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TRAINING OF STUDENTS IN RUSSIAN ENGINEERING UNIVERSITIES

LA FORMACION DE LOS ESTUDIANTES EN UNIVERSIDADES DE INGENIRIA DE RUSIA

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ABSTRACT

The present study aims to analyze the development of professional competencies from the category of soft skills in the process of training of students in Russian engineering universities on the example of the Moscow Polytechnic University, as well as the influence of the development of said competencies on the personal and professional effectiveness of future young specialists. The goal of the present study is to determine the style of leadership and its influence on the personal effectiveness of a leader, the effectiveness of teamwork, and the personal effectiveness of team members.

Keywords:

Innovation, professional competence, personal effectiveness, leadership, teamwork.

RESUMEN

El presente estudio tiene como objetivo analizar el desarrollo de competencias profesionales de la categoría de habilidades blandas en el proceso de formación de estudiantes en universidades rusas de ingeniería en el ejemplo de la Universidad Politécnica de Moscú, así como la influencia del desarrollo de dichas competencias. sobre la eficacia personal y profesional de los futuros jóvenes especialistas. El objetivo del presente estudio es determinar el estilo de liderazgo y su influencia en la efectividad personal de un líder, la efectividad del trabajo en equipo y la efectividad personal de los miembros del equipo.

Palabras clave:

Innovación, competencia profesional, eficacia personal, liderazgo, trabajo en equipo.

INTRODUCTION

The rapid acceleration of development and global changes in the trends and structure of socially significant processes leads to the transformation of socio-economic priorities and meaning-forming values both in society as a whole and each particular individual (Zotov, et al., 2021). The successful implementation of modern social development trends poses certain requirements for a person as the main initiator and conductor of all innovative changes. Among the most relevant requirements are the capability of active professional activity, the ability to make weighted and well-justified decisions with consideration of their long-term consequences, effective adaptation to the dynamic changes in social interaction, etc. It is of primary importance to consider the changes in social interaction as they have a significant influence on individuals, the economy, and society generating change in the labor market: the emergence of new competencies and specialties, changes in the requirements for professional training of young specialists, flexibility regarding the change of profession, geographic mobility, the introduction of artificial intelligence, the shortage of specialists of in-demand professions, etc.

These and many other changes in the labor market, in turn, shape changes in the system of professional training of young specialists within the paradigms of the modern educational process (Sekerin, et al., 2018; Sekerin, et al., 2019). The rapid pace of the development and implementation of information technology in all areas of life has revealed a great need for specialists in engineering (Semenova, et al., 2020). However, both the successful professional, career, and personal growth and the effective development of human capital as the main source of innovative development of modern society call for an effective combination of hard and soft engineering skills in a specialist. The article presents a continuation of the study, the first stage of which is covered in the article "Human Capital Development: Development of Professional Competencies through Soft Skills". (Semenova, et al., 2021).

The requirements for the quality of development of human capital are high in the modern world, but they inevitably transform to adapt to the dynamic process of development of the socially significant social processes. Maintaining the established rate of development generates the need for highly qualified specialists, predominantly engineers. Educational programs in engineering emphasize the development of hard skills due to the specifics of this direction of professional training. Vocational education with a focus on the development of soft skills impacts not only professional skills but also the way of thinking and the opportunities for self-actualization and professional effectiveness of a young specialist as a socially active person.

However, the recent years of practice show that it is hard skills that quickly become obsolete, reducing personal effectiveness, mobility, and professional adaptation of young specialists to changes in the labor market. For this reason, one of the most relevant and in-demand trends in engineering education is the formation and development of sufficient soft skills of future engineers that would ensure the effectiveness of their personal and professional self-actualization including innovative creativity, as well as improve their competitiveness in the labor market due to greater mobility and opportunities for flexible professional adaptation (Akhmetshin, et al., 2019; Semenova, et al., 2020). Goleman, et al. (2008), argues that ***"a person's effectiveness in professional activity directly depends on the degree of development of their soft skills that distinguish successful specialists from the unsuccessful ones and effective organizations from the ineffective"*** (p. 115).

Contemporary scientific knowledge indicates that soft skills can be divided (Covey, 2017; Batsunov, et al., 2018) into four main groups:

- group 1 – the basic communication skills including the ability to listen, manage interpersonal communication, substantiate one's opinion, negotiate, create and maintain group communication, public speaking and self-presentation skills, business correspondence ethics, the ability to maintain dialogue in critical situations, conflict resolution, etc. The development of these skills largely determines the effectiveness of interpersonal relations both in the professional sphere and the sphere of personal interests, as well as the effectiveness of social self-actualization, since the opportunities for it depend on the ability to communicate with other people, for instance, colleagues, employers, partners, management, etc;

- group 2 – self-management skills including the modern management technologies focused on self-management and self-development and, thus, contributing to increased personal effectiveness regardless of the sphere of professional activity. This group comprises the development and management of social intelligence, time management technologies, planning and goal-setting in professional and personal development, self-reflection, initiative, persistence, the development of stress-resistance, etc.;

- group 3 – the skills of effective thinking (intelligent thinking). Thinking is one of the main cognitive processes allowing one to construct the inner image of the world through analyzing and reflecting the manifestations of reality, create logical links between the internal and the external, identify patterns in the ongoing events, etc. Modern

science identifies several types of thinking. The examples include strategic, creative, logical, systemic thinking, etc. Effective thinking skills promote correct comprehension of what is happening and the extraction of personal knowledge (insight) from the experience and its transformation into skills, abilities, creation, creativity, etc.;

- group 4 – management skills (foresight-management). We believe that these skills to be ones of a higher order, based on the skills of the previously described groups, but on a higher level of professional and personal development, as they imply predicting (foreseeing) the consequences of social interactions and hence taking responsibility for these consequences. These skills typically include performance management, change and project management, planning, coaching, leadership, etc.

We believe that Covey's (2017), model of skill formation adapted to the formation of soft skills can be visualized as follows (Figure 1).

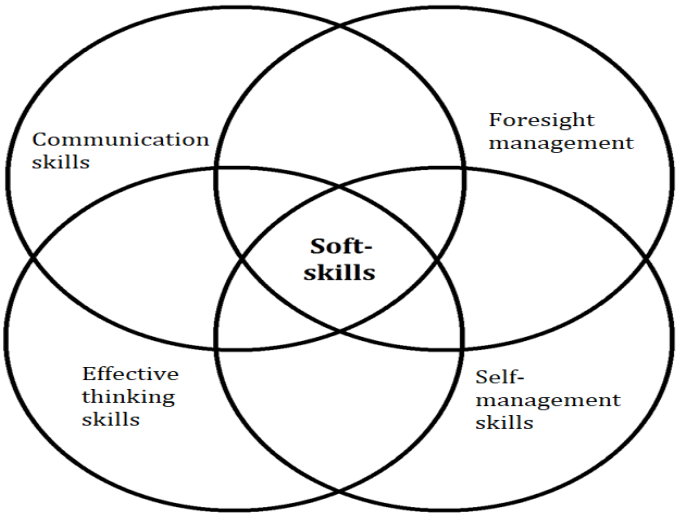

Figure 1. Soft skills.

Thus, the presence of soft skills in the professional profile of an engineer provides them with the advantages of personal and professional development since it contributes to a more comprehensive image of the surrounding reality, forms strategic thinking, and contributes to the development of effective interpersonal communication skills. Taking care of its current students, future engineers capable of successful professional and personal self-actualization, the Moscow Polytechnic University pays special attention to the formation and development of soft skills within the framework of engineering training including the skill of leadership that improves a young specialist's competitiveness in the labor market.

MATERIALS AND METHODS

One of the most highly demanded competencies referring to and based on soft skills is leadership. As previously noted, leadership is defined as a social phenomenon based on personal qualities and manifesting in the process of social interpersonal or group interaction (Goleman, 2016). In this study, we define leadership as a set of leadership skills (Semenova, et al., 2021):

> Leadership skills are
> A high degree of influence on the others, the ability to lead the team, gain credibility – competency 1 – influence;
>
> The ability to change people's behavior and motivate them for achieving the result – competency 2 – motivation;
>
> The ability to make managerial decisions and take responsibility for their consequences and results – competency 3 – organization and decision-making.

If we attribute each of the leadership skills to the groups of soft skills, "influence" refers to communication skills, "motivation" can be considered part of self-management skills, "organization and decision-making" is part of the effective thinking skills, and leadership itself as a skill relates to the skills of foresight management. The model of the skill of leadership adopted in the present study is demonstrated in Figure 2.

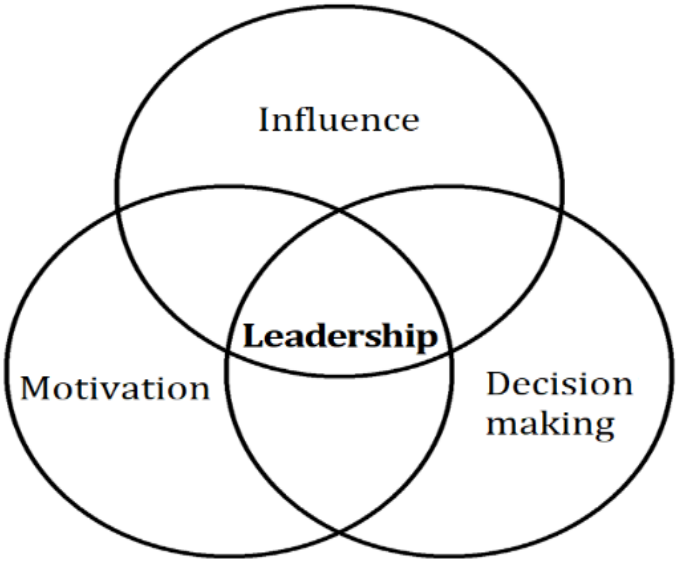

Figure 2. The leadership skill.

The empirical portion of the study was conducted with students of the Moscow Polytechnic University as a part of the academic discipline "Project activity". The present

study reports the results obtained in two years of research (the 2020-2021 academic year and the 2019-2020 academic year), the study continues at the present moment. The age of the study participants ranges from 17 to 20 years old. T

he study deployed the classic scientific research method used in psychology, economics, and sociology – the method of observation and analysis of observation results to identify behavior patterns, both stable and newly developed, that serve as indicators of the formation or development of a competency, as well as a factor of the manifestation of individual characteristics. In addition, the present study uses the survey method to collect information for the analysis of group process effectiveness. The object of observation and analysis is the social behavior and the elements (patterns) of social interpersonal interaction of team (project group) leaders with their teams in the process of working on an academic project. The study involves the analysis of group interaction in 25 teams and the leadership styles of 25 team leaders.

The manifestations of leadership as a social phenomenon and a social role are shaped by the individual characteristics of the person performing this role, as well as their repertoire of social skills in interpersonal interaction, their social culture, mentality, knowledge, personal values, etc. The conducted study demonstrates that the implementation of team leadership by students in the "Project activity" discipline is carried out through three basic styles of interaction between the leader and the team:

Style 1 – (referred to as the constructive style in this study) after the procedure of self-nomination and the formation of the team, the leader manages all major processes of team building and project work:

1. distributes the social roles in the team, determines the competencies, and outlines the area of responsibility within the role,
2. monitors compliance with the time limits (deadlines) for task completion,
3. actively shows personal involvement in the work process and interest in achieving the best possible result,
4. provides constructive assistance in problem situations both in interpersonal relations between team members (conflicts) and difficulties in the development of a project solution (the lack of information necessary for decision making, the lack of statistical data for the substantiation of the project solution, etc.),
5. consistently shows personal initiative and proposes creative solutions to the project objectives while trying to involve ass team members into the discussion to constructively assess the positive and negative consequences of the decisions,
6. delegates authority if realizes that another team member has the deeper knowledge and skills needed to cope with the task at hand.

Style 2 – (referred to as the laissez-faire style in this study) after the procedure of self-nomination and the formation of the team, the leader behaves in an aloof manner, not showing proper interest in team tasks, not demonstrating initiative, and not supporting initiative when it is demonstrated by another team member. The laissez-faire leadership style manifests itself in the following ways:

1. role distribution and the zones of responsibility in the team are established situationally and can change several times in the course of work on the project,
2. time limits are observed under the pressure of academic regulations and the danger of losing leadership,
3. personal involvement is demonstrated occasionally and is often accompanied by calls for the activation of teamwork,
4. creative and personal initiative is supported by this leader since it often substituted delegating and the development of project solutions,
5. "spontaneous delegation" is allowed. In this article, we understand "spontaneous delegation" as the ability of a team member to "take over" the execution of some leadership powers on their own initiative, which is not objected to by the leader, thus, this leadership style is called laissez-faire.

Style 3 – (referred to as the destructive style, or destructive leadership, in this study) after the procedure of self-nomination and the formation of the team, the leader demonstrates high personal initiative in resolving the project objectives believing themselves to be the only one capable of suggesting and generating anything. The coordination of teamwork is selective and is shaped either by personal interests, or the motive of preserving the functions that support the leader's power (leadership authority). This style does not provide for the manifestation of creative thinking and personal initiative, therefore, we consider it to be destructive. The destructive style manifests itself through the following patterns of interpersonal interaction:

1. The distribution of roles in the team is carried out compulsorily, the opinion and wishes of the performer of the role are not taken into account.
2. The zones of responsibility are blurred, and the leader can both expand and narrow them down at their own discretion.

3. The leader shows manipulative behavior, often provoking conflicts in the team to achieve their own goal and maintain their authority,
4. The leader attributes all major achievements to themselves, being unwilling to share the success with their team.
5. Time constraints are used not to motivate and support the team spirit, but to intimidate each particular team member.

The comparative analysis of the leadership styles is presented in Table 1.

Table 1. Comparative analysis of leadership styles.

Teamwork processes	Constructive style	Laissez-faire style	Destructive style
Group dynamics management	Occurs on an ongoing basis and is aimed at achieving the results	Is situational, aimed at solving the current problems, and does not always account for the impact on the result	Management is often manipulative and the interests of the team are not always observed
Decision-making	There is a group discussion of all possible solution options based on which the most effective decision is identified	The decisions are made spontaneously depending on the situation, alternative solutions are rarely proposed	Solution options are mostly proposed by the leader since the team members are passive, being afraid of criticism.
Attitude to creative initiative	Creative initiative on the part of team members is supported by the leader but is subject to analysis, evaluation, and improvement	The creative initiative is viewed as an opportunity to achieve the result without any special effort on the part of the leader and other team members	The creative initiative is subject to the leader's criticism which is often unjustified. Unconventional solutions are devalued and discarded
Building team spirit	The leader ensures the cohesion of teamwork aimed at an effective result which contributes to team spirit through the formation of trust, mutual assistance, and respect.	The formation of team spirit is situational and cannot serve as an element of motivation for effective teamwork due to being unstable.	Since most group processes are ordered, team spirit does not develop. Team members feel "held hostage" by the situation and look forward to finishing the project.
Teamwork result	The result is typically quite relevant, effective, and contains the elements of a creative solution.	The result typically comprises numerous disordered creative ideas that are not fully developed and, therefore, lack justification for use in solving problems, which leads to a negative result of teamwork	The result nearly always lacks novelty and creativity but does involve a justified analysis of possible solutions for the set tasks.
Management methods	Democratic, often preventative	Situational, emotional	Predominantly dispositive
Personal effectiveness of the leader	Development of the skills of interpersonal communication, critical and strategic thinking, and self-management, self-actualization, the development of foresight-management skills.	The development of self-management skills, awareness of the need for mastery of technologies for building interpersonal group interaction, self-actualization	Self-actualization, the development of self-management skills, and critical and strategic thinking
The effectiveness of team members	Self-actualization through teamwork, awareness of the importance of coordinated teamwork and its impact on the result, the recognition of each team member's right to have individual characteristics, the possibility of team creativity.	Self-actualization through teamwork, awareness of the importance of coordinated teamwork and its impact on the result, the recognition of each team member's right to have individual characteristics, awareness of the role of a constructive leader	Self-actualization through teamwork, awareness of the importance of coordinated teamwork and its impact on the result, the recognition of each team member's right to have individual characteristics, awareness of the effect of leadership style on teamwork effectiveness.

RESULTS AND DISCUSSION

The requirements for young engineers are changing in accordance with scientific and technological progress in the field of information technologies, as well as the possibilities for their implementation in socially significant processes, which expands the range of requirements for the competence of young specialists. The development of the skill of leadership, which refers to soft skills, can significantly improve the competitiveness of a young engineer in the labor market, as it contributes to the development of such skills as:

- the ability to work in a team showing tolerance and empathy for a person's individual characteristics (national, religious, cultural, and gender identity, way of thinking, etc.), which is a strategic skill in the modern mobile world community;

- the ability to take initiative "in one's own hands", thus managing and motivating work-related team interactions in the direction necessary for the goal result;

- the ability to shape and manage the socio-psychological characteristics of interpersonal communication processes to improve the effectiveness of the result of group (team) collaboration;

- the skills of competent delegation of authority and distribution of roles and responsibilities in the team accounting for the individual professional capabilities of team members and the time constraints of achieving the desired result.

The analysis of the study results reveals that at the time of the study, nine out of twenty team leaders demonstrated the constructive leadership style, six out of twenty showed the destructive style, and five leaders had the laissez-faire style. However, in the course of the development of the leadership competency, the demonstrated leadership style showed change, as well.

With time, the initially constructive leaders showed increased decisiveness in making creative decisions, experimented with creative team initiative, explored unconventional solutions involving risk, encouraged the team to look for innovative solutions, etc. The survey shows that all of these leaders are happy with the obtained experience. They report being more fond of the process of team interaction, the search for new things, and the opportunity for self-actualization compared to the very fact of having power. The personal experience of leadership serves for them as an opportunity to assess their potential and personal effectiveness and identify their strengths and weaknesses for further professional and personal growth.

In analyzing their experience, the leaders demonstrating the laissez-faire style typically assess it as flawed (three out of five respondents). Some of them say that they were unlucky with the team (two out of five people). The leaders in this group who demonstrated critical thinking, analyzing and realizing the lack of development in their leadership skills (three out of five people), changed their style of interaction in the team during the experiment, switching to the destructive style and taking the manifestations of initiative and the flow of group processes under their rigid control. As a result, the efficiency of the team decreased, but the effectiveness of the teamwork results rose due to the focus on the result and more detailed processing of the decisions being made.

The leaders with the destructive style have divided into two groups in terms of the analysis of their leadership experience:

- the leaders who have come to realize the ineffectiveness of their team management in terms of managing initiative and the opportunities of team members' creative self-realization, as well as the lack of team cohesion and focus on achieving the effective team result. These leaders admit that the lack of experience in leadership and team process management led them to fear the team members' recognition of their incompetence which they tried to compensate for through the elements of authoritative management. However, as soon as they gained an understanding of the specifics of group interaction and confidence in their abilities (the development of the leadership skill), the leaders of this group started to show the elements of the constructive style in managing teamwork, which led to increased teamwork effectiveness and improved creativity of the solutions;

- the leaders who, analyzing their interaction with the team, consider their own behavior expedient and view the power of authority implemented through subordination and coercion as the main instrument in team interaction.

Summarizing the analysis of the formation and development of the skill and style of leadership in the training teams, we can conclude that the development proceeds starting from a laissez-faire style through the destructive style and to the constructive style of leadership (Figure 3).

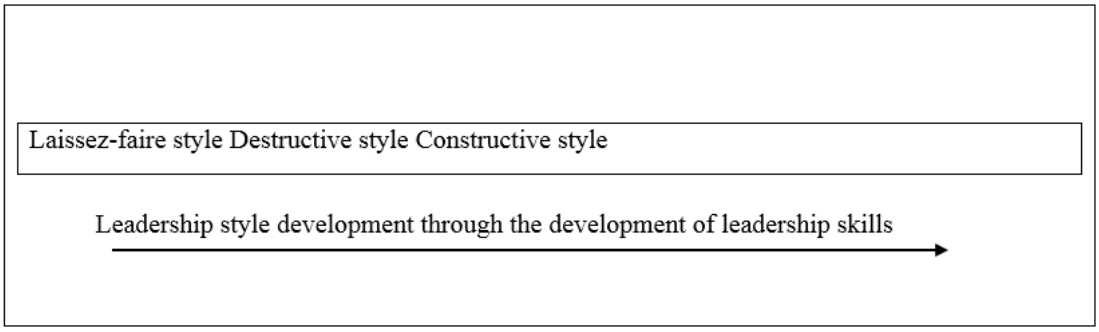

Figure 3. The analysis of the formation and development of the skill and style of leadership in the training teams.

From the point of the requirements for professional and personal development of an individual as a socially active person, the development of soft skills should be considered as a component of the personal behavioral motivation of each individual implemented through professional activity. Modern professional education focuses on the awareness and actualization of this motive, as well as its effective realization in the process of obtaining the necessary professional competencies and knowledge that can ensure competitiveness in the labor market and provide the opportunity for successful self-actualization and career advancement. The development of leadership (leadership skills) as a professional skill in the structure of engineering specialists' skills, knowledge, and competencies can be viewed as one of the key meaning-forming motives and skills in the professional activity of an engineer since it provides for the following professionally significant behavior patterns demonstrated by the study participants:

- the ability to work in a team, be an effective team member, show initiative, effectively manage the teamwork processes, be tolerant, the ability to critically assess the developed decisions – most innovative engineering ideas emerge as a result of collaborative creative work, transforming the idea into a competitive innovative solution requires teamwork, as well, and the success, promotion, and realization of the solution first as a project and then as a competitive market product calls for the collaborative effort, too;

- in the process of accepting innovative engineering solutions for realization, evaluating its possible long-term consequences, both positive and negative effects not only on the effectiveness of the implementation of engineering technologies but also the socio-economic development, the resolution of the current ecological problems, considering the technogenic effect on the global climate change, etc. (Sekerin, et al., 2014; Dudin, et al., 2016).

- showing social responsibility in the development and realization of new engineering solutions which serves as the main measure for the prevention of technogenic disasters, as well as the basis for creating new technologies that would meet the current needs of humanity without causing damage to the environment.

CONCLUSIONS

The importance of the development of major soft skills is largely due to the competitiveness of a young specialist and the demand for them in the labor market and, therefore, predetermines their potential career trajectory which supports the need for the development of soft skills in young engineering specialists. Moreover, the results of the present study demonstrate that soft skills development serves as motivation for professional growth, self-development, and more effective professional self-actualization which, in turn, entails increased personal effectiveness of a specialist and greater awareness of the social importance of the results of their work for the public good.

The development of soft skills competencies, particularly the competency of leadership, in engineering education allows improving specialists' competitiveness by means of a more effective adaptation to the changing requirements of the labor market and the mobility of the obtained professional competencies that are in demand.

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