



Optimalisasi Pembelajaran Bahasa Inggris 2 (English for Mechanical Engineering) untuk Mahasiswa Program Studi Teknik Perawatan dan Perbaikan Mesin Politeknik Negeri Fakfak

Optimizing English for Mechanical Engineering through Problem-Based Learning for Students of Mechanical Maintenance and Repair Engineering Study Program Fakfak State Polytechnic

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Abstract: *This research aims to enhance students' English technical competence by implementing Problem-Based Learning (PBL) for the English for Mechanical Engineering course at Politeknik Negeri Fakfak. However, the setting of this research is rooted in students' difficulties in understanding technical terms and applying English in engineering work environments. Implementing a participatory action research model with descriptive qualitative approaches, the research was conducted among 50 students of two classes. Data were collected through questionnaires, observations, and interviews. The findings showed that 88% of students perceived the learning material as highly relevant, 84% reported improved mastery over technical vocabulary, and 90% reported greater collaboration and problem-solving skills. Furthermore, the intervention fostered active learning behaviors, peer leadership, and a positive shift towards more favorable attitudes among students towards English as a professional tool. These findings confirm that PBL is a valuable approach to English language learning contextualization in the vocational education context, enhancing the development of both language and soft skills. The research proposes wider implementation of PBL across technical curricula to improve educational outcomes in correspondence with industry requirements.*

Abstrak

Penelitian ini bertujuan untuk meningkatkan kemampuan bahasa Inggris teknis mahasiswa melalui penerapan model pembelajaran Problem-Based Learning (PBL) pada mata kuliah English for Mechanical Engineering (Bahasa Inggris 2) di Politeknik Negeri Fakfak. Latar belakang penelitian ini berangkat dari permasalahan mahasiswa dalam memahami istilah teknis dan mengaplikasikan bahasa Inggris dalam konteks profesional bidang teknik mesin. Penelitian ini menggunakan pendekatan partisipatif yang dikombinasikan dengan metode deskriptif kualitatif, penelitian ini melibatkan 50 mahasiswa dari dua kelas. Pengumpulan data dilakukan melalui kuesioner, observasi, dan wawancara. Hasil penelitian menunjukkan bahwa 88% mahasiswa menilai materi pembelajaran menjadi lebih relevan, 84% mengalami peningkatan penguasaan kosakata teknis, dan 90% mengakui adanya peningkatan keterampilan kolaborasi dan pemecahan masalah. Selain itu, penerapan PBL mendorong perubahan perilaku belajar ke arah lebih aktif, munculnya kepemimpinan di tingkat mahasiswa, serta peningkatan kesadaran akan pentingnya bahasa Inggris sebagai alat komunikasi profesional. Temuan ini menunjukkan bahwa PBL merupakan strategi yang efektif dalam mengontekstualisasikan pembelajaran bahasa Inggris di lingkungan pendidikan vokasi, sekaligus mengembangkan keterampilan lunak mahasiswa. Penelitian ini merekomendasikan penerapan PBL secara lebih luas dalam kurikulum teknik agar hasil belajar lebih selaras dengan kebutuhan industri.

Kata Kunci: Problem-Based Learning, English for Mechanical Engineering, Technical Vocabulary Acquisition

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1. BACKGROUND

In today's globalized and technology-driven world, the English language is the only capability required in every profession, particularly engineering. Integrating English for Specific Purposes (ESP) in vocational training is the solution to bridging the gaps between learning in school and industry requirements. Specifically, English for Mechanical Engineering (Bahasa Inggris 2) is a significant communication medium that enables students to read technical texts, communicate with global sources of information, and collaborate within global workplaces. However, English for Mechanical Engineering teaching at most Indonesian vocational schools remains substandard, even though it is essential.

One of the most serious issues is that the teaching methods do not align with the students' practical needs. Traditional English teaching in engineering studies concentrates on fundamental language skills, such as memorization of vocabulary and grammar, without embedding them in the context of applications in mechanical engineering. As such, the students cannot grasp technical jargon, read engineering manuals, and employ academic material in English. This detachment limits them from applying English in real professional contexts, hence their competitiveness in the job market is reduced (Widodo, 2016).

It is the same in the case of the Mechanical Maintenance and Repair Engineering Study Program, Fakfak State Polytechnic, as well. The students are reported to find it challenging to acquire English technical terms related to their field. The lack of contextualized teaching approaches, like problem-based or task-based learning, worsens passive learning behaviors and a lack of student participation. Moreover, the existing assessment systems fail to give proper evidence of students' ability to use English in real-world engineering practice, further escalating the issue. In addition, contemporary education research encourages student-focused learning paradigms like Problem-Based Learning (PBL) to address these problems. PBL promotes active learning, critical thinking, and collaborative problem-solving by putting language learning in actual, discipline-based settings (Hmelo-Silver, 2004). Research has proved that PBL enhances learners' language skills while developing professional skills (Šliogerienė et al., 2025). However, efficient implementation of PBL requires redesigning the curriculum framework, appropriate assessment rubrics, and appropriate learning resources designed to meet mechanical engineering students' learning needs.

Accordingly, it is essential to maximize the Mechanical Maintenance and Repair Engineering Study Program course utilizing a PBL-based approach to advance students' language and employability skills. In addition to improving academic achievement, the action contributes to making graduates suitable to meet the language and technical demands of the global engineering employment market.

2. METHOD

This research was conducted in the Mechanical Maintenance and Repair Engineering Study Program, Politeknik Negeri Fakfak, West Papua, with the D3 Mechanical Maintenance and Repair Engineering Program students. The research covered the whole population of 50 students, i.e., two classes with 25 students in each class. The students were selected by their registration for the English for Mechanical Engineering course within the semester period, which was directly related to the research objectives. The greatest challenge overcome was the students' inability to understand English technical terms and apply them to real-life engineering processes. To address this problem, the cooperative approach was employed, in which the students and lecturers were involved in a collective effort to enhance the learning process through problem-based and contextualized learning techniques. The research used a Participatory Action Research (PAR) strategy, which emphasizes the active involvement of students as co-designers of learning solutions. Lecturers played facilitation roles, executing the problem identification, intervention design, and reflective appraisal processes. This guaranteed that interventions were immediately responsive to learning needs.

The research began with the facilitation of Focus Group Discussions (FGDs) among purposively chosen student representatives, lecturers of English, and curriculum staff. The FGDs explored technical English comprehension issues, engineering report difficulties, and communication problems in technical environments. Results of these FGDs were later used to develop Problem-Based Learning (PBL) modules and context-specific learning materials in collaboration. Students were actively involved at each learning level in the research: finding learning problems, proposing suitable engineering scenarios, returning feedback on learning materials, and participating in reflective workshops after every intervention cycle. This participatory approach increased engagement and setting-related alignment in learning. Study

54

design combined Qualitative Descriptive Research with Classroom Action Research (CAR) cycles. Both student groups went through iteratively repeated planning, acting, observing, and reflecting cycles to allow for continuous improvement in teaching methods. Data collection methods were observation of the classroom, semi-structured student and lecturer interviews, analysis of work by students, and reflective diaries. Data were examined by thematic analysis, emphasizing patterns of learner engagement, awareness of technical English, and application of English in engineering contexts. Triangulation of data sources ensured the validity and reliability of the findings.

3. RESULT

The results revealed that 88% of the students found the learning material very relevant to their field, proving that contextualization of mechanical engineering problems made the learning material more meaningful. Further, 84% of the students reported significant improvement in their knowledge and usage of technical English vocabulary, proving the effectiveness of PBL in promoting the acquisition of discipline-specific language skills. Lastly, 90% of the students agreed that PBL enhanced their collaboration and teamwork skills while solving problem-solving activities. Here, the researchers provide the indicators and responses.

Table 1: The Students' Indicators and Responses

No	Indicator	Positive Response (%)	Neutral (%)	Negative (%)
1	Relevance of Learning Materials	88%	10%	2%
2	Improvement in Technical English Vocabulary	84%	14%	2%
3	Engagement in Collaborative Problem Solving	90%	8%	2%

The results of the questionnaire, visualized in the table above, reveal a consistently positive student perception of the Problem-Based Learning (PBL) approach in the English for Mechanical Engineering course. Regarding the relevance of learning materials, 88% of students responded positively, indicating that the contextualized problems used in PBL were perceived as highly aligned with their field of study. Only 10% remained neutral, and a mere 2% responded negatively. Regarding technical vocabulary improvement, 84% of students agreed that PBL activities significantly enhanced their understanding and usage of engineering-specific English

terms, while 14% were neutral and 2% disagreed. The highest positive Response was observed in the collaborative problem-solving aspect, where 90% of students reported improved teamwork and communication skills. This reflects the effectiveness of PBL in fostering collaborative learning environments, with only 8% neutral responses and 2% negative feedback. These findings indicate that the PBL approach addressed students' learning needs and contributed to active engagement, vocabulary mastery, and the development of essential soft skills such as collaboration and problem-solving. The overwhelmingly positive responses further validate existing research highlighting the impact of PBL in enhancing linguistic and professional competencies in ESP contexts.

4. DISCUSSION

The following is an in-depth diagram of the research results for further details.

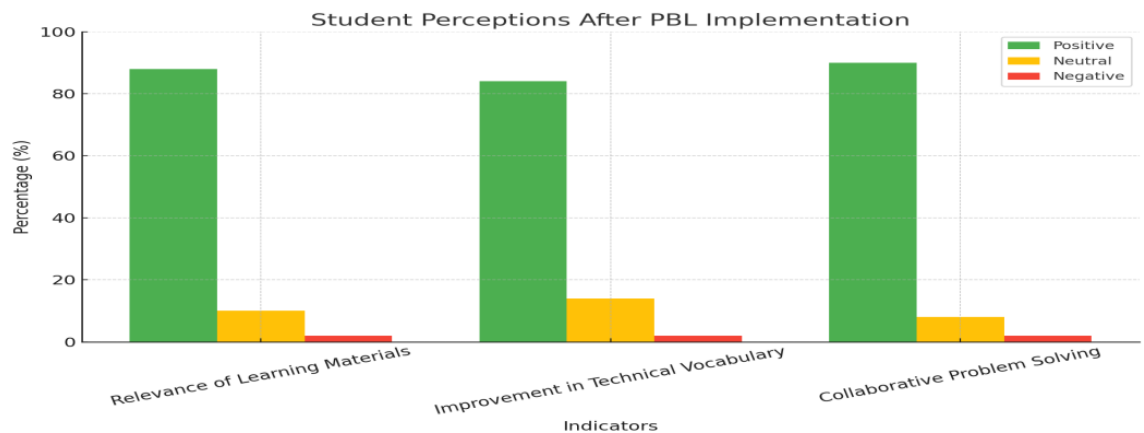


Figure 1 Students Perceprions after PBL Implementation

The bar chart shows how the students felt after Problem-Based Learning (PBL) was implemented in the English for Mechanical Engineering course. It demonstrates three leading indicators: learning material relevance, improvement in technical vocabulary, and team problem-solving participation. The statistics prove that 88% of the students felt that the learning material was relevant to their field of study. In comparison, 84% improved their application and understanding of technical English vocabulary. Moreover, 90% of the students agreed that PBL activities enhanced their teamwork and collaboration abilities. Few students responded positively or negatively (8–14%) or negatively (2%) on all indicators. Generally, the graph clarifies the positive impact of PBL on student engagement, technical vocabulary learning, and collaborative learning opportunities.

Problem-based learning has been shown to transform ESP classes by placing technical matter within communicative tasks in authentic contexts. For example, Mariotti (2024) states that PBL "constructs meaningful communication environments" and thus promotes disciplinary literacy in ESP engineering pedagogy. Also, experimental studies find that students acquiring technical English through online PBL outperform convention-setting counterparts on word lists – Shchukin et al. (2021) found significantly higher technical vocabulary scores after online PBL exercises compared to after lecture-based instruction. This increased regulation of jargon is supported by development in practice in communication: Porras-Soriano and García-Sánchez (2020) reported that engineering students who participated in real project tasks (e.g., commenting on civil-engineering documentaries in "Lunch & Movie" sessions) exhibited improved technical oral communication skills. In addition to language, PBL also builds the 21st-century skills that employers demand: Tuzlukova and Singh (2018) state that PBL led students to plan and work independently, think creatively and critically, and collaborate – one business-ESP student noted that "PBL encourages lifelong learning and enables students to develop... critical thinking, creativity and good communication skills".

Other writers also note that PBL fosters independent learning and active engagement (since students must undertake problem-solving) and enhances motivation. In the discipline of English-for-Business, Chi (2022) also found that PBL activities resulted in impressive additions to students' personal, professional, and social growth, and language learning. Finally, comparative research supports PBL over lectures: Hsieh and Knight (2008) showed that first-year engineering students in a PBL program had superior overall learning outcomes (including communication and teamwork skills) to those in a standard lecture course. Finally, ESP and engineering evidence support the view that PBL, in addition to improving mastery of technical vocabulary and student engagement, also builds communication skills and 21st-century problem-solving and collaboration competence. Below, researchers present some supporting documentation related to applying the Problem-Based Learning approach in the Bahasa Inggris 2 course.

a. Part 1: Implementation of PBL to students



Figure 3: Students explain the machines drawn and their functions.





Figure 4. Each group has finished presenting a 3-dimensional machine drawing and explaining its function.

Part 2: Focus Group Discussions with Lecturers and Curriculum Staff



5. CONCLUSION

This research found that implementing Problem-Based Learning (PBL) into the English for Mechanical Engineering (Bahasa Inggris 2) course substantially enhanced students' engagement, technical English vocabulary proficiency, and collaborative problem-solving abilities. Most students found the learning materials relevant, and they reported feeling more confident and engaged in their language study. Furthermore, the rise of informal peer leadership and increased cooperation suggest that PBL promotes language competence and critical soft skills in professional engineering environments.

Based on these findings, it is recommended that the Mechanical Maintenance and Repair Engineering Program curriculum continue to include PBL and consider extending this pedagogy to other technical courses. Faculty should be provided with faculty development programs to learn the skills required to design and facilitate PBL activities effectively. Additional strengthening of the industry-based learning materials and assessment rubrics will also continue to optimize students' learning achievements. Future studies could investigate the long-term effects of PBL on graduate employability and professional communication in industry.

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