

CAREER-FOCUSED ESP LEARNING THROUGH MECHANICAL ENGINEERING ANDROID APP AND FE PREP FLASHCARDS

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Abstract. The ever-growing shortage of engineers in the world job market makes education institutions more responsive to engineering labour needs. Engineering students graduate from the university with the expectation of being able to compete in a global business environment. Foreign language fluency is important for future engineers to excel in their careers and pursue their qualifications in English-speaking countries. The present study sought to examine the efficacy of the Mechanical engineering multiple-choice questions android application and FE engineering exam flashcards as tools for improving the vocabulary size on technical terms and developing the FE test-taking skills. To address these challenges, we used a one-group pretest-posttest design. Fifty college graduates studying ESP in their first year at Higher Education Institution Podillia State University, Ukraine, participated in the study. Pretest and posttest were comprised of two components: Quizlet engineering flashcards (25 terms) and 50 engineering multiple-choice questions. The participants were tested first under the control condition and then under the treatment condition. The technical vocabulary acquisition was measured on a scale from 0 to 12.5. The initial baseline shows an average technical vocabulary acquisition score increased from 4.9 to 8.6. To compare students' results in engineering multiple-choice questions before and after using the Mechanical engineering application we used Wilcoxon signed rank-sum test. The findings of the study indicate that the empirical value obtained is in the zone of significance. Consequently, the first hypothesis (the group's academic performance has increased significantly) is accepted. The study offers pedagogical implications for EFL instructors concerning the integration of the Mechanical engineering application and FE engineering exam flashcards to improve the engineering vocabulary size and develop test-taking skills in the FE engineering qualification exam.

Keywords: ESP, android quiz app, exam, flashcards, technical vocabulary, profession-based tasks.

Introduction

The U.S. Bureau of Labor Statistics that measures labour market activity, working conditions, and price changes in the economy added the engineering profession to the list of 20 occupations with the highest median annual pay. The U.S. Bureau of Labor Statistics projects employment growth for these workers, with nearly 140.000 new jobs expected for engineers over the 2016-2026 decade. However, the biggest challenge for engineering graduates in Ukraine is an inadequate level of English proficiency to meet the emerging needs of stakeholders and increase their employability in the engineering area through passing FE (EIT) and PE exams in English-speaking countries to prove engineering qualification and to become a licensed engineer.

The aim of ESP teaching in a technical university is to equip engineering students with English proficiency levels for target needs: reading, writing, listening and speaking in general and professional contexts and to prepare the students for qualification engineering exams. Acquiring four basic skills in a profession-based context and learning test-taking strategies for such exams as PE and FE is impossible without acquiring technical vocabulary and solving profession-based tasks. The issue of information technology tools was tackled in a considerable amount of research in recent years.

Teaching and learning technical vocabulary has traditionally been associated with challenging tasks because commonly used words have a different context in the field. According to Hsu [1], engineering undergraduates need to know 5000 technical word families to understand engineering textbooks. The results of recent studies revealed that engineering majors prefer to use determination strategies (analyzing pictures or gestures) and metacognitive strategies (listening and watching English media) [2] more frequently in comparison to cognitive strategies [3]. The m-learning environment in technical vocabulary learning is considered to be up-to-date, fast and provides countless contexts for technical words, correlations, explanations, as well as links to more resources [4, p. 178] and the students have positive acceptance towards the use of mobile apps in learning vocabulary [5]. However, it is important to treat m-learning as a supplement rather than a substitute for traditional learning [6].

Several studies have demonstrated that technology-based learning strategies can benefit engineering vocabulary acquisition [7-9]. The content of VocBlast as a newly-developed engineering vocabulary

app was reviewed from the language teachers' perspectives. The study showed the engineering students' positive attitude in adopting a vocabulary mobile app to learn technical vocabulary [10]. Busch-Lauer I. A. introduced some useful digital resources for teaching in the ESP classroom (online dictionaries, e-learning platforms, podcasts, webinars, networks, blogs, e-magazines and professional newsletters). The efficacy of using online dictionaries with engineering students in preparing for final exams was also examined in several studies [11]. A researcher mentioned resources for developing terminological knowledge such as Explore Technical English that addresses the needs of students in technical subjects on the language level B1 targeting C1 and offers plenty of opportunities for self-instructed study and exercising [12, p. 270].

The collaboration project between the National Cheng Kung University in Taiwan and the Oslo University College in Norway resulted in creating a novel virtual vocabulary tutor aimed to stimulate the joy of reading and independent college student work [13]. As could be seen from the literature review above, the research studies on applying technology in career-focused vocabulary acquisition are focused on a limited number of digital tools that can improve engineering students' performance. However, Mechanical engineering multiple choice questions android quiz app and FE engineering flashcards as effective strategies for increasing engineering vocabulary and developing FE test-taking skills have not been researched yet. Against this background, the purpose of this paper is to answer the research question: "Can engineering android applications improve students' ESP performance?" More specifically, this research has two objectives: 1. To explore the efficacy of using the Mechanical engineering android quiz app in increasing the technical vocabulary size of engineering students and developing engineering multiple-choice questions skills for the FE exam. 2. To examine the impact of FE engineering exam prep flashcards in improving students' vocabulary acquisition and developing profession-based multiple question test-taking.

The findings of this research are expected to assist future engineers in improving their foreign language skills in the engineering context and increasing students' awareness of the need for passing an engineering certification test. The rest of the article is structured as follows: first, literature on integrating different applications in engineering ESP teaching is reviewed. This is followed by a description of the research methods and procedures used in the study. Then the results of our study are discussed.

Materials and methods

To gather the data of the engineering students' progress in technical vocabulary acquisition and ability to solve profession-based tasks before and after using the Mechanical engineering android quiz app and FE engineering exam prep flashcards one-group pretest-posttest design was used.

Fifty first-year students of the Engineering and Technical Department entered the Higher Education Institution Podillia State University after the colleges agreed to participate in the study. They were selected due to their experience in ESP learning at college. Engineering students in the present study devoted thirty minutes of their two-hour ESP class to conduct the Mechanical engineering android quiz app and FE engineering exam prep flashcards activity over two semesters. The participants were tested (the test contained two components: Quizlet engineering terms flashcards (25 terms) and 50 engineering –multiple choice questions) before and after using apps. To measure the extent of students' progress we used the mean score for the first test component and Wilcoxon signed rank-sum test for engineering –multiple-choice questions. Wilcoxon signed rank-sum test was identified as the best research instrument for this particular study, because the Wilcoxon criterion is used when comparing indicators obtained on the same group of subjects, which does not exceed 50 participants, under two different conditions. The experimental hypotheses for the second test component were formulated:

- H_0 : There is no reliable increase in the group's academic performance.
- H_1 : The group's academic performance has increased significantly.

Mechanical Engineering Objective Questions MCQ is provided by My tutorial world team at no cost and can be uploaded at Google play. Mechanical Engineering Objective Questions MCQ Android Quiz app contains the most important questions in the form of question papers and objective questions with explanations and answers supported by pictures, schemes and formulas for engineering placement tests and job interviews and an engineering quiz that contains civil engineering, computer science and

mechanical engineering questions. Fig. 1 shows the screenshots of engineering multiple choice questions “Mechanical Engineering MCQ Set 1” and “Mechanical engineering Objective question”.

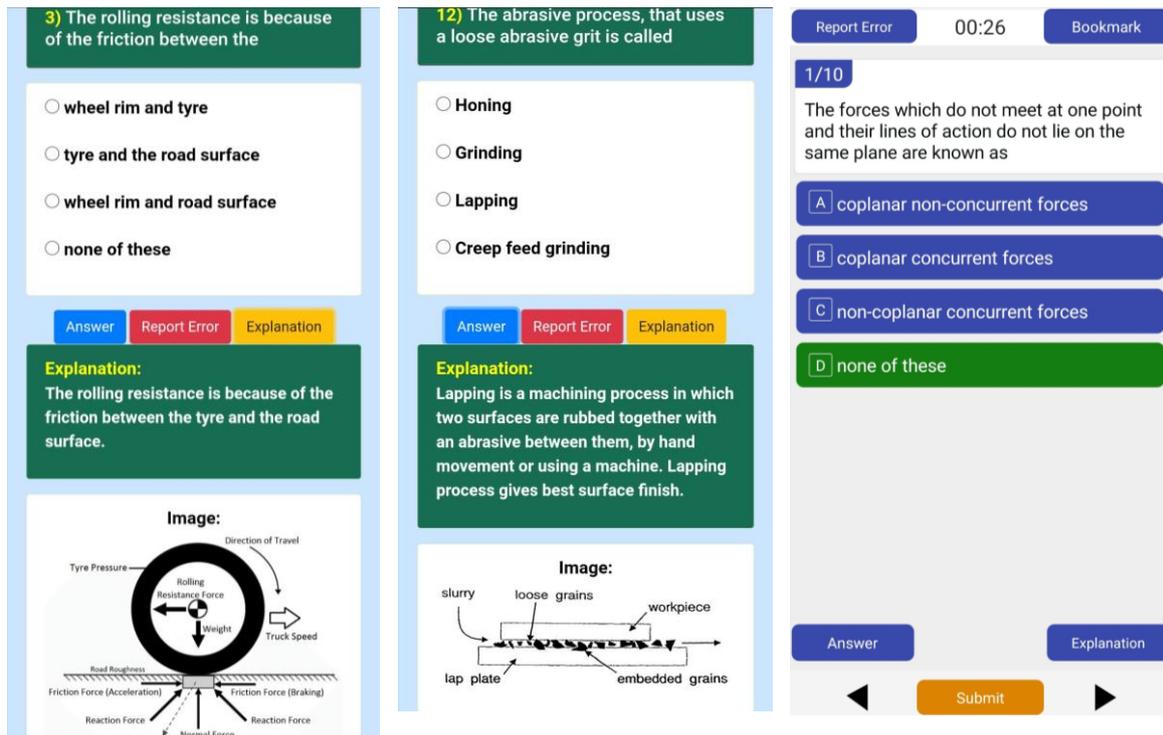


Fig. 1. Screenshots of multiple questions from Mechanical Engineering MCQ Set 1 and a quiz

To remember and practice unknown words from Mechanical Engineering MCQ we created modules in Quizlet. We also used FE questions flashcards ($n = 588$) available at <https://quizlet.com/300861212/fe-questions-flash-cards/> and fundamental FE exam prep: fundamental units questions flashcards (92) available at <https://quizlet.com/29130466/fe-exam-prep-fundamental-units-flash-cards/>.

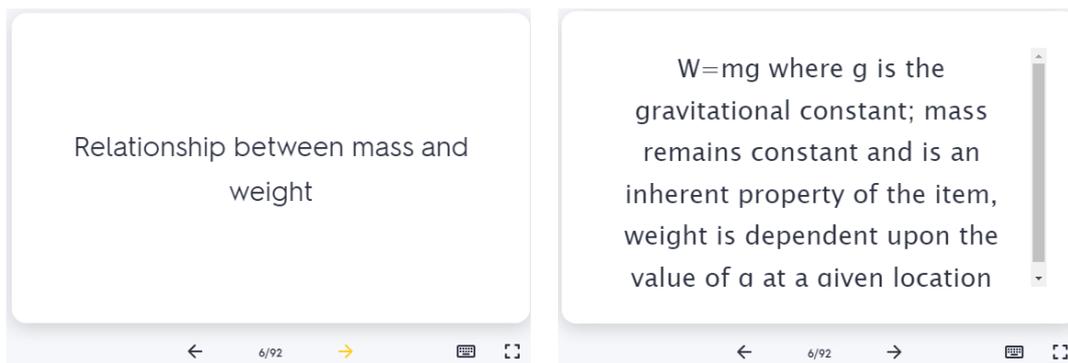


Fig. 2. Screenshots FE question flashcards

Results and discussion

At the beginning and the end of the academic year, 2020/2021 pre-and post-tests were used to compare engineering students’ progress in technical vocabulary acquisition and developing FE test-taking skills. The pretest and posttest had a similar structure, they consisted of two components: the engineering term definition (25 terms) and fifty multiple-choice questions. Each question in the first component of the test answered correctly was given 0.5 points. Accordingly, each question in the second

component of the test answered correctly was given 1 point. To analyze the pretest-posttest data the difference method was calculated with the help of Excel. The calculation is shown in the figure.

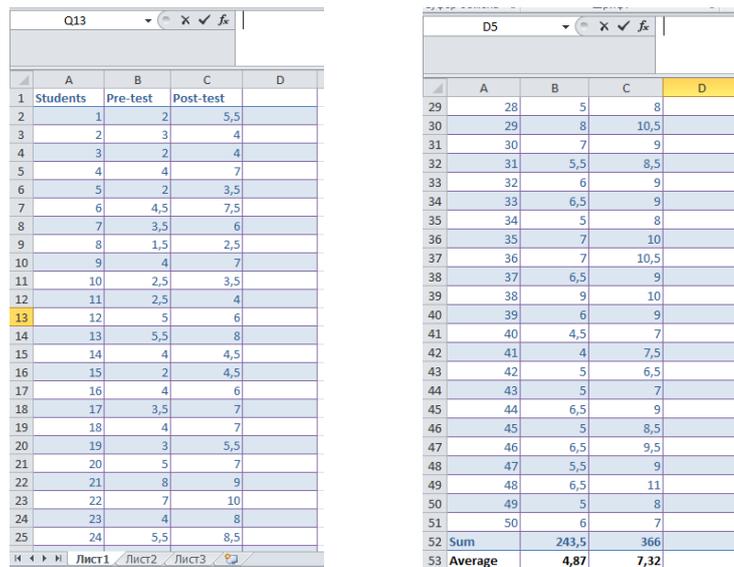


Fig. 3. Mean score for the first test component

The statistics in Figure 3 indicate a significant difference ($7.32 - 4.87 = 2.45$) in the mean average pre and post-test scores. The results of the first component of pre and post-test showed the increase of students' technical vocabulary size at 19%. To identify the differences in FE prep exam multiple-choice questions before and after using the engineering android app and FE prep exam flashcards we used the Wilcoxon T-criterion.

Table 1

Pre and post-test results in the second test component

Pre-test	14 8 10 15 9 20 15 7 19 13 10 23 26 18 12 17 9 14 8 17 23 21 15 26 19 18 9 13 19 24
	19 10 15 8 17 25 14
Post-test	28 10 6 11 14 19 23 16 27 12 19 11 17
	16 9 11 17 10 23 18 9 21 15 13 20 29 18 13 19 11 17 7 19 23 23 17 25 20 19 8 14 22
	26 19 11 18 10 19 29 17
	26 10 9 13 16 18 24 19 27 12 21 14 17

Table 2

Wilcoxon signed-rank test: differences between two paired samples ranked by magnitude, with corresponding rankings

Differences	2 1 1 2 1 3 3 2 2 2 3 -3 3 0 1 2 2 3 -1 2 0 -2 2 -1 1 1 -1 1 3 2 0 1 3 2 2 4 3 -2 0 3 2 2 1 1 3 0 0 2 3 0	15.8
Ranked differences	2 1 1 2 1 3 3 2 2 2 3 3 3 0 1 2 2 3 1 2 0 2 2 1 1 1 1 1 3 2 0 1 3 2 2 4 3 2 0 3 2 2 1 1 3 0 0 2 3 0	17.2
Ranks	22 7 7 22 7 36.5 36.5 22 22 22 36.5 36.5 0 7 22 22 36.5 7 22 0 22 22 7 7 7 7 7 36.5 22 0 7 36.5 22 22 43 36.5 22 0 36.5	108.5

The sum of the ranks of atypical shifts is T_{exp} and equals 108.5. In the table of critical points, we identify T_{cr} , where n is the sample size minus zero shifts ($n = 43$). Critical values T_{cr} for $n = 43$ and $\rho \leq 0.05$ are 336. Consequently, $T_{exp} < T_{cr}$ ($108.5 < 336$). It means that H_0 hypothesis is rejected and H_1 hypothesis is accepted. As we can see, Wilcoxon's T-test confirmed the validity of the experimental hypothesis: The group's academic performance has increased significantly.

This study investigated the impact of the Mechanical engineering android quiz app and FE engineering exam prep flashcards on engineering students' vocabulary size and FE test-taking skills. To our knowledge, it is the first study that demonstrates the effect of career-based android applications

(Mechanical engineering multiple choice questions android quiz app) and FE engineering exam flashcards in ESP learning. Pre and post-test results indicate that engineering students performed better after using technology. This is in line with previous studies on the benefits of the digital learning environment in ESP classrooms [4; 5; 7; 8; 10-12]. The results of the study proved the efficiency of using applications in ESP learning with engineering students. Nevertheless, previous research on integrating foreign language applications was primarily conducted with the implementation of such applications as VocBlast, Quizlet (on-line vocabulary platform), TechnoPlus English (career-based application) and the author's virtual platforms. The applications in the present study were chosen according to several factors: free download, career-based content, previous experience with vocabulary flashcard platform, profession-based tasks used in FE engineering exam with further explanation and the quiz. This study contributes to ESP teaching by demonstrating the importance of the implementation of career-based applications to prepare competitive engineers for the world labour market.

Conclusions

1. The review of existing literature revealed a research gap in conveying experimental studies considering the use of engineering applications in ESP learning that can enhance both professional vocabulary acquisition and developing multiple-choice test-taking skills for the FE engineering exam.
2. The present study experimentally proved the efficacy of using the Mechanical engineering android quiz app in ESP learning. The technology helped to increase the technical vocabulary size of engineering students and to develop engineering multiple-choice questions skills for the FE exam.
3. The study showed that FE engineering exam prep flashcards improved students' vocabulary acquisition.

Author contributions

Conceptualization, Olha Chaikovska; methodology, Iryna Zavadzka; software, Tetiana Kozina; validation, Olha Chaikovska and Iryna Zavadzka; formal analysis, Maryna Ikonnikova; investigation, Olha Chaikovska, Iryna Zavadzka, Maryna Ikonnikova and Tetiana Kozina; writing – original draft preparation, Olha Chaikovska; writing – review and editing, Olha Chaikovska and Iryna Zavadzka. All authors have read and agreed to the published version of the manuscript.

References

- [1] Hsu W. Measuring the vocabulary load of engineering textbooks for EFL undergraduates. In *Special Issue: ESP in Asia, English for Specific Purposes*, vol. 33, 2013, pp. 54-65.
- [2] Wanpen S., Sonkoontod K., Nonkukhetkhong K. Technical Vocabulary Proficiencies and Vocabulary Learning Strategies of Engineering Students, *Procedia - Social and Behavioral Sciences*, vol. 88, 2013, pp. 312-320.
- [3] Azmimurad A., Osman N. Vocabulary Learning Strategies: Learning Engineering Terminology among Engineering Majors for Industry 4.0 Readiness. *Universal Journal of Educational Research*, vol. 7, 2019, pp. 75-84.
- [4] Chirobocea-Tudor O. Vocabulary Acquisition in ESP. *Perspectives, Strategies and Resources. Studii si Cercetari Filologice: Seria Limbi Straine Aplicate*, 2018, pp. 171-180.
- [5] Deris F., Shukor, N. Vocabulary Learning Through Mobile Apps: A Phenomenological Inquiry of Student Acceptance and Desired Apps Features. *International Association of Online Engineering*, vol.13, No.7, 2019, pp. 129-140.
- [6] Ivan J., Krissh P. Technical vocabulary acquisition using the online learning approach among aircraft maintenance learners. *International Conference on Multidisciplinary Innovation and Economics*, September 8-9, 2021, [online] [20.03.2021]. Available at: http://icmie.nilai.edu.my/icmie/images/eProceedings%20of%20ICMIE%202021/ICMIE%202021_ID03.pdf.
- [7] Chen Y. L., Doong J. L., Hsu C. C. Contextualized vocabulary learning through a virtual learning environment. *Proceedings of SITE 2013-Society for Information Technology & Teacher Education International Conference*, March 25, 2013, New Orleans, Louisiana, United States, pp. 4108-4114.

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- [8] Ching G. Blog assisted learning: experiences in learning business English vocabulary. *International Journal of Research Studies in Education Technology IJRSET*, vol. 1, No. 1, 2012, pp. 3-12.
- [9] Klink P., Loveland T. Vocabulary development in T&E, DTE. *Technology and engineering teacher*, 2015, [online] [27.09.2021]. Available at: <https://www.iteea.org/File.aspx?id = 137363&v = 50a464d8>
- [10] Ghazali, M. A. I. M., Zuraina Ali. The impact of using VocBlast to learn technical vocabulary at tertiary level. *International Journal of Novel Research in Education and Learning*, Vol. 4, No. 3, 2017, pp. 22-25.
- [11] Chaikovska O., Zbaravska, L. The efficiency of Quizlet-based EFL vocabulary learning in preparing undergraduates for state English exam. *Advanced Education. Special issue*, Vol. 14, 2020, pp. 84-90.
- [12] Busch-Lauer I. A. A digital revolution in the ESP classroom? The potential of apps, podcasts, e-mags, and social networks revisited. *Languages for special purposes in a multilingual, transcultural world. Proceedings of 19th LSP Symposium, Vienna, 2013*
- [13] Bor-Tyng Wang Designing Mobile Apps for English Vocabulary Learning *International Journal of Information and Education Technology*, Vol. 7, No. 4, 2017, pp. 279-283.