



The role of the socio-psychological disciplines in the training of engineers (KNRTU experience)

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Introduction. The challenges facing today's engineers are so complex that they require the involvement of teams of experts specialized in different fields. The volume of information and knowledge needed to understand and solve problems is increasing so fast that one person cannot keep up with it all. Intense specialization increases the value of the ability to function on a multidisciplinary team. As a result, the need to add humanistic subjects to the traditional professional education of engineers and other technical staff is becoming evident, which generally manifests in the form of continued "humanitarization" of Higher Engineering Education. The subject of humanitarization of Higher Engineering Education is discussed extensively in the works of Y.Vetrov, A.Ivashkin, T.V.Smirnova, V.N.Stegniy, G.V.Shevtsova, and others^{7, 8, 9, 14}. There are sufficient reasons to assume that high-quality professional engineering education must comprise humanitarian component.

This opinion is shared by a number of international researchers^{3, 15, 16}, they agree that teamwork, team building, leadership, and conflict resolution skills are essential for a successful engineering career. This interdisciplinary approach to the training of undergraduate students helps to develop a more comprehensive vision of an engineer's professional activity.

The importance of incorporating of socio-psychological component into the content of undergraduate engineering curriculum is emphasized in the State Higher Professional Educational Standard (hereinafter – Educational Standard). For example, the Educational Standard for "Chemical Technology" program (bachelor's degree) requires that the graduates who have successfully completed the program, in addition to core professional competences, could demonstrate the following skills: the ability and willingness to develop productive working relationships with colleagues; teamwork; high motivation to perform professional activities; the ability to plan, organize, and supervise the work of subordinates; make managerial decisions.

Despite the existing difficulties in the process of adopting a competence-based approach in the Russian Education System¹², changes in the traditional educational paradigm and a revision of the content of education continue. One of the challenges in the process is to design the fundamentally new activity-focused techniques aimed at developing these competences.

As an example, we present the experience of Kazan National Research Technological University (KNRTU), where the "Workforce Psychology" course has been a part of the undergraduate engineering curriculum for several years now. Over 2,500 KNRTU students complete this course every year.

"Workforce Psychology" course is an integrative course that combines the elements of traditional academic disciplines (psychology, engineering psychology, social psychology, psycho-diagnostics). This course teaches students to recognize and appreciate the unique personality of each team member; it enables students to develop self-awareness and self-management skills that will help them reach their full potential, maintain productive relationships with other team members, and achieve effective communication. It is found that the stage of professional education includes the development of activities from educational-cognitive to training-professional and from it to a real professional¹³. In this connection, the main objectives of the course, in addition to the development and enhancement of students' theoretical and practical knowledge in team working, are to provide an understanding of the

psychological processes that influence professional interactions and prepare students to handle various challenges and break down barriers to inter-team communication. To achieve these objectives, the course includes the following sections: Business Communication, The Role of Personality in the Workplace, Professional Conflicts, Socio-Psychological Climate in the Workplace, etc. The learning process is designed in a way that teaches students how to integrate academic knowledge with practical application in their future careers.

Methods of the Study. During research the following methods were used: analysis of normative documents, generalization of teaching practices, content analysis, systematization and generalization of facts and concepts, action research method, observation, questionnaire survey, pedagogical experiment.

The Experimental Base of the Study. Experimental work was carried out on the basis of Kazan National Research Technological University. 178 students participated in the experiment.

Stages of the Study. The study was conducted in three stages:

- The first stage is devoted to the analysis of current state of the studied problem in the pedagogical theory and practice.
- The second stage covers the content development of the "Workforce Psychology" course; identifies stages and defines the principles of formation of social and psychological competencies, including objectives, methods, pedagogical conditions, criteria.
- The third stage involves the systematization, interpretation and synthesis of the research results; refines theoretical conclusions; processes and represents the obtained results.

Teaching methods. Modern practice-oriented forms, methods and educational technologies replace the classical (lecture-seminar-practicum) mode. The modern education is based on workshops, business and role-playing games, problem-oriented methods, context study, case study, etc. The main advantage of the new EdTechs is interactive nature, that allows stimulating better students' engagement and their active participation in the training process. Thus practical skills are acquired faster. The rate of learning is especially important nowadays because the period of studies has been reduced⁵. In our view the student's knowledge and skills in Workforce Psychology would benefit significantly if during the training the following methods are practiced: (i) socio-psychological trainings; (ii) simulation games; (iii) interactive group activities; (iv) case study; (v) brainstorming; (vi) discussion.

Karimov A. and Kazakova V. suggest that «although intellectual virtues cannot be taught directly, they can be fostered in the appropriate environment»². The appropriate environment can be created through active learning methods.

In order to enhance teamwork skills, the ability and willingness to cooperate with colleagues, we developed a system of training exercises which include diagnostic and formative components. Exercises in this block are aimed at team building, helping each participant of an interaction to reach their full potential, developing the skills of conflict-free interaction. These training exercises complement the content of lectures on "The Role of Personality in the Workplace", "Socio-Psychological Climate in the Workplace" and demonstrate how to maintain an effective cooperation. Active interaction during exercises allows you to assess and create a positive socio-psychological climate in the group (and, if necessary, adjust it), which in turn affects the level of student motivation. Training exercises in this case are used as the method of achieving the didactic goals.

Simulation game is an effective method of learning and developing the supervisory, management, and decision-making skills. It helps "re-create the objective and the social content of a professional activity, simulate the system of interactions specific to a certain type of workplace"⁶. In addition, the simulation game eliminates the gap between "the abstract nature of the subject and the real nature of the professional activity" (ibid.) The experience shows that games enables the development of all mental processes of a person more effectively than other types of activities, facilitating the transition to a new, higher stage of self-development¹¹. This method helps identify the main barriers to cooperation and mutual understanding, identify stressors and conflict-generating factors of teamwork, and identify ways to prevent or overcome these factors. Through participation in simulation games students have the opportunity to identify the leadership qualities, acquire group management, decision-making, and stress-management skills. Simulation games method was implemented as an addition to lectures on "Business Communication", "Professional Conflict Management".

The focus of training exercises and simulation games was on the management of interpersonal interaction.

In order to gather feedback from students on their participation in exercises/games and assignments, and learn how these activities impact the development of teamwork and communication skills, the authors developed reflective questionnaires for each block of assignments (training exercises, business games), asking students to answer questions that reveal the level of cohesion of the group, the presence and influence of the positive socio-psychological climate on the performance and the willingness to work in this group, the presence of barriers in interactions. In addition, each student had the opportunity to express their opinion about the work accomplished individually or in collaboration with others, describe their classroom experience and emotions during interaction within the team, etc.

It should be noted that the reflection was carried out after the completion of each exercise and at the end of a class. A content analysis of an exercise or class in general, creates the conditions for self-assessment, self-learning, self-development of students, giving a new meaning to the experience, information, summarizing the emotional outcomes, gathering feedback.

In addition to personal reflection, which was carried out in the form of a written essay, we conducted a group reflection, summarized the results, which helped participants to develop the ability to assess, understand, and perceive themselves and other members of the group. Students had an opportunity to find out how adequate their self-image is and how they are perceived by other members of the group.

Results. The study identified that all respondents, 178 people, acknowledge the positive impact of training exercises, business games and assignments for the development of socio-psychological and communication skills. The analysis of free-form written student essays on their classroom experience, impressions and comments showed the following.

All students are satisfied with the result of the group as a whole. The involvement of every member of a group in productive teamwork has been identified as an essential attribute of team cohesion (79% of respondents). In addition, all participants reported the significant positive affect of participation in practical sessions on team effectiveness. After students completed assignments/games, 65% of respondents said that the exercises helped them

enhance attention, observation, and the ability to feel the mood and psychological state of partners.

Among the factors that influence the successful implementation of group assignments, students identified the following factors: personality and management style of a leader (89%), individual psychological characteristics of group members (67%), basic conflict resolution and prevention skills (69%), ability to develop a strategy and an action plan (84%), and so on. However, many respondents noted that they deliberately chose a position of subordination, since the leadership role has already been taken by other member of the group during the implementation of particular assignments (31%).

After assessing the communication barriers, students noted that people's behavior is influenced by past experience, personal relationships, current needs, and other factors. Exercises aimed at developing the communication competences create conditions that help to identify the motives, focus, and needs of a partner.

As identified by students, the challenges faced by the members of a group can be objective and subjective. The objective challenges include the following: lack of care and attention from classmates to the opinion of some members of the group (46%); lack of assignment implementation supervision (67%); lack of understanding (41%); lack of clear understanding of the future profession (48%), which is understandable, since all participants are first-year students.

The subjective challenges include: difficulty of self-assessment (31%); difficulty of overcoming communication barriers, uneasiness (35%); limited time and lack of the skills necessary for assignment implementation (41%), etc. Despite the difficulties in cooperation within the group, participation in interactive exercises helps students gain experience and tools for using self-reflection as a learning technique in the future.

After the successful completion of the "Workforce Psychology" course, students were asked to evaluate the importance of effective communication skills acquired during the course for their future careers. It should be noted that all of the respondents agreed on the importance of acquiring these skills. More specifically, some respondents stated that they: "realized the importance of recognizing the individual psychological characteristics of each member of a group", "acquired effective goal- setting skills necessary to organize the work of subordinates," "classes contributed to positive group dynamic," etc.

Conclusion. Today's labor market demands engineers who are multidisciplinary experts, able to learn fast and make decisions in rapidly changing environment⁴. Modern engineers are required to have special technical training, as well as the social and psychological skills to ensure the successful interaction with other team members. Integration of socio-psychological disciplines into the content of engineering curriculum is fundamental to training of engineers that can meet the requirements of today's labor market.

The experience of teaching the social-psychological disciplines and feedback received from students who completed the "Workforce Psychology» course show that the acquired skills are highly valued by engineering students and can benefit them during their training and in their future career.

The use of interactive and active learning methods of teaching encourages increased interest and involvement of students in solving practice-oriented professional problems modeled in quasi-professional environment, that despite the conventionality of the game situation, allow participants to experience the real, true emotions, resolve conflicts, both interpersonal and intrapersonal challenges, develop the necessary knowledge, skills through group and individual reflection^{1, 10}. Specially organized didactic games encourage critical thinking and creativity in students; help them prepare for academic success and future careers.

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