhance students' understanding of essential concepts and terminologies in English for Specific Purposes (ESP).

Although the duration of the module implementation was relatively short, efforts were made to maximize the learning outcomes through structured learning activities, including discussions, problem-solving exercises, and collaborative projects. The cognitive outcomes of the students, as measured by the pre-test and post-test, were used to evaluate the effectiveness of the module. The description of the cognitive results obtained from the pre-test and post-test can be observed in the following table 1;

Table 1. Description of Cognitive Results

Test	Amount	Mean	S Error	S Dev
Pre	17	64.11	1.58	7.20
Post	27	80.41	1.17	6.12

Based on the data from the cognitive learning outcomes, it can be observed that the average cognitive score before using the *English for Naval Architecture* module (pretest) was 64.11, with a standard deviation of 7.20 and a standard error of 1.58. After the implementation of the module, the cognitive score on the posttest showed an average of 80.41, with a standard deviation of 6.12 and a standard error of 1.17. This indicates a significant improvement in the students' technical English proficiency after utilizing the module. The average score increase of 16.92 points from the pretest to the posttest provides clear evidence of the effectiveness of the module in enhancing students' understanding of technical English in the field of naval architecture.

This improvement in students' cognitive outcomes suggests that the *English for Naval Engineering* module effectively supported the development of their specific English language skills, especially in understanding technical concepts related to naval architecture. The enhancement in performance could be attributed to the incorporation of problem-based learning (PBL) strategies, which facilitated active engagement, critical thinking, and deeper comprehension of the material (Fitriyah et al., 2024). The significant increase in the posttest scores further supports the conclusion that the module successfully addressed the learners' needs in acquiring relevant technical vocabulary and concepts required for their future professional careers.

The pretest and posttest results were utilized to determine the effectiveness of the *English for Naval Architecture* module by applying the N-Gain normalization formula. This formula serves as a tool to assess the extent of improvement in students' learning outcomes by comparing their pretest and posttest scores. The N-Gain formula calculates the relative gain

in students' cognitive abilities, providing a quantitative measure of the effectiveness of the instructional intervention. By examining the difference between the pretest and posttest scores, the N-Gain value indicates the degree of improvement in students' understanding of the subject matter after the implementation of the module. It can be seen in this following table;

Table 2. Pretest, Posttest, and N-Gain Results

Score	Minimum	Maximum	Average
Pretest	42,5	70	64.11
Postest	62,5	87.5	80.41
N-Gain	0.23	0.65	0.46

Based on the table 2 above, it can be observed that the minimum score for the pretest was 42.5 and the maximum score was 70, with an average of 64.11. After the implementation of the *English for Naval Engineering* module, the minimum posttest score increased to 62.5, and the maximum posttest score rose to 87.5, with an average score of 80.41. These results indicate a significant improvement in students' technical English proficiency. The increase in both the minimum and maximum posttest scores reflects the positive impact of the module on students' understanding of technical English terminology and concepts related to naval engineering.

Furthermore, the improvement in students' performance, as shown by the higher average posttest score, suggests that the *English for Naval Architecture* module effectively contributed to enhancing their technical English skills. This outcome is particularly important as it demonstrates the ability of the module to provide students with the necessary knowledge and vocabulary specific to the field of naval engineering. Such improvements also imply that the module, combined with the Problem-Based Learning (PBL) approach, effectively facilitated students' engagement and comprehension of the subject matter (Jabarullah & Hussain, 2019). Thus, the results support the efficacy of the module

in improving students' technical language proficiency, which is essential for their academic and professional development in the field of naval engineering.

Furthermore, the calculation of the N-Gain Normalization shows an average score of 0.46, which is categorized as moderate. The N-gain results can be seen in this following table;

Table 3. N-Gain Criteria Results

Score range	Students	(%)	Criteria
g>0.7	0	0.00	High
0.3<g>0.7	16	0.94	Moderate
g<0.3	1	0.06	Low

Based on Table 3 above, it can be observed that there were no students categorized under the *high gain* criterion, while 0.94% of students fell under the *moderate gain* category, and 0.06% were classified under the *low gain* category. These results suggest that while the majority of students demonstrated moderate improvement in their English proficiency, only a small percentage showed a significant improvement, and an even smaller percentage exhibited minimal progress. Despite the absence of high gainers, the increase in pretest and posttest scores indicates that the *English for Naval Architecture* module has a positive effect on the students' learning outcomes.

The improvement in test scores, although moderate, is a strong indication of the effectiveness of the module. The moderate gain categorization suggests that the majority of students experienced a noticeable enhancement in their English language skills, particularly in understanding technical vocabulary and concepts related to naval architecture. These findings highlight the module's potential to facilitate learning, but they also imply that further refinements may be necessary to foster higher levels of improvement in some students. Nonetheless, the overall data supports the conclusion that the implementation of the *English for Naval Architecture* module

was effective in promoting the development of the students' English language skills within the context of their academic and professional needs in naval architecture.

The research findings indicate an improvement in students' cognitive learning outcomes, although not statistically significant, which can be attributed to the implementation of Problem-Based Learning (PBL) in the classroom. PBL offers a student-centered learning approach, challenging students to solve real-world problems relevant to their field of study, such as Naval Architecture. This method encourages students to think critically, creatively, and systematically to understand and resolve issues. This aligns with the observed improvement in students' cognitive outcomes, with the average scores increasing from 64.11 (pretest) to 80.41 (posttest). While the improvement falls within the moderate category based on the N-Gain analysis, it demonstrates that PBL fosters active student engagement in the learning process, even though the increase is not highly significant.

The implementation of the *English for Naval Architecture* module in a PBL-based classroom environment allowed students to enhance their technical reading skills through problem-based activities related to their academic field. For example, students were asked to read and analyse technical documents pertinent to Naval Architecture as part of the problem-solving process. This approach not only improved their cognitive understanding but also motivated deeper engagement with the material. However, the t-test results showed that the difference between pretest and posttest scores was not significant, possibly due to the limited adaptation time for students to fully acclimate to the PBL approach or the complexity of the module's content, which may require additional guidance. Furthermore, PBL also contributed to the development of other essential skills such as teamwork and communication, central to solving project-based problems (Fitriyah et al., 2024; Indriani, 2022). Students were encouraged to collaborate, discuss, and share ideas, which enhanced both their cognitive outcomes and social-professional competencies. Despite these positive aspects, the research suggests that the effectiveness of PBL with the *English for Naval Architecture* module still requires optimization, potentially through improved module quality, extended implementation time, or more supportive teaching strategies for comprehensive problem-based learning.

3.2 Students' Response of English for Naval Architecture Module

Another research findings on the students' perspectives on the *English for Naval Architecture* module based on Problem-Based Learning (PBL). The evaluation focused on four key indicators: module quality, its influence on skill development, the implementation of PBL, and the relevance and usefulness of the module. These indicators provided a comprehensive framework to assess the module's effectiveness and its alignment with students' needs and professional expectations. The results highlight positive perceptions from students regarding the module's quality, its contribution to skill development, and the integration of PBL, as well as its relevance to the curriculum and future professional applications.

In terms of module quality, the results reveal that the *English for Naval Architecture* module was well-received by students. A significant majority (91%) of students felt that the module effectively facilitated their understanding of the material, and 95% agreed that the content was highly relevant to the field of Naval Architecture. The structure of the module was found to be easy to follow by 88% of students, and 86% appreciated its systematic presentation. Furthermore, the clarity of language used in the module was

deemed satisfactory by 81% of students. These findings suggest that the module is organized, clear, and aligns with students' learning needs, making it an effective resource for learning technical English in the context of naval architecture (Donnelly & Fitzmaurice, 2005). It can be seen in the figure 1 below;
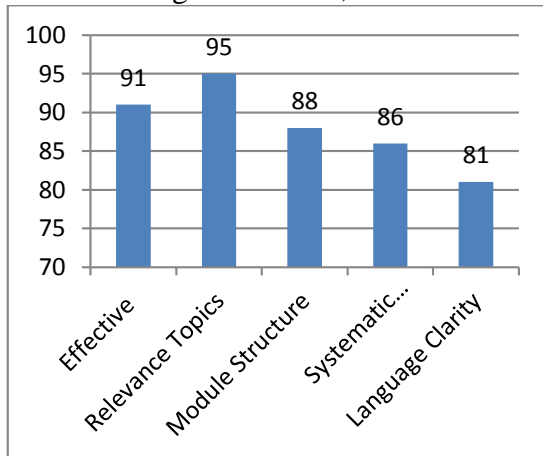

Figure 1. Students' Responses toward the English for Naval Architecture's module quality

The second indicator, which examines the influence of the module on skill development, shows that the module had a significant impact on enhancing students' competencies. The data indicated that 89% of students reported improvements in their problem-solving abilities, while 85% expressed greater confidence in using technical English. Additionally, 80% noted that the module contributed to enhancing their professional communication skills. The module also positively affected collaboration skills and critical thinking, with 87% of students affirming that it helped them work better in teams and think analytically. These findings highlight the module's effectiveness in fostering essential skills that are not only relevant to academic success but also crucial for students' future careers in Naval Architecture(Pertiwi et al., 2024). The results can be seen in this following figure;
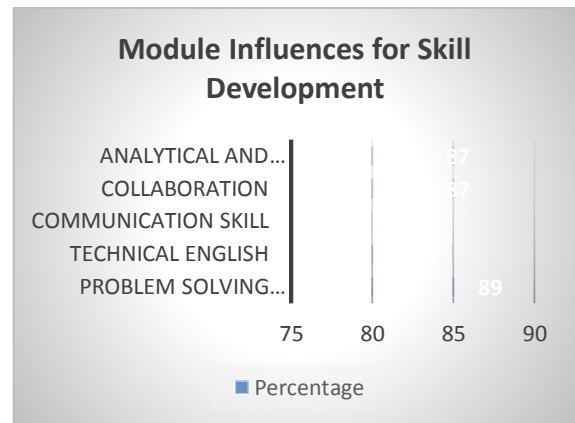

Figure 2. Students' Responses toward the English for Naval Architecture's Module Influences Skill Development

The implementation of Problem-Based Learning (PBL) within the module was another key aspect evaluated in this study. PBL proved to be a successful pedagogical approach in engaging students and promoting active learning. A large majority of students (86%) reported that the module motivated them to be more engaged in their learning, and the PBL activities helped improve their critical thinking skills. Additionally, 84% of students felt that the module enhanced their understanding of technical concepts, and 92% found group discussions to be particularly effective in deepening their understanding of the subject matter. These results align with previous studies suggesting that PBL encourages active participation and fosters deeper understanding, making it an invaluable teaching method for complex subjects like Naval Architecture (Badriyah et al., 2021; Indriani, 2022). Figure 3 below represented the results;
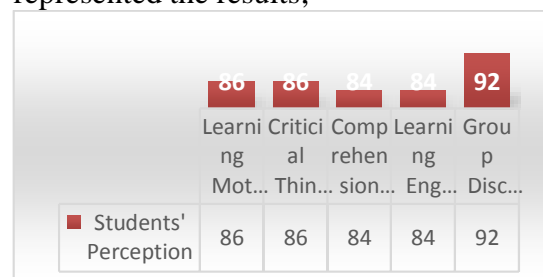

Figure 3. Students' Responses toward the Implementation of PBL in

English for Naval Architecture's Module

Finally, the evaluation of the relevance and usefulness of the module revealed that it effectively prepares students for real-world challenges. A substantial 86% of students felt that the module aligned well with their curriculum, and 91% believed that the content was applicable to their future careers in Naval Architecture. Furthermore, 91% of students agreed that the module helped prepare them for professional challenges, and 87% felt it enriched their learning experience. The module's alignment with students' learning expectations and its ability to provide both technical language skills and problem-solving capabilities were key factors in its success. These findings confirm that the module not only meets educational goals but also equips students with the practical knowledge needed for their professional development in the field of Naval Architecture (Donnelly & Fitzmaurice, 2005). The results were be figure out in this following figure;
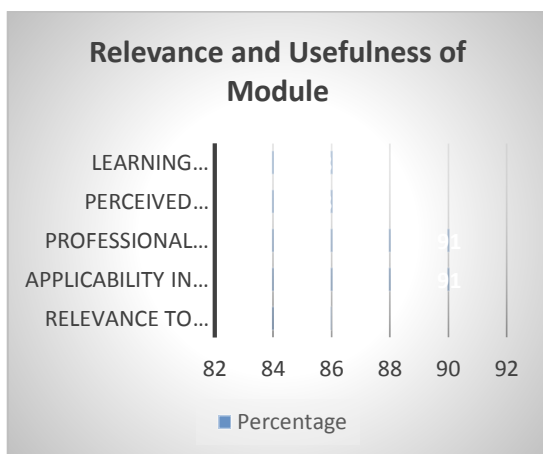

Figure 4. Students' Responses toward the Relevance and Usefulness of English for Naval Architecture's Module

Thus, the evaluation of the *English for Naval Architecture* module based on Problem-Based Learning (PBL) has demonstrated its effectiveness in enhancing students' understanding and skills in the field of Naval Architecture. The module received positive feedback from students regarding its quality, with high satisfaction rates for its clear structure, relevant content, and systematic presentation. It was found to significantly contribute to the development of essential skills such as problem-solving, technical English proficiency, professional communication, collaboration, and critical thinking. The integration of PBL within the module not only motivated students but also facilitated deeper engagement with the material, fostering a more interactive and reflective learning experience.

4. CONCLUSION

Based on the results above, it can be concluded that this study demonstrates that the implementation of the *English for Naval Architecture* module based on Problem-Based Learning (PBL) effectively improved students' English proficiency in the field of naval architecture. This is reflected in the N-Gain calculation, which yielded a result of 0.46, categorized as moderate. Although the improvement was not highly significant, the N-Gain value of 0.46 indicates a noticeable enhancement in students' English skills after using the PBL module. Through the PBL approach, students not only learn English theoretically but also develop more practical language skills that are relevant to the field of naval engineering.

Problem-based learning provides students with opportunities to apply English in solving real-world situations they encounter in the maritime industry, thereby increasing their motivation and understanding of the material. Additionally, the *English for Naval Architecture* module received positive feedback from students, as it helped enrich their understanding of the maritime world. Therefore, this PBL-based module can be an effective alternative for teaching English in naval architecture programs

and can serve as a model for developing more applied and contextual curriculum frameworks.

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