ENHANCING COMMUNICATION SKILLS OF ENGINEERING STUDENTS THROUGH EFL PLATFORM-ASSISTED PROJECT WORK

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Abstract. The primary goal of higher education is to prepare graduates for the working environment. However, traditional university courses often fail to teach the knowledge and skills highly demanded in the job market today. In particular, verbal and non-verbal communication skills in a professional context are essential. Fortunately, digitalization has made learning more convenient and effective through the implementation of technology. This article explores the use of EFL (English as a Foreign Language) platform-based engineering projects in ESP (English for Specific Purposes) extracurricular courses for engineering students in higher education contexts. The study aimed to assess the impact of using engineering projects developed with the help of partial incorporation of ESP learning courses on the Prometheus platform, on the formation of verbal and non-verbal communicative competencies of engineering students in the experimental group. The sample involved two groups of first-year students majoring in Electrical Engineering, Electromechanics, and Electrotechnology, with one group serving as the control group ($n_{contr.} = 25$) and the other as the experimental group ($n_{exp.} = 20$). Data was collected from students' engineering projects according to verbal and non-verbal communication skills criteria. For data analysis, we used Fisher's criterion to assess the formulated hypotheses, and the calculations were carried out with the help of MS Excel. The results showed that engineering students in the experimental group outperformed their group mates by more than 1.5 in terms of written competencies and non-verbal communication skills in the profession-based context. Further data analysis based on Fisher's criteria revealed a reliable difference in the share of participants who succeeded in defending the project in both groups. The study suggests that language learning platforms have the potential to be used in project-based study in ESP classes to help engineering students improve their verbal and non-verbal communication skills in a professional context.

Keywords: Prometheus platform; engineering projects; communication skills; electrical engineering students; ESP course; extracurricular course.

Introduction

There has always been a demand for skilled and qualified engineering graduates. Very often university engineering courses focus on developing technical skills and abilities, ignoring verbal and non-verbal communication skills in particular. Considering the specifics of ESP courses in technical universities in Ukraine engineering students face formidable challenges in acquiring these skills. To be more precise, an ESP course for future Electrical Engineers does not usually exceed the amount of 360 academic hours covered within four academic years or eight semesters. However, the course contains only 120 classroom academic hours, and 240 academic hours are allocated for independent students' work. To compensate for the lack of classroom training, foreign language instructors should not only employ appropriate teaching and learning methods which allow future engineers to develop communication skills and practice the content knowledge in professionally oriented contexts but also conduct regular extracurricular activities and ESP clubs to prepare engineering students for effective communication in professional contexts.

PBL (Project-Based Learning) differs from traditional ESP learning. It provides the application of students' prior or newly acquired knowledge, abilities, and competencies in English through the integration of PBL into ESP courses [1]. Students learn English that is related to their ESP major, as well as develop their studies-related knowledge in a way that is collaborative, investigative, and authentic [2]. In this respect, the PBL approach may become one of the strategies which enable ESP teachers to minimize or overcome the above-mentioned challenges such as lack of learning hours for ESP courses and a significant advantage of the hours allotted for student independent work, i.e. autonomy, for several reasons.

First of all, this approach meets the requirements of "Generation Z" or "Visual Generation", which prefers pictures to reading [3] and can be utilized as a multipronged approach in different educational settings GE – General English, EAP – English for Academic Purposes, ESP – English for Specific Purposes, EOP – English for Occupational Purposes, also viable for pre-service and teacher training programs [4].

Second, PBL provides numerous advantages for university students. It enables opportunities for language learners to develop all four language skills in integrated and contextualized settings [5; 6]. It has a considerable impact on communication [7], listening and speaking skills [8; 9] because it implies teamwork, written and oral presentations both to an academic audience and a professional one. PBL focuses on content learning rather than on specific language patterns, and students have opportunities to develop soft skills such as problem-solving, creativity, teamwork [1; 10; 11], critical thinking and argumentative skills [7], abilities to plan, manage, and accomplish projects through their content knowledge, presentation skills [11] and EFL skills in profession-based contexts [10; 1; 11].

Third, project-based learning considers diverse learning styles, which is a great advantage of this type of teaching method because it helps raise students' motivation and promote learner's autonomy [12].

Forth, considering the problem-solving nature of engineering disciplines, PBL for engineering students may enhance critical thinking skills and emphasize logical reasoning and analysis in a technical context. Moreover, teaching a foreign language to students of engineering specialties differs from teaching students of other specialties because of the technological foundation of engineering disciplines. Therefore, ESP training for engineering students may involve the integration of technology tools and platforms for ESP learning. This means that the use of technology, English for STEM online course resources, in particular in PBL, with the engineering students will contribute to improving communication skills.

The PBL research study in the Ukrainian context is focused on ESP teaching using projects with an emphasis on students' fields of study (Electrical Engineering) in extra-curricular activities with the engineering students. For this reason, the present study aimed at answering two research questions: (1) Is there any significant difference in students' ESP learning outcomes before and after being taught using PBL? (2) What skills does PBL instruction influence?

Materials and methods

We used a quantitative research method which included experiments to attain greater knowledge and understanding of the issue and to test hypotheses formulated. The study included 45 first-year bachelor students majoring in Electrical Engineering and enrolled in ESP extra-curriculum course during the first and second semesters of the 2023 academic year. Every academic year, teachers of the Foreign Languages Department approve the working plans of extra curriculum courses, scientific formations and English-speaking clubs at monthly department meetings. Accordingly, at the end of the academic year, the teachers of the Foreign Languages Department provide a report on the extra-curriculum activities conducted and discuss educational strategies that contributed to the achievement of high or low learning outcomes. According to the approved plan, we had 64 academic hours, 32 hours in each semester.

The main objective of the extra curriculum course was to practice all foreign language skills with a certain subject matter. During the two semesters, we incorporated authentic videos, podcasts, blogs and websites concerning Climate change, the Green House Effect and the Impacts of Climate Change on Our World, and Nanotechnology that Would Help to Slow down Climate Change. One profession-based project was planned at the end of the spring semester for students to apply both knowledge of the subject matter and their language skills in completing the project. Currently, research institutions and private companies are looking for engineers who can create and build new energy systems that can limit the effects of climate change. Many of these energy systems come from renewable energy sources, such as wind, solar, and hydroelectric power.

The students of the Podillia State University majoring in Electrical Engineering, Electromechanics, and Electrotechnology participated in the experiment. The control group had 25 students, and the experimental group had 20 students. The groups were not formed specifically for the experiment. The experimental and control groups are identical to groups 1 and 2 which have regular ESP classes. All participants have an average level of English-language competence, as they passed the entrance exam and scored more than 130 points in the subject.

Engineering students in experimental and control groups were asked to create a project in oral presentation format on the theme: New Energy System for your Country. Engineering students had to

describe a current energy system used in Ukraine, name it, explain the way the energy source creates power and prove its impact on the environment.

During the extra curriculum course, we read, watched, and listened to a variety of texts and multimedia sources, and performed comprehension check quizzes with the students of the control group. Moreover, the students of the control group were given instructions and useful materials on performing a good presentation.

At the same time, the experimental group of students agreed to implement English for STEM (Science, Technology, Engineering and Mathematics) online course resources from the University of Pennsylvania [13]. The advantages of the platform include quality profession-based video and text resources, digital format (Quizlet) for acquiring new terminology, assessments in test, quiz and game format to check the learned material, texts of scientific articles for students of different levels (B1-B2), bonus resources and certificates. All topics fully coincide with those mastered by the students of the control group. To teach presentation skills to the students of the experimental group, we used only one unit on the same Prometheus platform. This time the course was called Business English [14] where presentation skills were taught.

To implement problem-based learning with the engineering students we used the recommendations of Mathews-Aydinli (2007). We provided the students with available resources and research questions on the project theme and guided the students with comments on presentation content, language and manner of delivery [12]. All projects were completed individually, and the students from both groups presented their projects in the final week of the course.

Results and discussion

To evaluate the student projects we used rubrics given in Table 1.

Table 1

Rubrics for student project evaluation

Category	Element	Explanation	Points
Non Verbal Skills	Eye Contact	Hold attention of entire audience with the use of direct contact, seldom looking at notes	1-5
	Body Language	Movement seems fluid and helps the audience to visualize	1-5
	Poise	Student displays relaxed, self-confident, makes no mistake	1-5
	Persuasiveness	Topic knowledge, no visible nervousness	1-5
	Interaction	Pointing, referring, using appropriate expressions	1-5
Verbal Skills	Enthusiasm	Demonstrates strong and positive feelings about topic during entire presentation	1-5
	Elocution	Student uses clear voice and correct, precise pronunciation of terms so that all audience can hear the presentation	1-10
	Verbal Interaction	Highly responsive to audience comments and needs. Consistently clarifies, restates, and responds to questions. Summarizes when needed	1-10
Content	Subject Knowledge	Student demonstrates full knowledge by answering all questions with explanations and elaboration	1-5
	Organization	Student presents information in logical, interesting sequence which audience can follow.	1-5
	Mechanics	Presentation has no misspellings or grammatical errors	1-5
	Creativity	Very high creativity level. Student uses many graphics, pictures, video etc. Related, attractive and effective	1-5
	Development	Structured parts of presentation	1-5
		Total	**75**

The maximum score for the project presentation was 75 points, and the assessment was done in the format of “passed” or “not passed”. To receive a passing grade, students needed to achieve at least 60 points. In the control group (n = 25), 10 students completed the project successfully, while in the

experimental group, 14 out of 20 students received 60 or more points for their presentation. The proportion of successful completion in the first group was 0.4, while in the second group, it was 0.7. Therefore, the fulfilment rates differed by a factor of more than 1.5.

Based on the results, we can assume that the implementation rate in the experimental group is significantly higher than the rate in the control group. However, to perform a more accurate analysis of the results obtained, we decided to use Fisher's criterion and test the following hypotheses:

H_0: The share of students who successfully completed the project in the experimental group did not differ statistically from the proportion of students who successfully completed it in the control group.

H_1: The share of students who successfully completed the project in the experimental group was significantly higher than in the control group.

The calculations were performed using MS Excel and the results are shown in Table 2.

Table 2

Statistical calculation according to Fisher's criterion performed in MS Excel

Groups	***N***	**Passed**	P_i	φ_i	$\varphi_{exp} = 2.04$; $\varphi_{cr} = 1.64$ for $p \leq 0.05$
Control	25	10	0.4	1.369	$\varphi_{exp} > \varphi_{cr}$; H_1 is accepted
Experimental	20	14	0.7	1.982	

We conducted a study to examine the impact of technology-assisted PBL on engineering students' performance. Using Fisher's criterion, we found that φ_{cr} was equal to 1.64 and φ_{exp} was 2.04 for the significance of $p \leq 0.05$. Since φ_{exp} was greater than φ_{cr}, we rejected the null hypothesis, indicating a significant difference between the control and experimental groups. This suggests that the experimental integration of technology-assisted project work in ESP learning had a significant effect on project presentation skills compared to the control group.

However, to gain a comprehensive understanding of the impact of technology-assisted project work, it is necessary to delve into the qualitative aspects of the study. Examining the specific categories such as verbal, non-verbal skills and content in which students from both groups excelled or faced challenges provides valuable insights into the nuanced effects of the experimental intervention.

The results of the experimental group were as expected. The students performed well in verbal and non-verbal skills. To be specific, the category of verbal skills demonstrated enthusiasm and verbal interaction as the dominant skills, while persuasiveness and body language were the strongest skills in the context of non-verbal skills. We believe that such results can be attributed to the use of an online course and video content from native speakers. By imitating the speaker's manner in instructional videos, students were able to improve their verbal and non-verbal skills. On the other hand, students in the control group showed good results in terms of the content of the project, such as development and organization.

Our study is in line with the results of the surveys, which indicate that the PBL strategy in ESP teaching contributes to the development of various language skills, such as speaking, listening, and writing. However, our research differs from other studies because we implemented the project method based on the use of an online course created by native speakers and specialists in the energy industry. Our study showed that this method improves both verbal and non-verbal skills. Additionally, using this method as an elective course has its advantages as it helps develop skills that are not given enough attention due to a lack of classroom hours.

Conclusions

The analysis using Fisher's criterion provided valuable insights into the effectiveness of PBL in improving the test performance compared to the control group. By calculating the F-ratio and comparing it with the critical F-value, we were able to determine the significance of the difference between the two groups. This enabled us to draw the following conclusions:

1. Effective communication is a fundamental factor in engineering. Even highly qualified engineers may fail if they lack communication skills. Therefore, when learning a foreign language, emphasis should be placed on developing communication skills.
2. The project method is suitable for elective English for Specific Purposes (ESP) courses and clubs. In the context of ESP learning, it can contribute to the development of presentation or project-related skills, such as verbal and non-verbal communication.
3. Using online platform resources in ESP teaching through the PBL method can contribute to the improvement of language and non-language skills of students in technical specialties.
4. The findings of the present study can have implications for educational practices, highlighting the potential benefits of implementing technology in project-based ESP learning with engineering students in academic settings.

Author contributions

Conceptualization, O. C.; methodology, M. V. and L. K.; software, O. P.; validation, O. P.; formal analysis, O. C. and M. V.; investigation, O. C. and L. K.; writing – original draft preparation, O. C.; writing – review and editing, O. C. and L. K.; visualization, All authors have read and agreed to the published version of the manuscript.

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