Applying the Content-Based Instruction Approach to Vocabulary Acquisition for Students of English for Specific Purposes

Larysa V. Mosiyevych[1][a], Olena M. Mikhailutsa[1][b], Karina V. Belokon[1][c], Andriy V. Pozhuyev[1][d], Tetiana V. Kurbatova[2][e]

[1]*Zaporizhzhia National University, 66 Zhukovskoho Str., Zaporizhzhia, 69600, Ukraine*

[2]*Kryvyi Rih National University, 27 Vitalii Matusevych Str., Kryvyi Rih, 50027, Ukraine*

Keywords: Content-Based Instruction, Grammar-Translation Method, Mechanical Engineering, Semantization, Translation, Vocabulary Acquisition.

Abstract: The article aims to analyze the efficiency of applying the CBI (content-based instruction) approach to vocabulary acquisition for Mechanical Engineering students in ESP (English for Specific Purposes) classes. Analysis of Ukrainian coursebooks in ESP for Mechanical Engineering students shows that vocabulary acquisition is provided via Grammar-Translation Method (GTM). The pedagogical experiment is carried out to compare the vocabulary acquisition results based on the CBI and GTM. Group 1 and Group 2 are presented with new terminology via the above-mentioned methods. They also do different activities for mastering new terms. At the final stage, students do vocabulary assessment tests and questionnaire. Based on the results obtained, students' errors are studied. Wilcoxon-Mann-Whitney's test proves the hypothesis stated. In conclusion benefits and drawbacks of the CBI and the GTM are given. The authors develop recommendations for implementing CBI principles in vocabulary acquisition in ESP classes. The paper is intended for a wide range of specialists interested in teaching ESP and students.

1 INTRODUCTION

Presenting new terminology is an indispensable stage in ESP. It is assumed that students will learn a foreign language faster, better, and feel more confident in using it in the workplace if they effectively master subject-specific/profession-related terms (Cauli, 2021). Since terms are the basis of professional communication, neither reading nor speaking on professional topics is possible without mastering them (Bakirova, 2020). Learning technical terms in isolation is difficult for students, thus teachers should develop strategies to deal with the vocabulary they encounter (Quero and Coxhead, 2018).

Many ESP researchers prove that vocabulary teaching and learning is one of the most important aspects of ESP alongside the development of four basic skills. It is the underlying component on which other skills can be developed (Khazaal, 2019), "... foundation upon which to build the overall language proficiency" (Costeleanu, 2019). Vocabulary acquisition is essential in ESP because it helps learners understand the language and ideas of their field of activity (Quero and Coxhead, 2018).

Although there are some methodological papers deal with designing an ESP course for Mechanical Engineering students (Elizondo González et al., 2020; Izidi and Zitouni, 2017), there are no specific papers about teaching terminology for Mechanical Engineering students of ESP. That is why the problem of presenting new terminology for Mechanical Engineering students in ESP lessons is quite relevant.

As noted by Chirobocea (2018) and Marinov (2016), translation as a teaching method has been associated with the grammar-translation method for a very long time and, consequently, its use in teaching a foreign language is often criticized (Mart, 2013). Benati (2018) also defines the grammar-translation method as a traditional one which "...involves very little spoken communication and listening comprehension". The drawbacks of the grammar-translation method are as follows:

[a] https://orcid.org/0000-0003-3576-9736
[b] https://orcid.org/0000-0003-2935-7997
[c] https://orcid.org/0000-0003-2000-4052
[d] https://orcid.org/0000-0002-4083-5139
[e] https://orcid.org/0000-0002-0991-2343

Mosiyevych, L., Mikhailutsa, O., Belokon, K., Pozhuyev, A. and Kurbatova, T.
Applying the Content-Based Instruction Approach to Vocabulary Acquisition for Students of English for Specific Purposes.
DOI: 10.5220/0012646200003737

In *Proceedings of the 4th International Conference on History, Theory and Methodology of Learning (ICHTML 2023)*, pages 50-60
ISBN: 978-989-758-579-1; ISSN: 2976-0836

1) the result of this approach is usually a student's inability to use language for communication;
2) it does not focus on the context so the communication skills of learners remain poor.

The problem of teaching ESP for Mechanical Engineering students also deals with a lack of relevant coursebooks. The scope of Ukrainian coursebooks in ESP for Mechanical Engineering students shows that they are based on the principles of the GTM.The new words are introduced through English-Ukrainian translation.The set of vocabulary activities is also based on translation. Here is a comparative analysis of Ukrainian coursebooks in the context of our research objective (table 1).

Table 1: Comparative analysis of Ukrainian coursebooks in ESP for Mechanical Engineering students.

Vocabulary learning stages	The textbook by Ivanov et al. (2013)	The textbook by Shestopal and Slobodyanyuk (2017)
Presenting a new vocabulary	Translation	Translation
Practicing exercises	Including English-Ukrainian and Ukrainian-English translation exercises	Including Ukrainian-English translation exercises
Assessment Test	None	Multiple-choice test in English

Thus, available Ukrainian coursebooks in ESP for Mechanical Engineering students are mainly based on the grammar-translation method.

The English textbook "Career Paths: Mechanics" (Dearholt, 2015) is rated according to the Common European Framework of Reference for Languages at A1 (Book 1), A2 (Book 2), and B1 (Book 3) levels. They are inappropriate for third-year Bachelor students.

The e-coursebook "English for Mechanics" by May (2005) lacks language and content activities, except for providing answers to questions. Open Educational Resources (OER) do not have any English for Mechanics coursebooks available. Thus, the review of resources revealed that among available ESP coursebooks for 3rd-year mechanical engineering students, there are either materials of inappropriate English level (among authentic coursebooks) or coursebooks based on the GTM (in the Ukrainian ESP domain).

As an alternative, the CBI use in vocabulary acquisition in ESP classes is proposed in the study. CBI is an approach to language teaching in which content, texts, activities, and tasks drawn from subject-matter topics are used to provide learners with authentic language input and engage learners in authentic language use (Brown and Bradford, 2017).

Content-based instruction is considered as one of the effective instructional methodologies because it uses English as a medium to teach content knowledge while generating multiple opportunities for students to use English in class (Vanichvasin, 2019).

The development of vocabulary plays a crucial role for students of content-based instruction, as vocabulary development directly impacts their academic achievements by meeting both content and language learning objectives. CBI students need to master general English vocabulary for communication, as well as terms that are specific to their areas (Echevarría et al., 2010).

ESP vocabulary instruction is analyzed through comparison of CBI vs. GTM for Iranian Management students. The results indicated a significant propriety of CBI over the GTM in improving vocabulary acquisition of the ESP students (Ahmadi-Azad and Kuhi, 2016).

The problem of searching for the best methods is relevant in the Ukrainian educational environment. Although CBI is not so popular in Ukraine, it is quite relevant for ESP classes. According to the British Council review conducted in Ukraine, ESP and EMI are considered dominant approaches in English teaching at Ukrainian non-philological Universities (Bolitho and West, 2017). In the latest research, CLIL is added to ESP and EMI as the three principal approaches in tertiary education in Ukraine (Zarichna et al., 2020). CLIL implementation in the Ukrainian educational system has become a subject of the latest research by Leshchenko et al. (2018). The CBI approach has not received sufficient attention in ESP teaching at Ukrainian technical universities, and its effectiveness needs to be examined.

The article *aims* to compare the application of the CBI and the GTM for vocabulary acquisition for Mechanical Engineering students in ESP classes.

The research aim entails solving the following *tasks*:

1) examining the CBI principles;
2) designing vocabulary activities based on the GTM and the CBI principles;
3) comparing the results of mastering new terminology through the CBI and the GTM;
4) surveying the students from both groups regarding to assess the methods applied at a lesson;
5) identifying benefits and drawbacks of the CBI and the GTM in ESP classes;

6) developing recommendations for implementing CBI principles in vocabulary acquisition in ESP classes.

Hypothesis: based on the above-mentioned tasks, we expect that vocabulary acquisition through the CBI approach will outperform the grammar-translation method.

2 METHODS

A total of 40 third year bachelor's degree students of Mechanical Engineering specialty of the Engineering Institute of Science and Education, Zaporizhzhia National University are engaged in the pedagogical experiment. They were randomly divided into two groups, with 20 students in each group: 18 males and 2 females. The participants' age range was from 19 to 21. All of them speak Ukrainian as their mother tongue and learn English as a foreign language.

The grouping was not determined by their overall proficiency in English since the students had a similar level, as indicated by a Comprehensive English Language Test conducted prior to the distribution. In Group 1 new terms are introduced and mastered through the CBI, in Group 2 – through the GTM. The comparison results of successful memorization of new terminology are based on the test conducted at the next lesson. Besides, the students from both groups are surveyed regarding the applied method. Thus, research results are based on quantitative data from test results and qualitative data collected from students' questionnaires.

The research is carried out in three stages. At the first stage, a mechanical engineering-related text with new terms is selected. New terms are introduced to twenty students in Group 1 via visual aids and via the translation method in Group 2 before reading the same text. After that, the students in both groups read the text and do the vocabulary activities which are different in both groups.

At the second stage, the vocabulary assessment test enables to compare the results of vocabulary acquisition in both groups. Wilcoxon-Mann-Whitney's test is applied for proving the hypothesis stated. The additional data required are collected from questionnaires to get the students' responses to the CBI/the GTM in vocabulary acquisition.

At the third stage, the item difficulty of test results is calculated in each group, and compared.

To sum up, the experimental data are obtained from the results of vocabulary assessment test, and students' questionnaires.

3 RESULTS

The results are based on qualitative and quantitative data collection. Qualitative data are collected from the students' questionnaires. Information about their attitude toward a method applied at the lesson is collected. Four evaluation criteria are included: vocabulary presentation, meaningful activities, cognitive load, engagement/interest.

Comparison of the effectiveness of specified teaching methods in the two groups for a significance level of 5% for each criterion is conducted using the Mann-Whitney U-test. Hypotheses are formulated for each evaluation criterion: H_0 – the results in the two groups do not differ significantly, and H_1 – the results in the two groups differ significantly. The calculated data are presented in table 2.

Table 2: Students' questionnaires about the GTM and the CBI approaches.

Evaluation criteria	CBI average score	GTM average score	U_{emp}
1. Vocabulary presentation (scale 1-5)	4.5	3.75	75
2. Meaningful activities (scale 1-5)	4.5	4.25	156.5
3. Cognitive load (high / medium / low)	medium	high	
4. Engagement/ interest (scale 1-5)	5	3.75	15

For the given level of significance $\alpha = 0.05$, and sample sizes $n_1 = 20, n_2 = 20$, we find the critical value as $U_{crit} = 127$ from the table. The comparison of the obtained empirical values for each evaluation criterion with the critical value enables the following conclusion: the majority of students from Group 1 have more positive attitude toward using visual aids and contextualization. The students from Group 2 have negative attitude toward vocabulary presentation through translation and out of context. The results in Criterion 2 are quite similar: the students from both groups find the vocabulary activities meaningful. The majority of students in Group 2 indicate high cognitive load in the GTM, while Group 1 indicates its medium level. While all the students in Group 1 find the CBI approach engaging and interesting based on the final criterion, in Group 2, students have expressed an opposite opinion toward the GTM. The results enable to conclude that students in Group 1 have a more positive attitude toward the CBI, while students in Group 2 exhibit a less positive attitude toward the GTM.

Quantitative data are based on the results of the same multiple-choice test for both groups. The total number of questions is 30. They are supposed to be distributed among the first three levels of Bloom's taxonomy: remembering (items 1-10), understanding (items 11-20), and applying (items 21-30).

The number of mistakes made in the test at each cognitive level enables calculating an item difficulty. We calculated it for both groups, as shown in table 3 and table 4.

The formula used to calculate the item difficulty is presented in formula (Maharani and Putro, 2020):

$$item_{difficulty} = \frac{N_{correct}}{N_{tested}} \quad (1)$$

where: $N_{correct}$ – the number of students who answered correctly; N_{tested} – the number of students who are tested.

Table 3: Item difficulty in Group 1.

Cognitive level	Number of items in a test	Number of students who answered a question correctly	Number of students in Group 1	The difficulty index
Remembering	10	15	20	0.75
Understanding	10	15		0.75
Applying	10	13		0.65

Table 4: Item difficulty in Group 2.

Cognitive level	Number of items in a test	Number of students who answered a question correctly	Number of students in Group 2	The difficulty index
Remembering	10	13	20	0.65
Understanding	10	11		0.55
Applying	10	8		0.4

The next step is to compare item difficulty in both groups (table 5).

Table 5: Comparison of item difficulty in both groups.

Cognitive level	Item difficulty		
	in Group 1	in Group 2	difference
Remembering	0.75	0.65	0.1
Understanding	0.75	0.55	0.2
Applying	0.65	0.4	0.25

According to the results, no significant difference is found in the questions at the remembering level between Groups 1 and 2 (0.1). However, more significant differences are observed in the questions at the understanding comprehension and applying application levels (0.2 and 0.25, respectively). As the cognitive complexity of tasks increases according to Bloom's taxonomy, students in Group 2 exhibit a higher frequency of errors.

The result supports the hypothesis that the students taught through the CBI method demonstrate superior vocabulary acquisition compared to the group instructed by the GTM. This can be attributed to the fact that the activities based on the CBI approach are more meaningful, engaging, and motivating. Additionally, visualization and contextualization prove to be beneficial.

4 DISCUSSION

CBI and GTM differ in methodological backgrounds, so they are expected to result in different outcomes in vocabulary acquisition in ESP teaching. The vocabulary acquisition is divided into three stages (table 6).

Table 6: Stages of the vocabulary acquisition.

Stages	Group 1	Group 2
Presenting new terms	Visual aids	Translation
Practicing exercises	L2 (target language) exercises	L1-L2/L2-L1 exercises
Vocabulary assessment test	Multiple-choice est in L2	Multiple-choice test in L2

4.1 Presentation of new terms

To approbate the CBI approach, the theme "Suspension system" is chosen. The text for reading is taken from an electronic coursebook "English for Mechanics" by May (2005). It should be noted that the theme is rather essential for learning, however, it is included in none of the above-mentioned Ukrainian coursebooks in ESP for Mechanical Engineering students. To initiate the lesson, a word cloud is employed as a lead-in. The word cloud, generated using a digital tool called *Word Art*, is based on the text "Suspension System". It serves to introduce students to a new topic, activate their prior knowledge about the subject, and functions as an introductory stage of the lesson (figure 1).

ESP teachers might consider the following steps in their procedures for vocabulary instruction (Tumolo, 2007):

1) a source of new words presentation;

Figure 1: Word cloud.

2) activities done for understanding the meaning of the words;

3) creation of memory links and retention of the word form and meaning.

The following techniques can be used in the semantization process (Jata, 2018):

1) visualization;

2) definitions and explanation;

3) matching;

4) synonyms or antonyms;

5) guessing from the context.

A visual technique for semantization of Mechanical Engineering terms has been chosen for our research since visualization is one of the most efficient memorization strategies. Besides, verbal techniques are useful to explain more abstract concepts. Visualization is the way that can enable students to guess the meaning of unknown words and comprehend a text (Ghaedi and Shahrokhi, 2016). Visual learners can create mental images related to target words that help them memorize and store them in their long-term memory (Mohd Tahir and Tunku Mohtar, 2016). It should be noted that the visual method is rather relevant for students because a suspension system in L1 is familiar to them.

In Group 1, new terms are presented by visual aids before reading the text. The key terms are Shock absorber, Upper control arm, Coil spring, leaf spring, Stabilizer, Ball joints, Front hanger, and Rear shackle. The students should find these words in the image and guess their meaning (figure 2).

In Group 2, new terms are introduced by providing translations into Ukrainian, following the principles of the GTM. After the new terms are introduced, students from both groups read the text "The suspension system":

The suspension system of a car has two main functions. Firstly, it must keep all four road wheels in contact with the road, so that steering, braking, and the transmission drive can operate properly. Secondly,

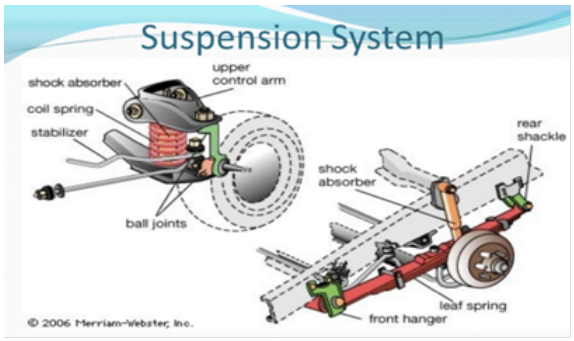

Figure 2: Suspension system.

the suspension system must offer passengers maximum comfort. The two functions are never quite compatible, so engineers always make a compromise. The main suspension components in modern cars are leaf springs, coil springs, wishbones, torsion bars, shock absorbers, and McPherson struts. Leaf springs are leaves of tempered steel clamped together and fastened to the chassis by a shackle at one end, a pivot at the other. Coil springs are often used together with wishbones to give an independent front suspension. McPherson struts also offer independent front suspension. They use a coil spring together with a shock absorber. The spring absorbs bumps, while the shock absorber dampens (stabilizes) up and down bouncing. A torsion bar is springy steel that absorbs bumps by twisting and untwisting. Torsion bars are often part of the front-end suspension unit.

4.2 Practicing new terms

The acquisition of new terms takes place within a single lesson lasting 85 minutes.

4.2.1 Practicing new terms in Group 1

We provide vocabulary acquisition for Group 1 based on CBI principles:

1) students' prior knowledge can help or hinder learning. When students can connect new information with knowledge and beliefs that they had previously, they will remember more and learn more quickly;

2) the more interrelationships among concepts, and the stronger and clearer those relationships, then the better a learner's understanding and ability to apply the concepts to new problems and new situations;

3) students' motivation determines, and directs;

4) to combine content and language lesson objectives in one class period;

5) scaffolding: when teachers create supportive conditions in which the student can participate and extend their current skills and knowledge to reach higher levels of competence;
6) no L1 (native language) in classes.

The principal types of post-reading activities for mastering new terms are as follows:

1. Matching exercises
2. Gap-filling exercises
3. True/false exercises
4. Categorization of words
5. Multiple-choice exercises
6. Answering questions

We agree with Myshak (2018) that the efficiency of assimilation of terms and their active use in oral and written professional speech depend in many respects on the appropriate system of exercises consistently aimed at both thorough understanding of terminology and enhancement of speaking and listening skills necessary for the application of this terminology to specific situations.

According to the CBI principles, students need to encounter new vocabulary in a variety of meaningful settings and activities. The activities divised by the authors offer opportunities for the students in Group 1 to learn and practice the newly introduced vocabulary words:

Task 1. Match the terms (1-7) with their definitions (A-G):

1. Suspension
2. Wishbones
3. Spring
4. Strut
5. Shackle
6. Torsion
7. Steering

A) the collection of components, linkages, etc. which allows any vehicle (car, motorcycle, bicycle) to follow the desired course;
B) the twisting of an object due to an applied torque;
C) a U-shaped piece of metal secured with a clevis pin or bolt across the opening;
D) system of components allowing a machine (normally a vehicle) to move smoothly with reduced shock;
E) Devices that are used to control the front wheels of automobiles;
F) an elastic object that stores mechanical energy;
G) components of an automobile chassis, can be passive braces to reinforce the chassis and/or body, or active components of the suspension.

Task 2. Fill in the gaps:

1) The main suspension components in modern cars are. . . .
2) The suspension system must offer passengers. . .
3) A torsion bar is springy steel that absorbs bumps by. . . .
4) The . . . stabilizes up and down bouncing.

Task 3. Tick the false statements:

1) The suspension system of a car has four main functions.
2) Steering, braking, and the transmission drive must operate properly.
3) The main suspension components in modern cars are leaf springs and coil springs.
4) Coil springs are leaves of tempered steel clamped together and fastened to the chassis by a shackle at one end, a pivot at the other.

Task 4. Match a part of the suspension system (1-4) with its function (a-d) and read the sentences:

1. Suspension system
2. Coil springs
3. Ball joints
4. Shock absorbers

a) To support the coil spring to further reduce the impact of a bump or pothole;
b) To connect your steering knuckles to the control arms;
c) To maximize the friction between your car's tires and the road;
d) To absorb the impact when a vehicle hits a bump in the road.

A stem sentence can be given as a model: "The function of the ... is to ..."

Task 5. Answer the questions:

1) What are the functions of the suspension system of a car?
2) What are the main suspension components?
3) Is a torsion bar used for speeding?
4) Are torsion bars and shock absorbers often used together to give independent front suspension?

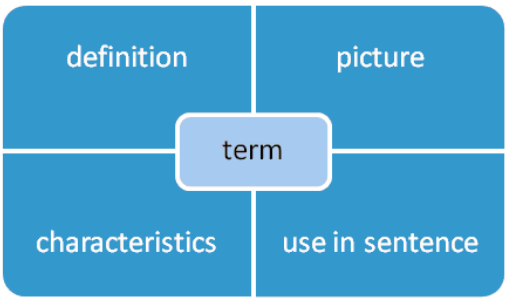

Figure 3: Frayer model.

The students are expected to study the new terms outside the class, where they should create the Frayer model (figure 3).

The Frayer model is an effective way to help the students understand the meaning of new words, use them correctly in sentences, and construct derivatives.

As an out-of-class activity, the students are also asked to create a mind map illustrating the components and functions of a suspension system. The digital tools such as Mind Meister, Canva, Wise mapping can be applied. Mind maps facilitate students' engagement, and help them recall and solidify new terms. Additionally, students are expected to review the new terms using flashcards on the Quizzlet platform.

Thus, the given set of vocabulary activities provides students with numerous exposures to new vocabulary in meaningful and contextualized ways. The activities create memory links and enhance retention of a word form and its meaning.

4.2.2 Practicing new terms in Group 2

Following the principles of the grammar-translation method (Milawati, 2019), and imitating a set of activities in above-mentioned GMT-related Ukrainian coursebooks, we designed the following vocabulary activities for Group 2:

Task 1. Read and translate the text "The suspension system" (see 3.1).

Task 2. Answer the questions:

1) What are the functions of the suspension system of a car?
2) What are the main suspension components?
3) Is a torsion bar used for speeding?
4) Are torsion bars and shock absorbers often used together to give independent front suspension?

Task 3. Match the terms (1-7) with their definitions (A-G):

1. Suspension
2. Wishbones
3. Spring
4. Strut
5. Shackle
6. Torsion
7. Steering

A. the collection of components, linkages, etc. which allows any vehicle (car, motorcycle, bicycle) to follow the desired course;

B. the twisting of an object due to an applied torque;

C. a U-shaped piece of metal secured with a clevis pin or bolt across the opening;

D. system of components allowing a machine (normally a vehicle) to move smoothly with reduced shock;

E. Devices that are used to control the front wheels of automobiles;

F. an elastic object that stores mechanical energy;

G. components of an automobile chassis can be passive braces to reinforce the chassis and/or body, or active components of the suspension.

Task 4. Find the examples of Passive Voice in the text.

Task 5. Translate the sentences from English into Ukrainian.

Task 6. Translate a text from Ukrainian into English.

The final activity is rather time-consuming to be assigned as an in-class task. However, it would not be reasonable to propose it as an out-of-class task, as students might apply machine translation.

A table summarizing the information about activities in both groups enables to compare them (table 7).

Table 7: Comparison of vocabulary activities in both groups.

Criteria	Group 1	Group 2
Using the mother tongue	-	+
Cognitive load	Not high	High due to translation skills
Relevant / irrelevant	Relevant	Activities involving translation are irrelevant: they are time-consuming, and students can translate them using ChatGPT/MT
Vocabulary exposure	Much high	Little low
Using digital tools	+	-

Thus, translation activities not only focus on key content vocabulary but also on passive vocabulary and grammar structures, leading to the split-attention effect and high cognitive load.

4.3 Vocabulary assessment tasks and questionnaire

The vocabulary assessment multiple-choice test is conducted at the next lesson in both groups. The total number of questions is 30. They are supposed to be distributed at the first three levels, *remembering (items 1-10), understanding (items 11-20)*, and *applying (items 21-30)*, of Bloom's taxonomy.

These three cognitive levels are relevant for new vocabulary acquisition. The number of mistakes made in the test on this or that cognitive level enables calculating an item difficulty. The formula looks like this: the number of students who answer a question correctly (c) is divided by the total number of students in the group who answered the question (s). The answer equals a value between 0.0 and 1.0, with harder questions resulting in values closer to 0.0 and easier questions resulting in values closer to 1.0. The formula is: c ÷ s = p (Renner, 2018). We calculate the item difficulty for both groups separately (table 3 and table 4).

The cognitive levels are not marked in the test, and the students can not see them. One sample question for each level is provided:

Level of remembering:

What is the term for the part of the suspension system that connects the wheel to the vehicle's body?

a) Shock absorber
b) Control arm
c) Sway bar
d) Strut

Level of understanding:

How does the suspension system contribute to vehicle stability during cornering?

a) By reducing vibrations and shocks
b) By maintaining optimal tire contact with the road
c) By adjusting the ride height automatically
d) By controlling the engine's power output

Level of applying:

You want to enhance the off-road capabilities of your vehicle. Which suspension component should you consider upgrading?

a) Shock absorbers
b) Coil springs
c) Control arms
d) Sway bars

Qualitative data are collected from the students' questionnaires (table 2). Information about their attitude towards the method applied in the lesson was collected. Four evaluation criteria are included: vocabulary presentation, meaningful activities, cognitive load, and engagement/interest.

5 ANALYSIS OF DATA OBTAINED

The pedagogical experiment is conducted to compare the CBI approach and the GTM at the vocabulary acquisition stage in ESP classes. Methods of mathematical statistics are applied to data processing.

As a null hypothesis H_0, it is assumed that there is no significant difference between students who are taught using the grammar-translation method (GTM) and students who are taught using the CBI approach to enhance students' vocabulary acquisition. Alternative hypothesis H_1, implies that there is a significant difference between students who are taught using the GTM and those who are taught using the CBI approach to enhance their vocabulary acquisition.

To prove or reject the hypotheses stated, the results in the experimental and control groups are compared before and after the experiment applying the CBI principles by using the Wilcoxon-Mann-Whitney's test. The Mann-Whitney U test is used to compare differences between two independent samples when the sample distribution is not normal and the sample sizes are small $n < 30$). When analyzing the results of the experiment, the use of this criterion is advisable, since for the obtained samples the requirement of a normal distribution for the t-criterion is not met, and this was confirmed by constructing frequency histograms for both groups. Based on the test results, tables are compiled for calculating the rank sums for students' samples in both groups. The SPSS Statistics software is used to calculate the criterion. The empirical value of the criterion U is calculated by the formula:

$$U = n_1 \cdot n_2 + \frac{n_x(n_x+1)}{2} - T_x$$

where:

n_1 is the number of students in the experimental group;

n_2 is the number of students in the control group;

n_x is the number of students in the group with a higher rank sum;

T_x is the larger of the two rank sums.

The empirical value of the Wilcoxon criterion is determined from the ratio:

$$W_{exp} = \frac{|\frac{n_1 \cdot n_2}{2} - U|}{\sqrt{\frac{n_1 \cdot n_2 \cdot (n_1 + n_2 + 1)}{12}}}$$

The critical value is determined according to the corresponding table at the significance level of 5%.

The empirical value of the vocabulary acquisition criterion at the beginning of the control stage of the experiment is in the insignificance zone, that is, there is no significant difference in the knowledge level among the students of the experimental and control groups. The empirical value of the Mann-Whitney U-criterion at the end of the control stage of the experiment $W_{emp} = 2.29$ is compared with the critical value $W_{0.05} = 1.96$. Since $W_{emp} > 1.96$, we can conclude that the reliability of the differences in the characteristics of the compared samples is 95%. It enables rejecting hypothesis H_0 about the CBI principles proposed in the study at the stage of terminological vocabulary acquisition. However, the alternative hypothesis about the impact of that approach on the level of terminological vocabulary acquisition among future mechanical engineers is accepted.

6 CONCLUSIONS

A comparative analysis of the CBI and the GTM for ESP lessons is conducted. The results are obtained on the basis of the students' questionnaires, and a multiple-choice vocabulary test.

The data obtained demonstrate the superiority of the CBI approach over the traditional GTM in terms of effective vocabulary acquisition for Mechanical Engineering students in ESP. Throughout the conducted investigation, the objectives have been achieved. We can conclude that vocabulary learning involves a certain amount of memorization. Learning words in context (as facilitated by the CBI approach) is regarded as more effective. Teaching students how to practice circumlocution rather than going straight to translation is giving them a valuable skill. It also gives them more practice with L2. Students encounter new vocabulary in a variety of meaningful settings and activities. CBI activities can provide repetition and exposure that is indispensable for vocabulary acquisition.

The research results enable to sum up the advantages and disadvantages of both methods (table 8).

The questionnaire responses of students in Group 1 showed that they enjoyed doing vocabulary activities and did not find it difficult to do the final vocabulary assessment test. Motivation and interest contribute to positive outcomes in learning. On the contrary, students in Group 2 reveal a negative attitude towards the vocabulary activities. Thus, CBI principles are eligible to be applied in ESP classes.

Table 8: Benefits and drawbacks of the CBI and the GTM.

The CBI	The GTM
Using no mother tongue	Using the mother tongue
Appropriate for bilingual groups	Inappropriate for bilingual groups
Introducing new vocabulary in context, and engaging manner	Introducing new vocabulary using the mother tongue
Developing a profession oriented lexical competence	Developing translation competence is irrelevant for STEM students
Stimulating, rewarding	Boring
More challenging for a teacher	More challenging for a student

Analysis of data obtained enables us to develop recommendations for implementing CBI principles in vocabulary acquisition in ESP classes:

1) supply meaningful topics and texts;
2) categorize new words into technical terms and general English words;
3) introduce vocabulary via visual aids;
4) take students' cognitive load into account;
5) use motivating and stimulating vocabulary activities with digital tools (word clouds, Frayer models, infographics, mind maps, etc.).

Further research prospects involve analysis of applying CBI to mastering listening and speaking skills for Mechanical Engineering students in ESP classes.

REFERENCES

Ahmadi-Azad, S. and Kuhi, D. (2016). ESP Vocabulary Instruction: A Comparison of CBI vs. GTM for Iranian Management students. *Asean Journal of Teaching and Learning in Higher Education (AJTLHE)*, 8(2):35–50. https://ejournal.ukm.my/ajtlhe/article/view/18853.

Bakirova, H. B. (2020). Formation of terminological competence in ESP education. *JournalNX- A Multidisciplinary Peer Reviewed Journal*, 6(11):63–68. https://tinyurl.com/mswvhzmj.

Benati, A. (2018). Grammar-Translation Method. In *The TESOL Encyclopedia of English Language Teaching*, pages 1–5. John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118784235.eelt0153.

Bolitho, R. and West, R. (2017). *The internationalisation of Ukrainian universities: the English language dimension*. Stal, Kyiv.

https://www.britishcouncil.org.ua/sites/default/files/2017-10-04_ukraine_-_report_h5_en.pdf.

Brown, H. and Bradford, A. (2017). EMI, CLIL, & CBI: Differing approaches and goals. In Clements, P., Krause, A., and Brown, H., editors, *Transformation in language education*. JALT, Tokyo. https://jalt-publications.org/files/pdf-article/jalt2016-pcp-042.pdf.

Cauli, E. (2021). Implementing CLIL approach to teaching ESP in academic contexts in Albania. *Journal for Research Scholars and Professionals of English Language Teaching*, 5(25). https://www.jrspelt.com/wp-content/uploads/2021/05/Eda-CLIL-Approach.pdf.

Chirobocea, O. (2018). A case for the use of translation in ESP classes. *Journal of Languages for Specific Purposes*, (5):67–76. https://www.researchgate.net/publication/323858764.

Costeleanu, M. (2019). The Role Of Vocabulary In Esp Teaching. In Soare, E. and Langa, C., editors, *Education Facing Contemporary World Issues*, volume 67 of *European Proceedings of Social and Behavioural Sciences*, pages 996–1002. Future Academy. https://doi.org/10.15405/epsbs.2019.08.03.120.

Dearholt, J. (2015). *Career Paths: Mechanics*. Express Publishing, London.

Echevarría, J., Vogt, M., and Short, D. J. (2010). *Making Content Comprehensible for Multilingual Learners: The SIOP Model*. Allyn & Bakon. https://tinyurl.com/5n999k9u.

Elizondo González, J. F., Pilgrim, Y., and Sánchez Víquez, A. (2020). Diseño de un curso esp para estudiantes de ingeniería mecánica. *InterSedes*, 21(43):78–102. https://doi.org/10.15517/isucr.v21i43.41979.

Ghaedi, R. and Shahrokhi, M. (2016). The impact of visualization and verbalization techniques on vocabulary learning of Iranian high school EFL learners: A gender perspective. *Ampersand*, 3:32–42. https://doi.org/10.1016/j.amper.2016.03.001.

Ivanov, O., Beshta, O., and Dolhov, O. (2013). *Anhliyska mova dlya studentiv elektromekhanichnykh spetsialnostey [English for Mechanical Engineering Students]*. Natsionalnyy hirnychyy universytet, Dnipropetrovsk.

Izidi, R. and Zitouni, M. (2017). Esp Needs Analysis: the Case of Mechanical Engineering Students at the University of Sciences and Technology Oran U.S.T.O. *Revue des études humaines et sociales -B/ Littérature et Philosophie*, (18):16–25. https://doi.org/10.33858/0500-000-018-054.

Jata, E. (2018). Teaching ESP Terminology- Case Study Agricultural University of Tirana (AUT). *European Journal of Language and Literature*, 4(3):22–27. https://doi.org/10.26417/ejls.v4i4.p22-27.

Khazaal, E. N. (2019). Investigating and Analyzing ESP College Students' Errors in Using Synonyms. *International Journal of English Linguistics*, 9(5):328–339. https://doi.org/10.5539/ijel.v9n5p328.

Leshchenko, M., Lavrysh, Y., and Halatsyn, K. (2018). The role of content and language integrated learning at Ukrainian and Polish educational systems: Challenges and implication. *Advanced Education*, 5:17–25. https://doi.org/10.20535/2410-8286.133409.

Maharani, A. V. and Putro, N. H. P. S. (2020). Item Analysis of English Final Semester Test. *Indonesian Journal of EFL and Linguistics*, 5(2):491–504. https://doi.org/10.21462/ijefl.v5i2.302.

Marinov, S. (2016). Translation Exercise Aided by Data-driven Learning in ESP Context. *ESP Today*, 4(2):225–250. https://doi.org/10.18485/esptoday.2016.4.2.5.

Mart, C. T. (2013). The Grammar-translation Method and the Use of Translation to Facilitate Learning in ESL Classes. *Journal of Advances in English Language Teaching*, 1(4):103–105. https://european-science.com/jaelt/article/view/281.

May, T. (2005). *English for Mechanics*. Lulu.com.

Milawati (2019). Grammar Translation Method: Current Practice In EFL Context. *Indonesian Journal of English Language Teaching and Applied Linguistics*, 1(4):187–196. https://doi.org/10.21093/ijeltal.v4i1.437.

Mohd Tahir, M. H. and Tunku Mohtar, T. M. (2016). The effectiveness of using vocabulary exercises to teach vocabulary to ESL/EFL learners. *Pertanika Journal of Social Sciences & Humanities*, 24(4):1651–1669. http://www.pertanika.upm.edu.my/resources/files/Pertanika%20PAPERS/JSSH%20Vol.%2024%20(4)%20Dec.%202016/23%20JSSH-1459-2015.pdf.

Myshak, E. (2018). Forming terminological competence of future specialists of the agroindustrial and environmental branches by foreign language means. *Euromentor Journal*, 9(3):68–76. https://www.proquest.com/openview/efe56e75eddf819a36d827997be06552/1?pq-origsite=gscholar&cbl=1316370.

Quero, B. and Coxhead, A. (2018). Using a Corpus-Based Approach to Select Medical Vocabulary for an ESP Course: The Case for High-Frequency Vocabulary. In Kırkgöz, Y. and Dikilitaş, K., editors, *Key Issues in English for Specific Purposes in Higher Education*, pages 51–75. Springer International Publishing, Cham. https://doi.org/10.1007/978-3-319-70214-8_4.

Renner, R. (2018). How to Calculate Difficulty Index. https://www.theclassroom.com/test-standardized-6680561.html.

Shestopal, O. and Slobodyanyuk, A. (2017). *Anhliyska mova dlya inzheneriv-mekhanikiv [English for mechanical engineers]*. VNTU, Vinnytsya.

Tumolo, C. H. S. (2007). Vocabulary and reading: teaching procedures in the ESP classroom. *Linguagem & Ensino*, 10(2):477–502. https://www.researchgate.net/publication/255593986.

Vanichvasin, P. (2019). Effects of Content-Based Instruction on English Language Performance of Thai Undergraduate Students in a Non-English Program. *English Language Teaching*, 12(8):20–29. https://doi.org/10.5539/elt.v12n8p20.

Zarichna, O., Buchatska, S., Melnyk, L., and Savchuk, T. (2020). Content and Language Integrated Learn-

ing in Tertiary Education: Perspectives on Terms of Use and Integration. *East European Journal of Psycholinguistics*, 7(1). https://eejpl.vnu.edu.ua/index.php/eejpl/article/view/295.