Foreign Language as an Element of the Content of Professional Preparation of Future Civil Engineers in Ukraine

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Abstract: The article is devoted to the issues of the foreign language programme content in the preparation of future civil engineers to the educational and future professional activity. The content and the role of foreign language in the above-mentioned type of training are described. The purpose of the article is to create a programme scheme in the form of four units that will be invariant for all faculties and specialties of the Odesa State Academy of Civil Engineering and Architecture and similar institutions by summarizing the experience of domestic and foreign institutions of higher education. To this end, we used methods of subject analysis of the content of education in Ukrainian and foreign universities and methods of relevant selection of didactic material. Generalization of invariant and obligatory educational components and pedagogical modelling were used at creation of the scheme. The study resulted in development of a four-unit system: general education unit (basic knowledge of English); special unit (knowledge of major academic field, in this case civil engineering); culturological unit (general cultural and intercultural preparation for communication); business unit (ability to conduct business negotiations and solve non-engineering practical and economic issues). The international significance of the article lies in the fact that the developed scheme can become a basis for software development and its further diversification in countries with a transformative state of education.

Keywords: *training, foreign language, civil engineers, building speciality, educational activity, professional activity.*

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Introduction

Today education is one of the most important factors in the sustainable development of society, competitiveness and national security of the state. Socio-economic reality requires from the professional education system such specialists, who could immediately, without an adaptation period, be able to fulfil specific professional duties in a quality manner. Quality of education is becoming a fundamental category of state policy all over the world, the main reference point of international policy in the field of education of UNESCO, the United Nations, and the European Union. In the Bologna process, aimed at creating a common European system of higher education, the quality problems of higher education occupy a major place.

Development of a contemporary professional higher education is interconnected with the innovative socio-economic situation of the development of the entire set of state and public institutions; formation of a new mentality of education and upbringing in educational institutions; the search for a set of value-forming motives and content of the professional image of a modern specialist, capable of variable professional self-realization.

The methodological and theoretical base of our investigation are theoretical approaches, formed in domestic and foreign pedagogy and psychology, referring to questions of foreign language mastering: the theory of consciousness and activity unity, stage by stage forming of cognitive actions (Galperin, 2000; Leontiev, 1975; Onishchuk et al., 2020; Rubinstein, 2002; Zinchenko, 2002 etc.); the installation theory (Artemov, 1969; Belyaev, 1967; Benediktov, 1974 etc.); the theory of activity (Leontiev, 1975); the theory of thinking and speech (Vigotskiy, 1999); the psychological conception of speech development (Zhinkin, 1982); the state of the ways of activity and their interconnection with personality development of future specialists (Ananiev, 1969, p. 235-249; Davidov, 1995; Galperin, 2000; Nerubasska & Maksymchuk, 2020a; Nerubasska et al., 2020b; Rubinstein, 2002, etc.); methodology and research methods of higher professional education (Gerasymova et al., 2019; Gershunskiy, 1998; Melnyk et al., 2019; Sheremet et al., 2019, Skatkin, 1986, etc.).

In scientific-methodological literature the issue about pedagogical conditions of qualitative foreign language mastering was arisen many times. The theoretical approach to this problem was reflected in the works of Gez (1982), Leontiev (1975), Pasov (1991), etc., but there are no unique views on this problem that causes further research of pedagogical conditions of

foreign language mastering in the educational process at higher educational establishments.

In our opinion, the success of foreign language learning in the process of professional training of future civil engineers depends on their activity, interest, the use of multimedia technologies in the process of learning, the use of life situations playing (here can be modelling of professional situations, like dialogues at work on building topics, conducting professional negotiations, making up building schemes, projects, graphics, estimates and so on). In these questions we relied on the work of Borisova (2004).

Rationale. Despite the analysis of numerous studies and study of the experience of foreign universities, we have not found framework programmes that could be taken as a model for Ukraine. Western scientists themselves acknowledge: “Unfortunately, engineering programs for bachelors today are not designed to prepare students to communicate in a global engineering environment. As the industrial world evolves to survive in an increasingly global marketplace, an obstacle to advancing technical collaboration is the inability of most engineers to speak a foreign language fluently” (Korth et al., 2007).

In practice, the problem of bilingualism of engineers manifests itself almost daily. For example, Korth et al. (2007) cite a typical production problem: an engineering company has problems with an imported product or a software failure. The simplest solution to such problem (say in the United States) is to establish an urgent direct telephone connection with a component manufacturer in another country. An interpreter complicates communication and makes it inaccurate (Korth et al., 2007). However, in practice, even in the world’s leading companies, engineers do not speak English well enough, and the practice of mediating international communication through translators or other intermediaries (instructions, mail, etc.) is thriving. It is clear that this does not correspond to either mobility or access to direct communication. We believe that for developing countries (in particular, Ukraine) it would be sufficient to form the main directions of such training at the transitional stage of engineering linguistic education. This is facilitated by the fact that the engineering profession in Ukraine is not yet so diversified and segmented.

Purpose of the article – is to generalize as much as possible the linguistic content of engineering education to four invariant blocks, on the basis of which it is possible to plan further diversification in countries with a transitional form of education.

Methods used – analysis of the content of education in Ukrainian and foreign universities, generalization of invariant and compulsory components, pedagogical modelling.

The hypothesis of our article is the following thesis: it is possible to create four framework units of knowledge, within which during the bachelor's program or self-education a future engineer will be able to better learn English as a foreign language.

Data saturation took place through the study of software of a number of Ukrainian and foreign universities that turn out engineers.

Research ethics. We agreed with the administration of educational institutions and the authors of individual software programmes that the components of their products will be used in the article.

The state of the problem of foreign languages learning at the higher educational establishments of a technical profile

In our time of rapid development of technologies there is a need to diversify training of future engineers, one of the ways of which may be study of a foreign language. Scientists claim that such diversification is associated not only with the professional diversity of engineers, but also with the diversification of foreign communication needs in the framework of inter- and intra-professional international cooperation, specifics of organizations, industries, etc. (Polyakova, 2015). We recognize that a contemporary engineer must know the basic vocabulary, the main genres of conversational and professional speech, and depending on the types of engineering activities - be able to communicate in their specific technological field. This is possible under the conditions of proper planning of the educational process and ensuring its continuity.

In the early 2000s, the world adopted a new concept – “the Plan for Education and Training Outstanding Engineers (PETOE)”. This plan requires that all institutions involved in the international education system develop their programs based on the implementation of international cooperation, international exchange and implementation of curricula on technical and cultural internationalization (Jian, 2012). Jian, who specializes in the promotion and implementation of the document (PETOE) believes that the above areas should be discussed and debated in leading universities, and the actual engineering competencies will be equivalent to linguistic and cultural, thus there should be a mandatory reform of foreign language teaching for future engineers all over the world (Jian, 2012, p. 1).

Leading language teachers recognize that a new stage of change in the acquisition of foreign language competence is taking place in the world,

when technological, digital, intercultural, neurolinguistic and other innovative conditions need to be taken into account (Turnbull, 2017). On the other hand, conceptualizing the communication needs of professional engineers creates new challenges for English teachers in higher education institutions. However, the positive factor is that students are motivated: they understand the benefits of bilingualism for future promotion, bonuses, career advancement, etc. The problem of software and methodological support of teachers for the training of highly educated engineers exists mainly in particular locations: in underdeveloped or remote regions, including Asia (Mohamed et al., 2014). It is not only a transfer of knowledge by effective methods: contemporary worker of dynamic spheres of society must speak a foreign language with high indices of “naturalness, automation, speed of speech reaction, authenticity, flexibility” (García, 2014).

Teaching English in countries with other morphological types of languages remains particularly problematic. This problem has been identified by Oxford University staff: even under programs delegated from Europe, training of China’s future engineers is problematic and needs further reform (Zhong-xin, 2012). However, the exchange of students and programs is seen as promising in terms of teaching and management of the educational process.

There are actually experimental studies on foreign language training of future engineers. For example, Nordman and Molodykh-Nagaeva (2017) experimentally proved that elements of traditional and innovative educational paradigms should be used when teaching students majoring in “Industrial and Civil Engineering” in a foreign language (Nordman & Molodykh-Nagaeva, 2017). At the same time, the authors noticed some synergy from the interaction of traditional and innovative educational approaches in teaching a foreign language in technical universities.

Many businesses and even educational institutions still use machine translation when solving production problems online. Moreover, in a number of universities in the late twentieth century pilot translation programs were introduced, which (it was believed) would replace training and be competitive in the labour market. Radu and Nicoara cite the Romanian experience of the late 1990s, when a new type of foreign language education was introduced at the Technical University of Cluj-Napoca, which was reduced to full formal English instruction with maximum involvement of automatic translation (Radu & Nicoara, 2006). It has now become clear that any communication, even engineering, is effective when it is “humanized” and anthropomorphic.

In this regard, an experiment to assess a foreign language competence of subsidiaries in Finland and China (in 2009) seems interesting. It turned out that a) the language competence of the working team (companies, groups) not only indicates a better psychological climate, but also production efficiency; b) subsidiaries with low foreign language competences showed little initiative, were more formal and were easily guided by directives (Björkman & Piekkari, 2009). This proves that high language competence of a team is directly related at the neuropsychological level with the socio-productive efficiency of the team. Moreover, according to the research, this applies to both humanitarian and technical organizations.

In this period of time, the system of education in Ukraine goes on the reformation stage - changing requirements for learning outcomes, improved training programs, to adopt experience of foreign higher education institutions, a convergence of domestic and foreign universities in the framework of the Bologna process. Currently, measures are being taken to develop and adopt state educational standards for higher professional education in a competency format, the definitions and classification of competencies, as well as their content, are being clarified. All of the above-mentioned processes in education are a reaction to the phenomena of globalization in the economy and the labour market. Among the representatives of various industries, there is a serious concern that young specialists - graduates of technical universities do not have not only a sufficient level of social competencies, necessary for effective communication, but also the ability to work in a team, to solve the tasks at hand successfully. There is an obvious gap between the existing state educational standards of higher professional education of technical specialties in a foreign language and social order.

Today, it is rather difficult and problematic to determine the content of education in a university. This is due to the fact that the issues of correlation of general scientific, general professional and special training of students of any modern university (in particular, technical) cause great disagreements in the Ministry of Education. The knowledge, skills and abilities that modern students acquire will be useful to them in their professional activities for many years. Consequently, in order to determine the content of one of the academic disciplines in the university, it is necessary to take into account the requirements of the society to the level of education at the present stage, which means to determine the amount of information, required by a student to carry out his future professional activities. In addition, the educational process at a university should be

aimed not only at mastering knowledge, skills and abilities, professional qualities, necessary for the implementation of professional activities, but also at formation of personal qualities.

In this regard, language teachers from the former Soviet Union are trying to develop concepts and approaches for transitional forms of education. Thus, Demyanenko and Leyfa testify to the surge of informatization, computerization and digitization in Russian society, which put forward new requirements for the training of both engineers and humanitarians. The researchers claim: "Professional training of engineers is the process of mastering general cultural and professional competencies that allow to perform professional duties in the field of engineering. Professional competence of engineers provides: efficiency of professional activity of Russian engineers at enterprises, successful solutions of their problems corresponding to functional responsibility, their interaction with the working environment and provides a basis for professional self-affirmation and self-improvement of one's personality" (Demyanenko & Leyfa, 2019, p. 92). Lingualisation and culturisation of engineering education, in their opinion, lie in further implementation of the competence approach and reliance on professional self-affirmation and self-improvement of the future engineer.

At the present time a particularly significant place in the university is given to teaching students a foreign language, since knowledge of a foreign language at a sufficient level is necessary for the training of specialists of any profile. In the programme of foreign language teaching, the main one is the personal-activity approach, which considers the learning process as the organization and management of educational activities, rethinking the goals and objectives of teaching, changing the functions of a teacher and students in the classroom, as well as, students, doing more independent work, solving research educational tasks, etc. From the point of view of this approach, a personality is a subject that is formed in an activity.

In addition, study of a foreign language at a university requires expansion and deepening of business contacts between specialists from different countries in order to conduct negotiations in a foreign language for professional purposes. To complete this task, it is advisable to agree between the teachers, teaching the discipline "Foreign language" the content of foreign texts in the specialty. You should also take into account the complexity, compliance of the content of foreign language texts with the programme of the university and the requirements of the state.

Development of the program in English language for all the faculties and specialties of the Odesa State Academy of Civil Engineering and Architecture

Having analysed the content of training of future civil engineers in state and foreign universities of a technical profile, we defined the general structure of the content of the discipline “English for future technical specialists”. This structure includes four units for training specialists.

The frequency of topics in the analysed programs allowed to outline compulsory topics of each unit. Thus, the general education unit (Comprehensive English) includes topics of a personal and regional nature, studied even in the senior classes of the secondary school. This can include such topics, as “My Biography”, “Ukraine”, “Kyiv”, “Odesa”, “Great Britain”, “London”, “USA”, “New York”, etc.

The content of the topics of the second unit is presented in the methodological guidelines for English for 1st and 2nd year students in the specialties of the Odesa State Academy of Civil Engineering and Architecture; special (English for technical specialties), which includes topics in the specialty, depending on the faculty and the chosen specialty. For example, for students of the Faculty of Industrial and Civil Engineering, the following topics are presented: “Civil Engineering”, “Ecology and Urbanization”, “Types of Buildings”, “Industrial and housing construction”, “The most widely used building materials”, “The problem of durability”, “Foundations”, “Walls”, “Partitions” and others.

For the students of the Faculty of Urban Construction and Economy, the following topics are presented to prepare students: “Concrete basics”, “Working with concrete”, “Concrete reinforcement”, “Foundations”, “Piles”, “Building materials”, “The basic components of a building”, “The construction site”, etc.

For the students of the Faculty of Architecture, such topics are presented: “From the history of architecture”, “Architectural styles”, “Gothic style”, “Architectural monuments of Odesa”, “Architectural design”, “Town reconstruction”, “Housing development”, etc.

For the students of the Faculty of Hydraulic Engineering, dominated the following texts: “From the history of dam construction”, “Water-power development”, “Dam safety”, “Irrigation systems”, “Types of spillways”, “Dam seepage”, “The choice of the site for dam” etc. For students of the faculty of “Irrigation and drainage construction” presented such texts, as the “Soils”, “Physical properties of soils”, “Chemical properties of soils”, “The sources of water-supply”, “Irrigation”, “Organic matter in soil”, etc.

The third unit of future civil engineers' training is culturological (English Culture), that includes the topics of English culture, and the fourth - Business English, where the following topics are studied: "Negotiations with foreign partners", "Employment at work", "Writing an autobiography", "Writing a resume", "My future profession", etc.

As we can see, the content formation of the units for analysis of the multidisciplinary programmes leads to some sporadic, chaotic, excessive generalization or, conversely, segmentation, so we will continue to try to construct these four thematic units so that they become basic and framework for further diversification of engineering professions and cultural self-improvement.

Allocation of the presented four units of foreign language training of future civil engineers makes it possible today to manage the training process efficiently, to ensure the focus of training and also to organize a differentiated system of teaching foreign languages in a technical university.

For the systematic definition of each block of foreign language training of future civil engineers, the following requirements were identified and introduced into practice:

- 1) the content of education of the discipline "English for students of engineering and construction specialties" is determined in accordance with the goals and objectives set at a certain stage of education;

- 2) the content of this discipline takes into account the following principles of education: humanization, humanitarisation, the principle of differentiated education, fundamentalisation, the principle of taking into account the age and individual characteristics of learning, innovation, continuity of education;

- 3) building the structure of the discipline "English for students of engineering and construction specialties is based on the principles and patterns of teaching methods of foreign languages in technical universities, taking into account all changes in the content of philological sciences.

- 4) the issue of the volume and gradual presentation of information for students is resolved taking into account the faculties, specialties and profiles of students.

- 5) the study and application by future specialists of new pedagogical and information technologies, technical teaching aids, multimedia programmes, as well as new methods of teaching a foreign language in order to form students' skills in analysis, development of creative potential, good professional skills, cultural skills, communication, development of communicative skills, formation of a worldview and broadening of horizons.

Let's try to characterize each of the four above-mentioned units of training future civil engineers to study the discipline "English for training of future civil engineers".

The general educational unit of preparation includes basic knowledge of the English language (greetings, goodbyes, the ability to tell about oneself, one's plans, topics from school material, personal and regional character, the main material on grammar, which includes the following topics: "Verbs to be, to have", "Turns there is, there are", "Times of active and passive voices", "Degrees of comparison of adjectives", "Modal verbs", "Personal and possessive pronouns", etc. This training unit is aimed at consolidating basic knowledge, skills and abilities in English proficiency, training students to study topics related directly to their specialty, to development of thinking skills, communication skills and ability to analyse in general training of students in the construction given to the university one semester.

Considering the discipline "English for preparation of future civil engineers" in the context of the general educational unit of training, the goal of training should be determined - formation of a base of English language proficiency, formation of basic lexical and grammatical skills, the ability to conduct monologues and dialogues on popular conversational topics. To achieve this goal, it is necessary to solve the following tasks:

- 1) Study and consolidate the basic material on grammar, which allows to competently build English sentences and form utterances;
- 2) To study and consolidate the necessary lexical material, to form the skills of greeting, farewell, the ability to talk about oneself, one's plans, to be able to conduct a conversation on everyday studies, as well as regional studies.
- 3) Be able to build dialogical, monological and poly-logical statements;
- 4) Actively use the studied lexical and grammatical material in the practice of the English language in practical classes in the classroom;
- 5) Active use of multimedia technologies for auditory and visual perception of material.

A special unit includes study of topics in the specialty, in this case, construction, for example: "Building materials", "The profession of a civil engineer", "Basic building components", "Construction site", etc., as well as in the classroom repetition of previously studied basic grammatical topics and study of new ones are carried out, such as "Infinitive and its turns", "Communion", "Gerund", "Sequence of tenses", "Conditional sentences", etc. Special training of future civil engineers takes the main place and two

semesters are allocated for it. Special foreign language training of specialists of any profile is necessary for conducting professional negotiations with foreign partners.

Considering the discipline “English for training of future civil engineers” in the context of a special training block, the goal of training should be determined - formation of the base of the English language proficiency in construction specialties”, formation of basic lexical and grammatical skills, knowledge of construction terminology, ability to conduct monologues and dialogues on professional topics. To achieve this goal, it is necessary to solve the following tasks:

1) to learn to choose speech patterns and grammatical structures for constructing statements;

2) to work through a large number of narrowly and broadly specialized construction texts, be able to highlight the main and the secondary meanings in them;

3) to bring to the automatism the use of lexical units fixed during training;

4) to strengthen the skills of conducting professional dialogues and polylogues for negotiating with foreign partners;

5) to use multimedia tools for both auditory and visual perception of the material.

The content of a special unit for training future civil engineers to study the discipline “English for training of future civil engineers” is formed taking into account the individual faculty and specialty, goals and objectives of professional training, types of professional activities of a specialist. It is necessary to work out skills and abilities in order to navigate well in specialized construction texts, pay attention to grammatical structures in technical texts, and study construction terminology well.

The culturological unit of training future civil engineers to study the discipline “English for training of future civil engineers” includes cultural topics. Only a few classes are allocated for the study of cultural topics in the program of a construction university, due to the limited number of hours devoted to learning English. This unit of preparation includes the following conversational topics: “Visiting a museum, theatre, cinema”, “Sightseeing the city”, “Monuments of art and architecture”, “Great figures”, “Holidays in England”, etc., as well as a repetition of previously passed grammatical topics. The purpose of this training unit is to consolidate skills of speaking on cultural topics, as well as, one might say, the study of culture and art.

This unit of training has the following goal - to teach students of the construction profile to conduct conversations on cultural topics and be able

to choose lexical and grammatical structures for building statements on cultural topics. To achieve this goal, it is necessary to solve the following tasks:

- 1) to learn to choose speech patterns and grammatical structures for constructing statements on cultural topics;
- 2) to work through a large number of texts on cultural studies;
- 3) to conduct a comparative analysis of the cultural heritage of Ukraine and England;
- 4) to apply new multimedia technologies (for example, Skype, Zoom, Google Meet) to negotiate with English-speaking students from other countries.

The business unit of training future civil engineers to study the discipline “English for training of future civil engineers” includes the following topics: “Negotiations with foreign partners”, “Employment”, “Writing an autobiography”, “Writing a resume”, “My future profession” and others, as well as a repetition of previously passed grammar topics. The purpose of this training block is to consolidate the skills of writing business letters, autobiography, resume, conducting business negotiations with foreign partners.

This unit of training has the following goal - to teach students of the construction profile to conduct business negotiations in a foreign language correctly, to correctly draw up and execute business correspondence. To achieve this goal, it is necessary to solve the following tasks:

- 1) to learn to choose the right speech patterns and grammatical structures for the correct design of business correspondence, business negotiations;
- 2) to learn the skills of business etiquette;
- 3) to apply multimedia technologies.

Schematically, the four-unit system is presented below, in table 1.

Table 1. *The content of the programme of learning English in the training of future civil engineers to their professional activity*

Preparation units	Content	Purposes	Tasks
General	General knowledge of English (greetings, saying “good bye”, talking about oneself, one’s plans, the topics from the	Formation of the base of foreign language mastering, formation of the basic lexical-	To learn and fix the basic grammar material, that allows to build set-expressions and sentences; to learn and fix the

	school material, personal and country studying character, basic grammar material, including such topics as: "The verbs to be, to have", "There is, there are", "The tenses of active and passive voice", "The degrees of comparison", "Modals", "Personal and possessive pronouns", etc.	grammar skills, the skills of building monologues and dialogues on popular conversational topics.	lexical material to form the skills of greeting, saying "good-bye", to talk about oneself, one's plans, to be able to lead a conversation on general and country-studying topics; to be able to build monological and polylogical statements; to use the lexical-grammar material, learnt in class; to be able to use multimedia technologies for the auditory and visual perception of the material.
Special	Studying special topics, in our case, concerning building and civil engineering, for instance: "Building materials", "The profession of a civil engineer", "The basic components of a building", "The construction site", etc., and also revising the earlier learnt general grammar topics and learning the new ones, such as: "Infinitive", "Participle", "Gerung", "The sequence of tenses", "Conditional sentences", etc.	The base formation of foreign language mastering in building topics, formation of basic lexical-grammar skills, knowledge of building terminology, skills to lead monologues and dialogues on professional topics.	To choose the turns of speech and grammar structures correctly for statements' building; to work at a great number of narrow- and broad specialized building texts, the ability to emphasize main and secondary information in them; to automate the use of lexical units; to fix the skills of leading professional dialogues and polylogues for negotiations with foreign partners; to be able to use multimedia technologies for the

			auditory and visual perception of the material.
Culturological	This block of preparation includes the following conversational topics: "Visiting a museum, a theatre, a cinema", "Sightseeing", "The monuments of art and architecture", "Great statesmen", "The holidays in England", etc., and also the revising of earlier learnt grammar themes.	Fixing of conversational speech skills on culturological topics, and also studying of culture and art.	To choose the turns of speech and grammar structures correctly for statements' building on culturological topics; to work at a great number of texts on culturology; to hold the comparative analysis of cultural heritage in Ukraine and the European countries; to use multimedia technologies (Skype, Zoom, Google Meet, etc.) for negotiations with foreign students.
Business	Includes the following topics: "Negotiations with foreign partners", "The employment", "Writing autobiography", "writing a CV", "My future profession", etc, the purpose of this training unit is fixing the skills of writing business letters, autobiography, CV, negotiations with foreign partners.	To teach the students of a building profile to lead business conversations correctly, to make out business correspondence correctly.	To choose the turns of speech and grammar structures correctly for building statements for the correct formalizing of business correspondence, and conducting business negotiations; To learn the skills of business etiquette; To use multimedia technologies.

Conclusions

Having looked through the structure of foreign language programme of future civil engineers' preparation, we have come to the following

conclusions: definition of the structure of the English-language training of future civil engineers is based on the requirements of the foreign language study programme at the university. These requirements allow to form four compulsory invariant units (topic directions) not only for all faculties and specialties of the Odesa State Academy of Building and Architecture, but also to become a framework basis for diversification of language education of students.

When setting goals and objectives at each training unit, we determined completeness, accuracy, availability of the structure of the educational material. All four training units complement each other.

This structure of English-language training allows students and teachers to organize the learning process in accordance with the goals and objectives of the above-mentioned kind of preparation. The program of foreign language is directed to the preparation of future civil-engineers to the execution of educational and future professional activity in accordance with the demands of contemporary labour market.

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