On professional and pedagogical competence development of technical university teaching staff

Rais Safin\textsuperscript{1} (0000-0003-1864-7876), Evgeny Korchagin\textsuperscript{1} (0000-0003-0549-9739), Ilfak Vildanov\textsuperscript{1} (0000-0003-1902-1621) and Runar Abitov\textsuperscript{1} (0000-0003-4219-9815)

\textsuperscript{1}Kazan State University of Architecture and Engineering, Kazan, Russia
E-mail: safin_15_418@mail.ru

Abstract. The fundamental task of engineering education lies in interdisciplinary integration of content and teaching methods through the development of multimedia and virtual technologies. This leads to new demands on the professional knowledge, abilities, skills, and qualities of a teaching staff member. The main objective is to test the effectiveness of methods of formation and development of professional and pedagogical competence. The main results of the research allow identifying methods of development of professional and pedagogical competence (collaborative, personalized; training, consultations) and evaluation criteria, characterizing a public recognition of the scientific and educational activity of teachers. These methods allow developing a program for the training of faculty members, including participation in the scientific and teaching activity, organization of personal exhibitions, the development of individual projects to optimize higher education. The criteria identified allow to include characteristics of actual and potential activities of a teacher.

Keywords: faculty, technical university, civil engineering education, professional education, competence, personal traits.

1 Introduction

The construction industry maintains a leading position in the economy. This is due to highly qualified personnel trained at technical universities [1-20]. This leads to new requirements for professional and pedagogical competence of university teaching staff members, both in knowledge and teaching experience, to ensure optimal structuring of scientific knowledge to solve actual problems [2]. Faculty is the carrier of scientific knowledge and special types of activities, as well as the teaching art of the formation of the readiness of students to solving professional problems. It is known that the efficiency of professional and pedagogical activity of a teacher increases, providing possessing the awareness of their motives for this activity, an adequate assessment of their personal qualities, a sustainable focus on professional-determination and self-improvement.

The object of study represents the process of formation and development of the professional and pedagogical competence of a university teaching staff member. In the structure of professional and pedagogic competence, several components may be identified: 1) a special component that includes knowledge, skills, the qualities required to give a course [3]; 2) methodological component, containing knowledge, abilities, skills, and qualities required for the effective training of students [4]; 3) sociology-psychological component, including knowledge, skills, and qualities required for communication, motivation [5]; 4) auto-psychological component, providing the knowledge, abilities, skills, and qualities required for self-diagnosis and self-improvement [6].

The methods of formation and development of professional and pedagogical competence of the teacher consist of three groups. First, it is the collaborative methods, including participation in scientific and scientific-methodological activities: scientific-practical conferences, forums, contests, webinars, refresher courses, lessons, discussions video recordings of activities [7]. Secondly,
personalized methods, combining personal exhibitions, a publication of research results in peer-reviewed journals, scientific publications, self-education [8]. Thirdly, training and consulting [9]. The objective of the research is to check the efficient methods of the formation and development of professional and pedagogical competence of a faculty member at a technical university.

2 Methods

The leading approach of the study is competence, allowing to consider professional and pedagogical competence of faculty member as an integrative quality of personality, influencing professional self-determination and self-improvement, position compliance competitiveness on the labor market, and providing stable positive results in the education of students. During the study the following methods were used: theoretical (analysis, synthesis, generalization, systematization); sociological (observation, interviews, questionnaires).

Experimental verification of the effectiveness of the methods of formation and development of professional-pedagogical competence of the faculty was carried out from 2018 to 2020. 200 teachers and 300 students of Kazan State University of Architecture and Engineering participated in the experiment. Samples of teachers and students were formed. The sample consisted of: teachers including professors (average age - 53) and associate professors (average age - 46) who conduct training classes on major subjects, with students of "Civil engineering" major. The sample of students consisted of senior students of the "Civil engineering" major.

Experimental verification of the effectiveness of the formation and development of the method of professional and pedagogical competence of the teacher was carried out in three stages (initial, formative, final). On the initial stage, with the help of questionnaires, students’ opinions about professionally significant qualities of the personality of the teacher were revealed. The main qualities of the personality of the teaching staff member are sensitivity, attentiveness, reasonable demands, responsibility, objectivity in relationships and assessments, clear diction, erudition, and respect for students. Taking into account the views of students, a program was developed to verify the effectiveness of the methods of formation and development of the professional-pedagogical competence of the teacher.

In the formative stage, the program was implemented. To test the effectiveness of collaborative approaches by the scientific conference "Innovative methods in construction education", educational forum "The introduction of smart technologies into construction education: problems and solutions" webinar "Features of management of the educational process in a modern University" were conducted. Refresher course on "Technologies of creativity of a teacher." were organized. To test the effectiveness of personalized methods personal exhibition results of scientific achievements of teachers were organized. To test the effectiveness of training on "Communication with students: risks and best practices" online consultations were conducted.

On the control point, using the survey, the evaluation criteria and levels of professional and pedagogical competence were clarified. The following criteria and their indicators were found: 1) the criterion of public recognition – academic degree, academic title, honors, membership in international and specialized academies; 2) the scientific criterion – number of publications, the value of the Hirsch-index, number of patents, number of grants received; 3) teaching criterion – the number of publications of educational-methodological work, participation in competitions. Under these criteria and indicators, high, medium and low levels of development of professional-pedagogical competence were revealed. The high level corresponds to the type of teachers, which is characterized by a high degree of creativity, independence. The middle level includes teachers that are characterized by the active orientation on business performance, but weak focus on creativity and independence. The low level represents the unmotivated teaching staff. They are the most satisfied with their profession, despite the low performance.

3 Results and Discussion
At the present stage of development of civil engineering education, the role of the professional and pedagogical competence of the teacher is becoming increasingly important. In the scientific literature professional and pedagogical competence of teaching is considered as a pedagogical skill. Pedagogical skill includes 1) integration of personal characteristics and professional-important regulations in the individual psychological activities [10,11]; 2) higher level of teaching activity [12,13]; 3) synthesis of scientific knowledge, skills, and abilities of methodical art and personal qualities of the teacher [14,15]; 4) the complex of personal qualities providing a high level of self-organization of professional activity [16]. The results of the study allow us to consider professional and pedagogical competencies as a system of professionally significant knowledge, skills, and qualities of the person.

Features of the professional and pedagogical competence development of the teacher are as follows. First, the integration of collaborative and personalized methods, training and consultations to develop a program of teachers’ training, including participation in scientific and teaching activity, organization of personal exhibitions, the development of author’s projects on optimization of construction education. Secondly, the evaluation criteria for the development of professional and pedagogical competence reflects public recognition, research, the activities of the teachers. Thirdly, the identification of levels of development of professional-pedagogical competence (high, medium, low) will set the relationship among the components of professional-pedagogical competence and methods of their development (table 1).

| Components of professional and pedagogical competence | The content of components of professional and pedagogical competence | Methods of formation and development of professional-pedagogical competence |
|------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------------------------------|
| Special                                              | Knowledge: scientific knowledge of the fundamental laws of nature, society and human activities; subject knowledge; Skills: designing skills the acquisition of new knowledge from various information sources; ability to search for fundamentally new approaches to the solution of problems | Personality: commitment, determination, creativity, independence, honesty, social activity | collective methods (scientific-practical conferences, forums, a publication of research results, personal exhibition, webinars refresher courses) |
| Methodical                                           | Knowledge of didactics and methodology of teaching; Skills: apply existing knowledge to establish pedagogically appropriate relationships; the desire to resolve the pedagogical tasks | Responsibility: tolerance, demands, optimism, empathy, observation, organization | team-based methods (scientific-practical conferences, forums, contests, webinars, refresher courses, scientific-methodological publications of lessons discussion of video lessons) |
| Socio-psychological                                  | Knowledge of the methods of communicative behavior; Skills: discussion, ability to take responsibility, to cooperate | Good communication skills, readiness to cooperation, tolerance | personalized methods (solo exhibition, self) |
| Auto-psychological                                   | Knowledge of how to practice self-improvement; Skills: manage their behavior; the ability to reflect | Self-criticism, the desire for self-realization | Training consultations |

Table 1 indicates that methods of formation and development of the professional and pedagogical competence of a teacher are interrelated. Correlation techniques allow allocating the essence of professional-pedagogical competence both objectively and subjectively. The objective aspect consists
of the successful solution of pedagogical tasks. The subjective aspect reflects the personal qualities of the teacher.

4 Conclusions
Identified methods (collective, personalized, training and consultations) are effective for the formation and development of professional and pedagogical competence of a technical University teacher. It is established that the effectiveness of collaborative approaches increases with the intensification of motives in research activities and development of creative and intellectual abilities. The effectiveness of personalized methods increases with the activation of cognitive processes and the development of pedagogical thinking. The effectiveness of training and consultations increases with the activation of emotional and volitional processes (goal setting, decision making, conflict of motives), and development of the capacity for self-regulation.

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