Metalinguistic Awareness in Technical Communication

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Abstract. The paper discusses the socio-communicative function of the engineer’s foreign language training where the content should be based on materials of the global latest technological advances and understanding the essence of production culture in different countries. The structure and content of foreign languages training is revealed taking into account the potential of multilingualism, technocommunication and metalinguistic awareness. Foreign language training contributes to the formation of linguistic, communicative and metacognitive skills. International modern requirements to the students’ foreign language training at an engineering university are actualized, its contradictions and features of pedagogical forms, methods and tools are identified. The content and structure of multilingualism, technocommunication and metalinguistic awareness of the students’ foreign languages training at an engineering university are revealed. A methodology for the implementation of foreign language training in combination with multilingualism, technocommunication and metalinguistic awareness is devoted. The effectiveness of the proposed methodology was proved through the realization of group international study trips where students showed an understanding of technology by means of foreign languages and a metalinguistic awareness focusing on the cultural traditions of the region and local features of production. A conscious approach to deeper linguistic knowledge, cultures of different countries and technologies according to the high language and communications requirements in the field of science and technology, combining linguistic and engineering thinking in the human mind for a more complete understanding of the essence and content of engineering education is argued.

Keywords: Metalinguistic awareness \textsuperscript{C}\  Technocommunication \textsuperscript{C}\  Multilingualism \textsuperscript{C}\  Foreign languages training

1 Introduction

Megatrends such as climate change, urbanization, demographic change, food and energy security on the one hand and global conditions for economic development, including globalization, digitalization, hypercompetition, informatization, industrial revolution 4.0 on the other hand are stimulating changes in all spheres of human life and are remaking strategies of high technology engineering modernization. The goal of high-tech engineering is to improve the well-being and quality of life of all people and to preserve the ecological safety of the planet. The global need for the development of
innovative processes, the accumulation of the newest technologies has activated international scientific and technical communications and the possibilities of technical communication. An interesting opinion was expressed by scientist Stephen Doheny-Farina from MIT University, he argued that in a large context the technical and commercial processes of converting technologies into products are communication processes [1]. One of the most relevant forms of world scientific and technical forms of interaction is the transfer of technologies. In the framework of transfer the dissemination of innovative technological solutions, intellectual activity between countries, individual industries or industries are carried out. In modern conditions of rapid transformation of socio-economic shifts this exchange gains strategic importance and shapes regional, national and international scientific and technological sustainability.

Rapid changes in the technical sphere and modern forms of scientific and economic cooperation impose corresponding requirements not only on its infrastructure but on the specialists involved in various segments of engineering. The fundamental transformation in the role of equipment and technologies in society, their invasion of the anthropological essence of man requires other key competencies from specialists than in the past. In the transition from studying at a university to the labor market in addition to technical and professional skills it is important to have personal and social skills, such as communication, organizing and managing time, knowledge of regional features of engineering, and high responsibility for making engineering decisions and social adaptation for young specialists. At the same time the socio-communicative function of the engineer’s foreign language training is increasing, the content of which should be based on materials of the global latest technological discoveries and understanding the essence of production culture in different countries. This will allow students to more widely analyze current problems, evaluate the consequences of technological and social changes, predict and recognize trends and stay one step ahead.

It should be noted that on the part of students, their attitude to the study of languages has changed. It means that their understanding of the importance of communication in the modern world gives grounds for rethinking the role of foreign language training in higher education, for a deeper students’ interest in learning several languages and realizing the need to adapt foreign language training to the realities of modern society [2]. The transition from foreign language training in the traditional format to a deeper understanding of the role of intercultural and technical communication in several languages in the modern context of technological change has matured.

An integral part of the scientific and technological process along with the invention and production is technical communication (technocommunication). Technocommunication is the ability of an engineering university student to professional communication strategies in order to transmit technical information in several languages, taking into account the socio-cultural characteristics of the countries producing the technical product. Technocommunication is expressed in the form of search skills, critical analysis, synthesis, distribution, adaptation, visualization information in several foreign languages, including for a wide audience of users. To successfully start-up of a product on a global and local market, an engineer requires a core analysis of customer expectations at the national and international levels and the subsequent linguistic and functional support of its quality. It deals with a simplified language describing the principles of the product in several languages, considering regional features of potential
consumers [2, 3]. Despite the digitalization has allowed a large number of users to connect to the Internet, however, the majority of them do not speak English, that is why it’s so important to localize (adapt) the product for international users using technocommunication and multilingualism.

In combination with knowledge of several foreign languages (multilingualism), with understanding of the principle of their functioning (metalinguistic awareness) technocommunication significantly widens the access of specialists to scientific and technological progress in the context of interstate, international scientific relations and intercultural communications. Multilingualism is considered as the acquisition of two or more foreign languages at any level necessary for intercultural, professional and technical communication, for working in multinational teams with speakers of other languages and national cultures, for understanding the national and cultural context of the countries producing the technical product and recognition the specifics of work in the engineering industries beyond boundaries. Acquisition of several foreign languages contributes to the formation of a more meaningful attitude to the language, that is to say, metalinguistic awareness. It is expressed in the ability to critically perceive someone else’s culture and experience, to compare, analyze linguistic and sociocultural phenomena, independently choose strategies for studying foreign languages and linguistic reflection. Metalinguistic awareness in the process of foreign languages training allows to tap into the intricacies of linguistic and engineering thinking.

The aim of this study is to determine the content, structure, features of modern foreign language training at an engineering university, leading to the identification of the integrated potential of multilingualism, technocommunication and metalinguistic awareness.

2 Method and Materials

To achieve this goal, theoretical (analysis of psychological, pedagogical, sociological literature, normative documents and products of educational activities of students) and empirical research methods (observation, conversation) were used.

At the first stage of the study (2017), the structure and content of foreign language training was revealed considering the potential of multilingualism, technical communication and metalinguistic awareness.

Engineering education involves the formation of a professional engineering culture consisting and understanding of sociocultural and humanitarian knowledge allowed to assess the place and possible consequences of technical development in a wider sociocultural context. Therefore, we offer to consider the educational and cognitive resource of multilingualism, technological communication and metalinguistic awareness within students’ foreign language training at an engineering university. By focusing on these three characteristics, foreign language training will contribute to the formation of linguistic, communicative and metacognitive skills.
The focus on multilingualism, technological communication and metalinguistic awareness in foreign language training at an engineering university was based on:

– *modern requirements* of employers to engineer’s formation, to the level of their foreign languages acquisition, *recognizing* the need to learn several languages by students in order to solve professional problems;

– *contradictions* between the expansion of the exchange of products of scientific and technical activities, increasing international, intercultural, scientific and technical communications and the insufficient level of adaptation of graduates of engineering universities to professional activities in the conditions of transformation of economic relations;

– *features* of pedagogical methods, forms and means in the framework of students’ foreign language training at an engineering university.

The integration of multilingualism, technocommunication and metalinguistic awareness in foreign language training at an engineering university is due to the general low level of students’ ability to perceive the intercultural diversity of countries [4], to interact socioculturally in the process of caring out educational and professional tasks, the ability to show a world outlook and the ability to apply a systemic approach to solving problems, the ability to analyze scientific and technical information in several foreign languages, readiness for activity in multinational teams and the ability to self-education, self-realization and self-development [5].

At the second stage of the study (2018) the content and structure of multilingualism, technology communication and metalinguistic awareness in foreign language training of students in an engineering university were revealed.

*Multilingualism* includes:

- knowledge of the system of languages studied;
- knowledge of the linguistic features of different social layers, representatives of different generations, genders, social groups of various countries;
- ability to position itself as a representative of a national culture;
- the ability to mediate, interpret one culture in terms of another;
- ability to work with foreign language information and create new text in several languages;
- knowledge of the features of linguistic choice depending on the social and cultural norms of native speakers [6, 7].
- formation of tolerance [8].

*Technocommunication* consists of:

- knowledge of the socio-cultural foundations of society;
- the ability to produce a technical text and adapt it to a wide audience;
- strategies for transmitting technical information in foreign languages;
- skills to persuade, motivate with the help of technical information;
- the ability to take into account current trends in the development and achievements of foreign science, engineering and technology in professional activity;
- ability to collect and analyze scientific and technical information.
Metalinguistic awareness includes:

- skills of self-organization and self-education;
- linguistic reflection [9];
- regulation of personal cognitive processes, including new ways of thinking - critical, creative, non-linear and systemic [10];
- knowledge of strategies for independent study of foreign languages;
- linguistic abilities for linguistic observation and language conjecture;
- the ability to identify similarities and differences in the studied languages [11].

At the third stage (2019), a pedagogical experiment was carried out to integrate multilingualism, technocommunication and metalinguistic awareness into foreign language training of students at an engineering university, moreover theoretical and experimental results concerning the effectiveness of the proposed model of foreign language training of students at an engineering university were demonstrated.

3 Results and Discussion

The experimental work was carried out at Kazan National Research Technological University. Participants were Bachelors (second year), majoring in «Biomedical Engineering» (aged 19–20) and “Power Engineering and Electrical Engineering”.

During the experiment multilingualism, technical communication and metalinguistic awareness training was realized using traditional and innovative teaching methods, comparative methods were applied to analyze the culture, communicative behavior and functional structure of different languages, differences and similarities in phonetics, vocabulary, grammar, stylistics of two foreign languages and native language were revealed [12] as one the method of intensification of professional training [13]. The use of various didactic units in the classroom (multilingual dictionaries, glossaries, contrasting assignments, authentic texts) in combination with various organizational forms of work (classroom, extracurricular and independent), methods of students’ cognitive activity (explanatory, illustrative, research, method of problematic presentation of information), pedagogical technologies (training in cooperation, development of critical and systemic thinking), active and interactive teaching methods (virtual tours, brainstorming, project method, dialogue of cultures) [14], developing of tolerance focused on a deeper understanding of the importance of multilingualism, technocommunication and metalinguistic awareness. In the classes, specially developed methodological guidelines “Medical Engineering”, “Multilingual Russian-English-French dictionary of medical engineering terms” and a glossary for Bachelors, majoring in “Biotechnical systems and technologies” were used.

Table 1 shows the pedagogical methods, forms, and tools used in preparing foreign students of an engineering university.
After completing the foreign language training program, students expressed a desire to independently apply for participation in the grant program “Group Study Visit to Germany” as part of the scholarship programs of the German Academic Exchange Service DAAD (2017) and take part in the internship (Germany 2019). To participate in these programs, students decided to independently study the German language, although this was not provided for by the requirements. Based on the existing linguistic experience, students individually chose the language learning strategy including the method of acquisition of two foreign languages of one Romano-Germanic group. This method is focused on communicative-cognitive and contrasting principles and implies the purposeful development of students’ cognitive abilities through the new foreign language. It means the extensive support in the acquisition of the next language (L3) on similar linguistic and sociocultural phenomena in languages that are in contact in the educational process: native (L1), first (L2) and second foreign languages (L3).

During the trip in the process of the observation of the linguistic and communicative behavior of students a clear positive dynamic was revealed. At the beginning of the trip at formal meetings with the administration of universities, teachers and scientists, students adhered only to the English, for example while discussing the engineering education system in different countries or during the presentation of their university and the scientific activity of the department. Within informal conversation with foreign students, communication was carried out in several languages: in English, French and German due to a decrease in psychological linguistic barriers, lack of language control by teachers and a decline in fear of making a speech mistake. Subsequently, within the group of students, an increase in the frequency of use of phrases of everyday and technical English and German languages was noted, which is explained by their repeated listening and reproduction in an environment of everyday, business and technical communication. It is important to note that in plus with linguistic progress, a better understanding of the cultural characteristics of Germany has also formed. In the culturological aspect they became more familiar with the history, architecture of the country, production facilities, revealed differences in the behavior of Germans from Russians, recognized the characteristic features of the German mentality - punctuality, respect for the law, ecological culture.

During the trip students realized the importance of multilingualism, technocommunication and metalinguistic awareness while hosting in another country and

| Multilingualism | Technocommunication | Metalinguistic awareness |
|-----------------|---------------------|--------------------------|
| • Multilingual dictionaries and glossaries; • parallel text; • sociodrama; • brainstorm; • virtual excursion | • Writing texts for various audiences; • schematization of information; • presentation, • explanation of the principle of operation of the device in simple language | • Contrasting tasks; • independent work; • tasks for the analysis of communicative behavior; • reflective and motivational questions; • thinking out loud |

Table 1. Pedagogical methods, forms and means of developing multilingualism, technocommunication and metalinguistic awareness.
communication with representatives of other nationalities. They understood the key role of multilingualism, technocommunication and metalinguistic awareness during all events, including a discussion seminar on the use of alternative energy sources at the University of Applied Sciences with representatives of several countries, when they tested expressions of technological innovations in several languages (L1, L2, L3). The visit of Siemens enterprise allowed them to discuss not only the latest production technologies, but also to analyze the sustainable development program, corporate ethics (Code of conduct) and social responsibility of the enterprise in terms of industrial culture, history, science and technology.

During the trip students significantly increased the level of technical communication in several foreign languages and showed accumulated knowledge and skills in situations of practical international professional communication, showed adequate communicative behavior, demonstrated their readiness for intercultural communication in the field of scientific and technical communication during all meetings, seminars, presentations and round tables at technical universities and at a German company.

Studying in an extended program of foreign language training with the inclusion of multilingualism, technocommunication and metalinguistic awareness, students have great chances and desire to learn other foreign languages in the system of additional education [15], independently or on-line [16], they actively apply for training in graduate students abroad and take part in international university programs, are part of international internships in Vietnam/China, France [17, 18], and motivate and explain to other students the possibility of participating in the university’s international activities.

4 Conclusion

Multilingualism, technological communication and metalinguistic awareness in the process of foreign language training is manifested as a conscious approach to deeper linguistic knowledge, cultures of different countries and technologies, taking into account the high requirements for language and communications in the field of science and technology. Such an approach to foreign language training at an engineering university not only comes forward the language in its classical sense, but also combines linguistic and engineering thinking in the mind for a more complete understanding of the essence and content of engineering education. An engineer after such foreign language training with a systematic perception of multilingualism, technological communication and metalinguistic awareness will be able to translate the content of technical courses into several foreign languages, tapping into the essence of technological processes through linguistic communicative thinking. The appearance of technical courses in foreign languages at a university not only raises the international university attractiveness ratings, but also favors the organization of communication and interaction between the university and enterprises, business, and the state in the process of transferring knowledge, leading to increasing the academic mobility of students and teachers. In other words, within the university’s mission, multilingualism, technocommunication and metalinguistic awareness should be considered as an opportunity to implementation and design of advanced education.
Because of foreign language training implies an in-depth immersion in the linguistic sphere and culture, it unites people in the framework of a common social responsibility for the preservation of the biosphere and technological safety. Specialists of all areas are connected by a single planetary thinking [19], where a special role is played by metalinguistic awareness based on knowledge of different languages and cultures [20], awareness of the social consequences of technological innovations in each country. As an illustration of the above thought, one can cite the example of the coronavirus pandemic in the current year, it clearly shows how experts in many areas have united by a common goal - the search for chemical production technologies against the threatening virus. All specialists are ready to communicate and solve one single task - to survive on our planet.

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