Pedagogical aspect of development of professionally significant language skills of engineering students

Rozaliya Akhmetgareyeva and Diliara Gainanova

1Kazan State University of Architecture and Engineering, Russia
E-mail: rozateacher@mail.ru

Abstract. The study investigates the pedagogical aspect of forming the professionally significant language skills of future engineers. The results emphasize the determining role of employees who are called “linear personnel”. It stands out that one of the factors ensuring the successfulness and effectiveness of the professional activities of a linear engineer is his ability to act confidently in the foreign environments, receive, process and transmit professionally significant information in a foreign language. In justice to previous research in this direction, we note that they practically do not reflect the problems of developing professionally significant language skills in a technical university that are directly related to the types and functions of an engineer’s professional activity. The results obtained during the experiment showed that situational language teaching characterized by the verbal and cogitative task, problems is an effective means of forming the professionally significant language skills of future engineers. Situations developed and tested by the authors in the training courses build up the language interaction close to as real as in various professional situations.

Keywords: engineering activity, linear engineer, forming the professionally significant language skills, future engineers, institution of higher education, foreign language.

1 Introduction

Important social and economic changes in society, the growth of modern engineering technologies, development of various technical projects and current turbulent processes in the global economy determine a need to review the quality of engineering training at technical universities. The integration of Russia into the international technological space has necessitated engineers who speak a foreign language along with Russian. Currently, fundamental changes are occurring in the nature of engineering activities, first of all, the complexity and improving creativity, it is becoming multidimensional and corporate. We see a social order for an engineer who is capable of multi-scale social and managerial modeling and has the necessary knowledge and experience in a related field. At the initial stage of training, it is already necessary to form a new type of linguistic persona. This is a person who speaks several languages and is able to read and process technical documentation fluently. The search in this direction leads to the need of investigating the problem of development of professionally significant language skills of engineering students. Technical bilingualism becomes a necessary requirement for future success in the profession. Fluency in a foreign language along with Russian makes an engineer competitive, opens up wide professional opportunities for him, and creates the conditions for Russia's integration into the world system of industrial relations. Specialists who are focused on working in the international technological space are needed.
The issues of improving the language training of specialists as a general pedagogical problem are revealed in the researchers of N. Cramer [1], E. Gözüyeşil [2], R. B. Habib [3], V. Khisamova [4], Y. Y. Kovalyova [5], L. Sobinova [6], K. D. Vatşay [7], A. M. Zhandildinova [8], S. Zulfugarova [9].

The problems of teaching foreign languages in higher education institutions, the development of its substantive and organizational aspects at the theoretical, methodological and methodical levels are considered in the scientific works of A. M. Abdyhalykova [10], I.V. Atamanova [11], M. Bojović [12], R. Dabyltayeva [13], R. A. Fahrutdinova [14], A. Z. Ibatova [15], A. Z. Ibatova [16], A. Y. Niyazova [17], A. Y. Niyazova [18], V. B. Pomelov [19], K. Sasirekha [20], R. L. Viktorovna [21] and a number of other contemporary authors [22; 23; 24; 25; 26].

Overcoming any crisis in society, improving and deepening market mechanisms in the economy require a revaluation of the role and importance of engineering capacity. The urgent need to adapt the education system and ways of its organization to the dynamic requirements of the economy and production shows significant opportunities and reserves in improving educational technologies, forms and methods of training used in the professional training of future engineers.

The changes outlined above in the goals and requirements for the content of higher professional education of engineers require a review of the goals, content and technologies in the foreign language training system, strengthening the material and technical base and staffing.

It is also indisputable that English is more popular as the language of international communication.

In actual practice, there is a mismatch between the objective requirements for a modern engineer and the classical volume, structure and content of their language training. We are confident that the process of foreign language training of engineering specialists should solve broader problems in relation to the established practice, be focused on professional activities, which will entail changes in the goals, content, and structure of language training.

A small example can serve as a confirmation of the relevance of the study. In 2019 the most advanced multi-level parking was put into operation in the city of Kazan. The parking lot is equipped with the most advanced engineering equipment. The following engineering systems are provided for the full and safe operation of this parking lot: automatic fire alarm system, gas pollution control system, access control and management system, fire extinguishing control automation system, etc. Of course, for the competent and safe operation of the entire list of engineering equipment, linear engineering staff with a set of basic engineering competencies is required. We need a specialist who can read a text in the original language fluently, feel familiar with the foreign technical documentation from the manufacturer of different equipment. An engineer who is able to communicate with a foreign contract partner who previously performed installation and commissioning of engineering equipment is in demand. We need technical staff that is able to correctly operate and perform routine maintenance, ready to solve a variety of technical tasks. Recruitment and hiring of specialists for such complex engineering facilities-engineers who are able to correctly process technical documentation and have language competence is an urgent need today.

2 Materials and methods

To solve these tasks, a set of research methods was used: analysis of various literature on the research problem; analysis of educational and program documentation; didactic design and pedagogical experiment; testing and questioning; diagnostic methods and subsequent correction. Methods of mathematical statistics were used to process the results of the experiment.

As the methodological basis of the research, the following ideas were used: systemic and activity-based approaches, forecasting and designing educational systems. The theory of linguistic competence of future specialists in the process of vocational education and training is chosen as the base one. Empirical and theoretical methods were used to solve the tasks. Empirical methods are based directly on experience, related to observation, questioning, interviewing, with the study of the results of graduates. These methods were supplemented by experiments and experimental work. Theoretical methods (analogy, modeling, system analysis) made it possible to reveal the main contradiction of research and justify the psychological and pedagogical conditions for the formation of professionally
significant language skills of future engineers, determine the content, structure of the formation of professionally significant language skills at technical university. The research was carried out on the basis of Kazan State University of Architecture and Engineering.

In the course of experimental work, the main objects of monitoring the training of future engineers to interact in a foreign language are professionally significant language skills in speaking, reading and writing, taking into account the specifics of language activities.

We have identified the main criterion - the correctness of statements in oral and written form, or obtaining information as a result of understanding an oral statement or a text (technical drawing). We consider the correctness of the communication act as an additional criterion.

The essence of the experiment was to identify the level of developing professionally significant language skills in students.

In the experiment, the dependence of the formation of professionally significant language skills on the implementation of a complex of psychological and pedagogical conditions in experimental groups was traced:

- the educational process is aimed at developing students’ complex of professionally significant language skills and readiness to transfer them to various types of engineering activities;
- an effective means of forming the professionally significant language skills is situational language teaching characterized by the verbal and cogitative task, problems, message content, the form of utterance (monologue or dialogue), lexical and grammatical units for the implementation of their intent. Situations developed by the authors in the training courses build up the language interaction close to as real as in various professional situations;
- modeling of educational-speech situations is carried out on an interdisciplinary basis through intrasubject, intersubject and extensive synthesis.

The emphasis was on how students mastered professionally significant language skills (linguistic, sociolinguistic, discursive, sociocultural, etc.), which allow for qualified translation in all types of engineering activities (design, survey, construction and restoration, maintenance, etc.), using the full range of language tools, contributing to students' initiative, creativity and independence in the process of making a particular decision to translate.

An important stage was the reflection of the identified intersubject, intercycle connections in the generalized model of the educational and speech situation. Based on this model, professionally significant educational and speech situations were developed, which covered almost all the main academic disciplines and workshops. These included “cross-cutting” educational situations that run through the entire course; target situations that run through several academic subjects and are aimed at achieving a broader goal.

Educational and speech situations were developed for each course of study. In the proposed situations, students were asked to independently get out of the created professional situation, to carry out verbal interaction. Senior students were offered more complex educational and speech situations, the solution of which made it possible to judge their readiness for real engineering activities. The situations proposed in the experiment are the most typical description (model) of engineering activity.

3 Results

The paper reveals the essential features of professionally significant language skills and the process of their development: terminological features; the content of innovative engineering activities in the international technological space; “subject-subject” and “subject-object” relations, etc.

The structure and content of preparing future engineers for real work in the industry are presented through a systematic analysis of the engineering activity of a modern specialist, its types and basic functions, the structure of the engineer’s labor, the system of educational and speech situations and exercises.

In the research, innovative engineering activity, representing a verbal and cogitative activity of an engineer, is a multifunctional type of cross-language and cross-cultural communication and consists in
understanding and transmitting the content of information (text, technical scheme) created in the language of one culture, by reformulating it in the language of another culture.

As a result of this work, changes in the level of formation of professionally significant language skills in future engineers, as well as the composition and features of the complex of psychological and pedagogical conditions are revealed. It has been experimentally proved that an effective means of forming professionally significant language skills are educational and speech situations characterized by the verbal and cogitative task, problem, message content, form of utterance (monologue or dialogue), lexical and grammatical units for the implementation of their intent. Situations developed and tested by the authors in the training courses build up the language interaction close to as real as in various professional situations.

The research allows us to argue that situational language teaching can be an effective means of forming professionally significant language skills.

4 Discussions
Statement and study of the problem of development of professionally significant language skills of future specialists are really conditioned by objective needs in training of engineering staff.

The validity of the results and conclusions of the work, provided an adequate definition of the initial methodological positions; based on fundamental psychological and pedagogical research; the use of complex empirical and theoretical methods; the experiment in a real educational activity; the duration of the experimental work; direct participation of the authors confirmed the hypothesis put forward in the work.

The problem of training a specialist in the field of professional communication is presented as the most important component of a modern engineer, which is organically interrelated with the types and functions of innovative professional activity. Successful acquisition of language competence by future specialists in technical universities through the solution of developed educational and speech tasks contributes to the expansion of international contacts and interaction of engineering specialists from different countries.

Proof of the above is the fact that the WorldSkills professional skills championship was held in Kazan in August 2019. Our state has been a part of the WorldSkills International movement since May 2012. As part of other states, we pay great attention to the popularization of working professions among young engineering personnel.

The main results of the research in the form of a work program and methodological recommendations are used in the practice of teachers of the Kazan State University of Architecture and Engineering.

5 Conclusion
The main outcomes of this work are the results obtained. It has been confirmed that the process of teaching a foreign language to engineering specialists should solve broader problems in relation to established practice, be focused on professional activities, which will entail changes in the goals, content, and structure of language training. The proposed content of integrated language training includes an invariant part that contributes to the formation of language knowledge and skills, and a variable component, which should take into account the specifics of the engineer’s innovative activity. They are structured in integral blocks and provide interconnection with general professional and special disciplines.

The content of language training through the introduction of educational situations in the learning process contributes to the formation of communicative language competence necessary for engineering activities in the global technological space.

The authors revealed the essential features of professionally significant language skills and the process of their formation: terminological features "subject-subject" and "subject-object" relationships, etc. The authors developed and justified the component composition and features of psychological and pedagogical conditions for the formation of professionally significant language skills in future engineers.
Among the conditions highlighted, the target orientation of the entire educational process, its content, methods, forms of organization and training tools for the gradual formation of professionally significant language skills is mandatory (the first level is elementary translation skills sufficient for further educational activities; the second level is basic translation skills necessary for professional foreign language activities using basic language tools; the third level is professional language skills that allow to carry out a qualified translation in all types of engineering activities of an innovative nature using the full range of language tools. The set of educational situations was carried out on the basis of the principles of professional orientation, continuity, integrity and completeness that adequately reflect the essential features of engineering activities in general.

It is necessary to emphasize the practical significance of the work done. The results obtained and the developed pedagogical model for the content of additional linguistic training of future engineers, implemented at the Kazan State University of Architecture and Engineering, allow further training of specialists of dual competence.

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