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APPLICATION OF ILLUSTRATIVE MATERIALS IN FOREIGN LANGUAGE TEACHING FOR ENGINEERING SPECIALTIES

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ABSTRACT

In the process of learning a foreign language for specific purposes, the most suitable, adequate, and innovative approaches are constantly being sought, concerning how and which/what additional (supplementary) materials contribute to more effective 1) subject and 2) language content learning, as well as concerning easy knowledge transfer - from the native to the foreign language. The following paper examines the importance of various content components and illustrative materials as supporting engineering students' foreign language teaching and learning. By means of an exploratory survey (survey card), the opinion of the students was collected and analyzed, which is indicative of the materials suitable for application in a working environment in their relation with the conceptual apparatus in the studied material in the native and foreign languages.

Keywords: foreign language teaching, foreign language for specific purposes, illustrative materials, engineering students.

INTRODUCTION

The norms dictated by modern society have long demanded the mastery of at least one foreign language. Hence, it is the need to increasingly optimize the process of learning not just one, but several foreign languages (simultaneously). Policies set out by employers and the European Union (EU) ("lifelong learning strategy") already speak of multilingualism. In some higher education institutions, foreign language curricula (German, French) have been developed and successfully implemented which automatically place students in the position of learning two foreign languages (the one in which the subject is taught as well as (another) foreign language, which in the classical case is English). Hence the need is to apply innovative approaches to support and optimize the process of learning two foreign languages simultaneously. Back in time, the study of a foreign language was mainly for the purpose of understanding the literature of that language [1]. To date, however, it is far from being simply about learning literature - the reasons range from personal, to cultural and educational, to economic, as part of the EU's flagship policy of multilingualism. Speaking only one foreign language is no longer enough, so the motivation to find and implement methods that make the acquisition of (several) foreign languages as easy and fast as possible is more on the agenda. In addition, when we bring this case into the classroom of higher education institutions, particularly engineering ones, we face a number of challenges. Engineering students learn not just a foreign language, but a foreign language for specific purposes oriented to a specific scientific field: mechanics, chemical engineering, mining, etc. This puts both lecturers and students in a specific situation: the former have to approach the educational process with such a methodology that in the time provided in the foreign language curriculum will prepare future engineers as

well as possible in mastering the conceptual apparatus (thesaurus); and the latter - to complete the course of study having mastered the relevant terminological units as well as possible. This is a key point: to approach with the most appropriate methods and means. The motive for this article is precisely this - to present the best and most efficient working methods and tools. One of the most successfully applied ones are illustrative materials, i.e., a form of visualization presented as a drawing, picture or photograph to facilitate the understanding of a topic. Visual materials are necessary for language teaching lecturers in order to support learning because the more we appeal to students' senses, the better they will learn the language. The visual is key as it taps into visual memory where learners allocate what they see (via visual memory) [2]. The visual supports learners in making sense of language, and in learning it authentically, but also in gaining autonomy and engagement - effectively and cognitively. Illustrations support the comprehension of texts, concretization of abstract concepts and teaching of grammar, support more effective acquisition of specific terminology [3]. Visual materials are more versatile than the written form [4]. Some of the advantages of visual materials are:

"- to explain concepts;

- to show connections, rules or formulas;

- when presenting statistical or other data for clearer understanding;

- for visualizing things that are difficult to bring to life in our minds" [5].

EXPERIMENTAL

The focus of this paper is on investigating the effectiveness of two educational tools for training engineering students in foreign language for specific purposes, briefly presenting the author's reasons for choosing these two instruments, namely:

- concept map,
- multimedia (presentations) with its various manifestations.

The successful mastery of conceptual apparatus is the basis of meaningful learning and a key factor for the professional realization of future engineers [6, 7]. Meaningful learning is present when students are capable of knowledge transfer and are also able to continuously integrate new knowledge into existing knowledge. Mastering meaningful learning encompasses several stages: memorization, active and purposeful reproduction of specific terms from the long-term memory, and elaboration, differentiation, and integration of these concepts into organized cognitive structures [8].

Concept maps were created in the 1970s to visually demonstrate the process of incorporating new concepts into learners' vocabulary [9]. They illustrate knowledge in the form of a map to which new knowledge can be added at any time. This tool helps to structure ideas and build mental images of abstract and complex concepts [10].

Novak and Cañas define the concept map as a graphical tool used to summarize and illustrate knowledge [11]. The terms in a concept map follow a certain hierarchical structure, i.e., the more general concepts are at the top, and branching down from them follow the more highly specific ones. The concept map visualizes the connections between the key concepts of the thesaurus of a specific professional field, each complemented by others in the corresponding hierarchy. Concept maps are also referred to as a "cognitive tool" [12]; they are even compared to databases and visualization tools [13], which are valid for any educational domain. The motive for adopting this tool is its flexibility in terms of integrating new knowledge [14]. This structure can be as detailed as needed at a certain point and evolve to a stage that meets the specific needs of learners at another given point in their educational journey (Fig. 1). In the academic year 2019/2020, for the purpose of dissertation research, a concept map with conceptual apparatus for the specialty of Technical Mechanics was developed and approbated together with a lecturer in a fundamental discipline as part of a bilingual educational tool [15]. The latter includes:

- instructions for use;
- a bilingual concept map;
- a test with diverse tasks;
- illustrative material on the content of key terms;
- a bilingual glossary of concepts (thesaurus);
- answer sheet;
- survey card.

Following the application of the concept map, a survey was conducted among undergraduate students to collect their opinion on the advantages and benefits of this tool. Part of the survey card and the students' responses are presented in Table 1.

Another widespread and proven over time as

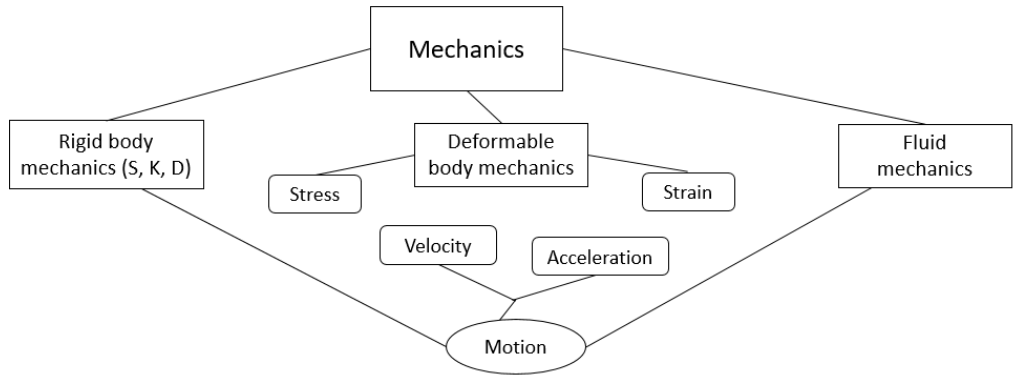

Fig. 1. Part of a concept map in technical mechanics [15].

Table 1. Part of the survey concerning the application of concept maps and students' answers (2019/2020) [17].

Question	Answers (%)				
	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Concept maps in Bulgarian and English are useful for:					
understanding the connections between concepts	37.14	48.75	8.75	0	5.71
identifying the strengths and weaknesses of the way of learning, and for further development	42.85	42.85	8.75	2.85	2.85
a more efficient approach to learning aimed at better results	40	40	11.42	2.85	5.71

important components supporting language learning are multimedia and presentations. Observations on the application of the latter followed a visit to the Technische Universität Bergakademie Freiberg, Germany, under the Erasmus+ programme - Staff Mobility for training [16]. Multimedia is an important part of the English for specific purposes classes at the Technische Universität Bergakademie Freiberg. This is an adequate way for students to be exposed to authentic materials in their first year of study - videos, discussions and interviews that are relevant to their professional field and would be useful for their professional development. In the second year of study, the focus is again on the application and handling of visual materials, with a particular emphasis on the preparation of presentations as an appropriate method of practicing communication. The motive for working with presentations is based on the notion of lifelong learning. The practice at the University of Mining and Geology "St. Ivan Rilski" (UMG), Sofia, for majors in the 3rd semester "in a stream" involves students working with academic texts from the respective professional field. With a sufficiently good level of proficiency in the foreign language for specific purposes, students also prepare presentations on specialized topics [16]. At the University of Chemical Technology and Metallurgy (UCTM), Sofia, students of the German-taught major "Chemical Engineering" handle Berkeley-Madonna mathematical software as part of their training and listen to presentations in a foreign language for specific purposes.

Since not all students in each group reach a high level of proficiency in the foreign language for specific purposes, the motivation for including additional tools and supplementary materials, upgrading the illustrative materials used so far, emerged in order to support the students in the learning process. Therefore, and following the final return of students and lecturers to fully face-to-face teaching (a consequence of the pandemic in 2020), and as continuation of the 2019/2020 research, another survey was conducted in the academic year 2022/2023 among students from two universities. It aims to provide reasonably accurate information on what additional illustrative teaching materials/approaches will assist these students in improving their skills in the foreign language for specific purposes.

RESULTS AND DISCUSSION

Students' responses to the 2019/2020 survey make clear their opinion on the application of the tool "concept map" (the full survey and results are published in [17]):

In the academic year 2019/2020, students' opinion on the application of concept maps indicates that concept maps are useful for:

- understanding the connections between concepts: almost 86 % affirmative responses;
- identifying learning strengths and weaknesses, and for future development: almost 92 % affirmative responses;
- a more effective learning approach for better results: 80 % affirmative.

In conclusion, it can be summarized that the visual tool "concept map" is suitable for use in foreign language classes for engineering students, since visual materials achieve better results in learning subject content than the use of text alone. In this case, visualization and visual symbols are relied on as they are easier to recognize and support better understanding of abstract ideas and concepts [18]. Table 2 presents the students' statements and responses that were collected during the 2022/2023 survey.

Table 2. Questions and students' opinion on the statements in the survey 2022/2023.

No	Question	Answers (%)				
		Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1	Working with standard/text learning materials (textbook, workbook, dictionaries) is sufficient when learning a foreign language for specific purposes.	8.33	16.67	33.33	41.67	0
2	Working with presentation materials (multimedia) is suitable for improving skills in a foreign language for specific purposes.	41.67	50	8.33	0	0
3	Do you think that multimedia should be more widely used in teaching and learning a foreign language for specific purposes?	75	8.33	8.33	8.33	0
4	Do you think that it is appropriate for students to participate in the foreign language for specific purposes classes with their own presentations?	25	58.33	8.33	8.33	0
5	Do you think that the application of illustrative/visual materials in foreign language for specific purposes classes helps the knowledge transfer from the native to the target language? If so: - the visualization should be similar to that when learning concepts in the Bulgarian language;	75	0	25	0	0
	- it is useful to use different visual images.	0	0	0	0	0
6	Working with visual materials would support the understanding of abstract concepts and ideas in foreign language for specific purposes classes.	75	25	0	0	0
7	Suggest examples for similar alternative methods and visual materials, which, according to you, would be useful for more effective language acquisition (also for languages for specific purposes).	• watching geological films in German with Bulgarian subtitles; • additional explanatory materials (grammar exercises, tables, photos/ images), videos; • graphs, diagrams (graphic materials), presentations.				

The data in Table 2 show that 28 % of the students give an affirmative answer to question 1, 35 % cannot give a definite answer, and nearly 42 % think that the standard materials (textbook, study notebook and dictionary) are not sufficient in foreign language for specific purposes classes. In question 2, nearly 72 % (affirmative answers) believe that working with illustrative materials, or presentations/multimedia, is suitable for improving skills in a foreign language for specific purposes. Even more telling are the affirmative responses to question 3 - 83 % believing that the use of multimedia should be more widespread in foreign language for specific purposes classes; followed by 8.33 % neutral (unable to judge), and the same number (8.33 %) giving a negative response. Regarding question 4 - whether students should participate with their own presentations in foreign language for specific purposes classes: 83.33 % of the responses strongly agreed that they should, 8.33 % could not commit to an exact answer, and 8.33 % also gave a negative response. For question 5, the responses were split into 75 % affirmative and 25 % no definite answer ("neither agree, nor disagree") for the "the visualization should be similar to that when learning concepts in the Bulgarian language" part. This indicates that, in order to achieve knowledge transfer from the native to the target language students need to work with similar content in both languages. Question 6 received a full 100 % affirmative response, reinforcing the claim that working with visual materials will support the understanding of conceptual apparatus and abstract ideas in the foreign language for specific purposes. For question 7, students give various suggestions, including:

- watching geological films in German with Bulgarian subtitles;
- additional explanatory materials (grammar exercises, tables, photos/images), videos;
- graphs, charts (graphic materials), presentations.

The clear wording "geological films in German with Bulgarian subtitles" is of interest here. This unambiguously shows the students' need to listen to the original German language, at this stage of their studies still relying on the native language for clarification of terminology if such is needed, which in turn will help for faster knowledge transfer (content and language).

CONCLUSIONS

The foreign language lecturers' leading goal is to educate their students as well as possible for working with a conceptual apparatus - both in the classroom and later as professionals in an engineering work environment. This is why it is necessary for the lecturers to keep their teaching methods up-to-date, as well as the educational tools applied in the classroom. The exploratory study conducted in the academic year 2022/2023 aims to present the students' opinion on the application of illustrative materials to better master the conceptual apparatus. According to the results, students believe that the application of illustrative materials should foster a faster transfer of subject and language knowledge, as well as the improvement of students' foreign language competences in specialized terminology at the foundation in engineering education and then in engineering practice. The use of illustrative materials (multimedia/presentations) should enhance the quality of learning and support the understanding of abstract concepts and ideas, thus improving students' skills and stimulating and motivating them to learn foreign language(s) for specific purposes.

REFERENCES

1. M. Lessard-Clouston, Towards an Understanding of Culture in L2/FL Education, The Internet TESL Journal, 3, 1997, 1-12.
2. J. Underwood, HyperCard and Interactive Video, CALICO Journal, 6, 3, 1989, 7-20.
3. A. Karakaş, G. Karaca, Use and importance of illustration as materials in foreign language teaching, Balıkesir Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 14, 26, 2011, 351-357.
4. A. İşler, Yazılı Ders Materyallerinde İllüstrasyon Kullanımının Yeri ve Önemi, Milli Eğitim Dergisi, 157, 2003, 55-63, (in Turkish).
5. H.I. Yalın, "Ders Kitapları Tasarımı", Millî Eğitim, 132, 1996, 61-65.
6. R. Mayer, Rote versus Meaningful Learning, Theory Pract., 41, 4, 2002, 226-232.
7. J. Mestre, Transfer of Learning; Issues and Research Agenda (Report of a Workshop held at the National Science Foundation: Department of Physics), University of Massachusetts, Amherst, 2002.

8. R. Atkinson, R. Shiffrin, in: K. Spence, J. Spence (Eds.), The Psychology of Learning and Motivation: Advances in Research and Theory, 2. Academic Press, New York, 1968, 89-195.
9. J.D. Novak, A Theory of Education, Ithaca, NY: Cornell University Press, 1977.
10. J.D. Novak, The Theory Underlying Concept Maps and How to Construct and Use Them (Technical Report IHMC CmapTools 2006-01 Rev), Florida Institute for Human and Machine Cognition, 2008, 1-36.
11. J.D. Novak, A.J. Cañas, The Theory Underlying Concept Maps and How to Construct Them (Technical Report No. IHMC CmapTools 2006-01), Retrieved 01/08, Florida Institute for Human and Machine Cognition, 2006.
12. S.P. Lajoie, S.J. Derry, Computers as Cognitive Tools, (1st ed.), Routledge, 1993.
13. D.H. Jonassen, Semantic networking as cognitive tools, in: P. Kommers, D.H. Jonassen, J.T. Mayers (Eds.) Cognitive Tools for Learning, F 81, 1992, 19-21.
14. J.D. Novak, A.J. Cañas, Building on Constructivist Ideas and CmapTools to Create a New Model for Education, 2004.
15. Tsv. Vukadinova, Research on the Thesaurus of Engineering Disciplines and the Development of Language Competence, UCTM, 2021, (in Bulgarian).
16. Tsv. Vukadinova, Similarities and differences in teaching English for specific purposes to engineering students at the University of Mining and Geology "St. Ivan Rilski", Sofia, and the Technical University Bergakademie, Freiberg. University of Mining and Geology "St. Ivan Rilski", Journal of Mining and Geological Sciences, 62, 4, ISSN 2682-9525 (print), Sofia: Publishing House "St. Ivan Rilski", 2019, 130-132.
17. Tsv. Vukadinova, S. Terzieva, J. Javorova, Foreign language teaching - goal of engineering education, and tools in the educational environment, Foreign Language Teaching, 49, 4, 2022, 385-396, (in Bulgarian).
18. Tsv. Vukadinova, Advantages and benefits of using concept maps in foreign language teaching for engineering students, Proceedings of the Department "Foreign Languages and Sports" at the UMG "St. Ivan Rilski" - Sofia: PH "St. Ivan Rilski", XVIII/2018, 51-63, (in Bulgarian).