



Modern Challenges of Higher Technical Education Teachers Working with Engineer Specialty Students

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Abstract. The goal of a modern system of technical education is to prepare new-generation engineers capable of working under severe circumstances, such as uncertain future risks and dangers. These engineers should be in charge of designing higher-order technologies which also consider human values and ethical norms. Achieving such ambitious goal should be ensured by sophisticated teaching department, that are open to organize more innovative programs, to form professional environment for future engineers and organize different formats of interaction throughout classes. The aim of article is to revision modern teacher's competencies and preparedness for providing new class activities under condition of innovative changes. Novelty of research is based on development of ideas about activity approaches with the recognition of specific features of technical education teacher's activities that works with young engineers. The practical significance lies in the possibility of using the article data for conducting further research; studying the difficulties faced by teachers; forming new educational resources for lecturing students.

Keywords: higher education, technical higher education, technical university, future engineers, university teacher, pedagogical activity, professional competencies, professional activity, innovational changes, activity-based approach, readiness of teacher.

Introduction

The development vector of world economy is directed to the formation of sixth technological tenor that is connected with the new wave of engineering innovations. In conditions of globalization, ubiquitous

increase in information technologies, elements of «smart grid», transformation of industries at digital economy, the feature and profile of engineering's professional activity undergo changes, that is being multifunctional which requires the development of

synergetic thinking with displacement of accent at scientifically intense processes.

More and more modern researchers tend to believe that an important role in professional activity of an engineer is played by his attitude to the results of activity, developed technical thinking, which is formed in the process at professional training, which allows seeing the problem from different sides and suggesting different ways of its solution, and which can also become the basis for professional competence formation.

There are significant changes in the professional activity of an engineer, which form serious engineering-technical «challenges» to the existing systems.

The role of an engineer in modern society is being reevaluated, his professional activity is becoming more and more complicated; the share of multidisciplinary and interdisciplinary research in technical sciences is increasing. Therefore, the demands of the labor market and employers for technical specialists, who should be responsible, competent, with a high level of professionalism, are changing.

The defined tendencies force to have a new look at higher technical education and preparation of engineering staff as a whole. Technical education today goes from explicit «academical» and develop educational programs to specific needs of economy and its high-technological segment, improve new formats of interaction with industry and business community, which form an order for new engineering specialists [1].

In conditions of increasing the difficulty level and complexity of engineering-based problems, the technical education has to provide the preparation of specialists for predicting and preventing such issues which society will face in the future.

The article actualizes the problem which leads to find answer on what the teacher of higher education should be like? It is important to understand, which requirements are being presented to teacher activity and how they can be prepared to achieve the order for competent and highly qualified engineering staff.

The aim of the article is to reveal the degree of readiness of teachers to organize own activity and activity of students that are necessary in preparing qualified engineering staff.

Materials and methods

To conduct the research, several methods were used: 1) theoretical analysis of publication which is dedicated to changes at engineering sphere; 2) the frequency-structure analysis of professional-pedagogical activity, that enables to define its essential characteristics; 3) content-analysis of normative documents, that are directed to define requirements to higher education teacher activity that are working with engineering students; 4) focus group method that gave an opportunity to find the readiness of teachers in preparation of engineering staff of new generation.

The article uses materials of foresight predictions of development of engineering sphere and technical education [2, 3], scientific publications, regulatory policies [4], results of teacher and students survey [5, 6, 7, 8].

Focus group research was conducted at Karaganda Technical University. 24 teachers were invited to the focus group sessions. Each focus group included 6-8 participants with different working experiences as technical education teachers that enabled to organize productive discussion of questions that are concerning the changes at engineering sphere and technical tasks, that are faced by teacher in conditions of innovative changes, the responsibility of teachers for a result of their activity, the readiness of teachers to prepare engineering staff of future generation.

Results and discussion

By presenting results of conducted research, we divided them into 2 groups. The first group was formulated based on the use of theoretical methods, theoretical analysis of scientific articles and frequency structured analysis, as well as content analysis of documents.

The transformation of engineering sphere, that is caused by the transition of society to higher educational tenor, was noted by several changes:

- The development of engineering innovation at the sphere of bio and nanotechnologies, genetic engineering, quantum technologies, micro-electromechanics, zero carbon energy and industrial ecology;
- The appearance of digital economy tools, sharing economies and new social technologies;
- Customizing and digitalizing industrial process;
- The need to form new generation specialists with innovative thinking approach and as a result by strengthening the professional ethos of modern engineer.

Based on that, the professional activity of engineer is changes, which is expressed in increasing commercialization of activity products on one side and strengthening of responsibility on results from the other. It leads to formation of new social order in preparation of highly qualified specialists of technical profile, that can work in conditions of indefinite future, technical risks and dangers, construct technologies of higher order in consideration with human values and ethical norms. (I.D. Belonovskaya, L.V. Kansuzyan, S.I. Gerasimov, N.V. Pogukaeva, I.I. Galimzyanova and etc.).

Technical education reacts to new challenges sharply and in regard to that, there are innovation processes at technical education, like:

- 1) Infrastructure of university is changing to integrated innovations platform, that includes business incubators, technoparks and technovalleys, scientifically intense startups, industries, laboratories of applied sciences, centers of evaluating competencies for future engineering specialists. Technical university provides the collaboration of industry

and business with universities (L.D. Githelman, T.B. Gavrilov). Nowadays it is a technological platform, where active knowledge and technology transfer is being conducted. There are new intellectual products, that contribute to develop of countries' economy (V.I. Stymkovskiy, D.A. Voloshin, M.V. Kozhevnikov, O.B. Rizhuk and etc.).

2) The modern architecture of educational process provides the opportunity to organize different models of preparation and re-preparation of engineering staff, like corporative, «on workplace» and dual (J. Mayster, T. Schultz, S. Satback, M.O. Surayev, L.D. Githelman).

3) New forms of technical education subject developing, which leads to complicated teacher activity (D.V. Manturov, S.B. Shitov, G.D. Horoshavin, N.R. Tayvonen, B.R. Clark, E.Yu. Firsova).

The basic tendency in development of modern technical education is outlined by creating the innovational oriented infrastructure for sustainable production of qualifies and competent engineering-technical and scientific-technical staff, as well as elite specialists.

The activity of higher technical education teacher differs by its bio-professional feature which is shown at table 1.

From the professional point of view, the teacher of non-technical education and the teacher of technical education are completing similar functions, but the content can differ.

Traditional functions of teacher at higher education now are changing towards creative, managerial, entrepreneurial, constructive-projective and that are directed to evaluate opportunities and resources of inner and outer environment of university in solving specific practice-oriented tasks in preparation of future engineers [9, 10].

At works of Y.V. Gathen, T.I. Kornilova, L.N. Makarova, T.M. Tkacheva it was noted that modern teacher of technical education is not only moderator, mediator, communicator, organizer of educational relations, but also a specialist at technical engineering and educational engineering spheres. Nowadays,

it is impossible to step back from the necessity to know engineering technical specifics in university preparation, while teaching social and humanities sciences, and vice versa to step back from necessity to know pedagogical innovation in organizing the educational process, while teaching the engineering module disciplines. At the activity of teacher, it is new era of integration at engineering and pedagogical knowledge, and it is the only path to increase the quality of new engineers preparation.

It is important to note that the structure of teacher activity is being more and more complicated. The frequency structure analysis of professional-pedagogical activity (S.M. Markova, M.G. Minin, G.M. Romancev, Z.S. Sazonov, T.M. Tkacheva, L.F. Krasinskaya, V.M. Prihodko) lead us to the conclusion that this activity is a continuous process of making decisions for professional-pedagogical and engineering-technical task, that are directed to organizing diverse practical oriented situations that enable to gain an experience for future engineers at implementing the gathered norms, examples and rules of professional ethics.

The difference of higher technical education teacher activity is in its context that is expressed by specific features of completed tasks.

1) Adding into the productive team interactions (with colleagues, business-partners, customer) to develop education programs that are required to the society of new technological tenor.

2) Projecting the content of own discipline on the language of competencies in consideration with innovative changes at engineering and pedagogy spheres.

3) The ability to adequately evaluate the level of own professional conformity and to choose the necessary programs on improving the qualification and professional re-preparation to develop pedagogical directions of own sphere (teacher, who does not have pedagogical education) or professional-oriented direction (teacher, who does not have technical degree).

4) Mastering the new type of competencies

Table 1 – The comparative characteristics of professional and pedagogical activity of teacher at higher technical education and non-technical university

Parameter	The content of professional-pedagogical activity of teacher at higher technical education	The content of professional-pedagogical activity of teacher at higher non-technical education
Activity object	Students	Students
Activity result	Technical education specialists	Non-technical education specialists
Activity tool	Pedagogical and info-communicational technologies. Engineering-technological informational contribution.	Pedagogical and info-communicational technologies
Activity functions	Managerial, directional, tutor-based, entrepreneurial, engineering-based	Managerial, directional, tutor-based, entrepreneurial
Activity subject	The personality, who has professional knowledge, skills and abilities (academical and engineering)	The personality, who has professional knowledge, skills and abilities

(scientifically-research based, managerial, entrepreneurial) to form products of professional-pedagogical activity and develop innovational mobility.

According to the content analysis of documents (especially educational standards in the sphere of technical education and professional standards at pedagogical activity), it is important to note that in conditions of rapid technological development of engineering sphere, the role of teacher undergoes changes, that can transform into the resource for knowledge as an organizer of educational relations.

In accordance with new standards of professional activity, the teacher should be able to organize educational environment in the way it would be possible to achieve goals of technical education and receive the necessary result, that could help at next stages of education and would be helpful at future engineering carrier. Continuity of education is directed towards mastering the structure of teaching course by students, its intradisciplinary feature, that is supposed to be in cooperation of different scientific sphere of knowledge and its studies. The practice-oriented approach at education creates conditions to form and develop professional competencies of future engineer, who can easily compete at the labor market and create export-oriented product. By this way, the teacher of technical education requires the portfolio of competencies that characterizes it as a specialist at engineering-technical and engineering-pedagogical sphere of activity.

The modern teach of higher technical education is the person who is distinguishable by «innovative mentality» (P.F. Kubrushko, L.I. Nazarova); by being flexible and adaptive at the environment of technologies transfer, as well who can solve tasks of educational and behavioral feature.

Innovative thinking is a creative process of using original ideas or methods to solve new tasks that has not been by teacher yet. (For example, applying for scholarship, registration of a patent, new approach to construct educational materials) [11].

The teacher today is required to not only develop and digitalize educational resources at high quality, provide the informational support and accompany students, but also to be able to form results of intellectual activity at the point of scientific publications, projects, grants, patents.

The readiness of teacher of higher technical education to innovations at the work with engineering students can be viewed as a combination of features of teacher, that are defined by his directions to develop at own activity and activity of whole faculty, as well as his ability to elicit actual problems of technical education, find and realize its effective approaches at solving tasks.

The process of development of this readiness consists in preliminary analysis of own practice, self-analysis of strengths and weaknesses, introducing with engineering innovations, re-thinking basic principles of innovative activity; analyzing colleagues' experience, that are successfully working with future

engineers, increasing qualification or presenting projects at integrating innovations to professional-pedagogical community [12].

The second group of research results that is presented in this article, was taken with the help of focus group method, that enabled to analyze the readiness of university teachers to preparation of engineering staff of new generation.

Here, we will describe our conclusions. Teachers do not always understand value orientations of their own professional-pedagogical activity; they not the lack of knowledge and skill, that are required to sustain the professional status; point on low innovational competency at organizing the educational process; they are worried on the fact that they can not timely rebuild own professional-pedagogical activity in line with the challenges of the time.

In addition, data from focus groups showed the distrust of teachers to innovations; unreadiness of the overwhelming majority of participants to receiving new competencies, like managerial, project-based and entrepreneurial; unwillingness of few teachers to orient on higher results of their pedagogical work; inability to overcome psychological, value-oriented and mental limits.

The collected empirical material gives a basis to assert that their deficits which are specific for professional-pedagogical activity of teachers at higher education (Table 2).

The outlined at table deficits lead to improper supervising of students, lack of confidence at new approaches to education, unconsciousness of having psychological and mental barriers at own activity in conditions of innovative changes.

However, teachers acknowledge the necessity in realizing innovative activity and having continuous creative search, projecting ways at professional rise, teaching himself expert skills at organizing innovations, risk analysis and effects of integrating provided pedagogical innovations.

Conclusion

As a condition to development of readiness of teacher at higher education to organizing innovative changes, we can note several:

1) Including teacher (especially humanities faculty members) to engineering-pedagogical community of technical education, that contributes to their integration into engineering values, understanding of its features, and realizing the role of their own discipline at professional competency of student.

2) The encouragement of teachers at organizing pedagogical innovations, that can provide the development of pedagogical directions of their personality.

3) Stimulating research and grant activities of teachers.

4) Providing to teachers' real professional-oriented tasks.

By this way, the modern teacher of higher

Table 2 – Deficits of professional-pedagogical activity of teacher at higher technical educations and ways to overcome them

Deficits of professional-pedagogical activity of teacher at higher technical educations	Ways to overcome them
<ol style="list-style-type: none"> 1. The lack of knowledge at psychological, pedagogical, social spheres to support competency at professional-pedagogical activity. 2. The lack of interest to activity and experience of other colleagues. 3. Unreadiness to eliminate deficit at the development of professional competencies. 4. Inability to overcome psychological, value-oriented, mental limits. 5. Inability to create proper conditions for organizing practice-oriented education. 6. The necessity in skills of planning and predicting of own professional-pedagogical activity at orientation on requirements of professional standards and qualified characteristics. 7. The acknowledgement of the necessity to change the system of preparation for engineering staff, but not unconsciousness of mechanisms of these processes. 8. The lack of implementation ways for new technologies and methods of professional education: digital education, mixed education, coaching, trainings. 9. At most of cases the loss of authority of higher generation as an experience holder, the lack of mentoring institute. 10. The lack of managerial and scientific-research knowledge and skills to form results of intellectual activity. 11. Not always responsible approach to own direct responsibilities. 	<ol style="list-style-type: none"> 1. The development of professional module for the qualification improvement course dedicated to teachers of higher technical education, that prepared to do the professional-pedagogical activity in conditions of innovative changes 2. Organizing university, faculty or department sessions, which is aimed to inform teachers about innovations at engineering sphere and pedagogy: <ul style="list-style-type: none"> - New technological tenor of society and engineering innovations; - Innovative educational technologies (online education, coaching, trainings) at the system of higher professional education; - Practice-oriented education at professional clusters, consortiums and communities; - Competent approach to project teaching disciplines or technical university teachers. 3. Conducting teaching trainings on self-organizing and self-management at conditions of innovative changes at university. 4. Psychological and mentor support of beginning teachers through conversations, finding problems, difficulties, engagement into work and projects of more successful teachers. 5. Self-motivation to professional development and releasing inner barriers by teacher himself: internship at other faculties of university or other universities; work with groups of stronger students; systematic visiting at classes of more experienced teachers; highlighting methodic days for self-education; choosing creative forms of methods and forms of organizing the interaction with students and colleagues.

technical education is required to have different multifunctional competencies, that can help to organize and realize own professional activity in conditions of innovative changes to teach engineers of new formation.

Nowadays, universities are concerned about the question of preparing teachers of higher education to work at new conditions and they actively practice different formats to organize courses of raising the qualification, master classes, trainings, coaching and internships, as well as intra-university seminars, that can contribute to communication between faculties of technical and humanities disciplines, their engagement at common projects and grants disciplines.

Analysis of domestic and foreign experience, methods of education organization for students at technical universities allowed us to create a modular training program for teachers to work in conditions of innovative changes. When developing and implementing the modular program, the following

factors were taken into account:

- correspondence of the program structure and content to the state requirements;
- assimilation of innovative teaching techniques;
- use of methods of collaborative activity and contextual learning;
- satisfaction of teachers' interests through the analysis and discussion of their own experience;
- taking into account the heterogeneous level of teachers' training for independent work.

The modular teacher training program consists of several stages: theoretical, design, practical.

At the theoretical stage of module development, it is planned to study and analyze the information block (lectures-discussions on the topics «Innovative changes in engineering industry», «Innovative changes in technical university teachers' activity», etc.).

At the design stage teachers can be offered individual and collective forms of work: round table format, master class, coaching, storytelling (story

about changes in professional and pedagogical activity, history of teaching, situation), etc.

At the practical stage it is planned to form patterns – samples of behavior which correlate with the competences: project, research, managerial; case studies on the results of professional development will be considered.

The analysis of the obtained data on the results of the module program implementation will allow to reveal the degree of readiness of teachers at technical universities to activity under conditions of innovative changes.

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Инновациялық өзгерістер шарттарындағы жоғары техникалық білім беру оқытушыларының жұмысын даярлау¹***ӘЗІМБАЕВА Жанат Амантаевна**, аға оқытушы, azimbayeva@yandex.ru,²**ДРОБОТЕНКО Юлия Борисовна**, п.ф.д., кафедра меңгерушісі, drobotenko@omgpi.ru,¹«Әбілқас Сағынов атындағы Қарағанды техникалық университеті» КеАҚ, Қазақстан, Қарағанды, Н. Назарбаев даңғылы, 56,²Омбы мемлекеттік педагогикалық университеті, Ресей, Омбы, Тухачевский жағалауы, 14,

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Аңдатпа. Жоғары оқу орындарының инженер салалары қоғам, өндіріс және үкіметпен қойылған талаптар техникалық білім берудің жаңа бағыттарын белгілейді. Заманауи техникалық университеттің басты міндеті – техникалық профильдегі мамандарды жаңа талаптарға сай болуын қамтамасыз ету, яғни белгілі болашақ қауіптерімен күресуді үйрету, қауіп қатерлерді болжап жұмыс істеуді дамыту. Инженер жұмысындағы үрдістері адами құндылықтарды ескере отырып, белгілі этикалық нормаларға сай болуы тиіс. Айтылған нәтиже тек оқытушылардың инновациялық бағытта дамып, сабақ үрдісіне жаңа бағдарламаларды енгізу арқылы қамтамасыз етуге болады. Ол студенттерге жаңа қоршаған ортамен қамтамасыз етіп, педагогикалық әрекеттестікті және компетенцияны дамытуға жол береді. Мақаланың мақсаты – оқытушылардың инновациялық өзгерістер кезіндегі өзінің жұмысы мен студент жұмысын ұйымдастыруға дайындығын бағалау. Зерттеудің ғылыми өзектілігі оқытушының жұмысын жаңа ойлармен байытуда белгіленеді. Зерттеу техникалық университет студенттерінің ерекшеліктерін ескере отырып, кәсіби психологиялық және педагогикалық, методикалық және дидактикалық тапсырмалар арқылы дамытуды түсіндіреді. Зерттеудің қолданыс аясы оның берілген ақпаратты болашақ зерттеулерде қолдану, оқытушылардың оқыту кезіндегі кедергілерін зерттеуге, және аталмыш біліктілік арттыру курстарын дамытуға мүмкіндік береді.

Кілт сөздер: техникалық жоғары білім беру, техникалық университет, болашақ инженерлер, оқытушы, мамандық компетенциялар, профессионалдық іс-шаралар, инновациялық өзгерістер, ісәрекеттік тәсілдеме, оқытушы дайындығы.

Современные компетенции преподавателя технического вуза в работе со студентами инженерных специальностей¹***АЗИМБАЕВА Жанат Амантаевна**, старший преподаватель, azimbayeva@yandex.ru,²**ДРОБОТЕНКО Юлия Борисовна**, д.п.н., зав. кафедрой, drobotenko@omgpi.ru,¹НАО «Карагандинский технический университет имени Абылкаса Сагинова», Казахстан, Караганда, пр. Н. Назарбаева, 56,²Омский государственный педагогический университет, Россия, Омск, набережная Тухачевского, 14,

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Аннотация. Задача современного технического вуза видится в подготовке высококвалифицированных специалистов инженерных специальностей, способных работать в условиях неопределенности будущего, технических рисков и опасностей; конструировать технологии высокого порядка с учетом общечеловеческих ценностей и этических норм. Успех решения данной задачи обеспечивается готовностью преподавателей технического вуза к реализации инновационных программ, которые отвечали бы требованиям общества нового технологического уклада; формированию профессионально-ориентированной среды обучения будущих инженеров и организации различных форматов взаимодействия; освоению новых компетенций: научно-исследовательских, менеджерских, управленческих, предпринимательских. Цель статьи – определить степень готовности преподавателей к организации своей профессиональной деятельности и деятельности студентов в условиях инновационных изменений. Научная новизна исследования заключается в обогащении идей деятельности подхода знанием о специфике деятельности преподавателей технического вуза, работающих со студентами инженерных специальностей; задач, которые они решают при организации образовательного процесса. Практическая значимость видится в возможности использования материалов статьи для проведения дальнейших исследований; изучении затруднений преподавателей технического вуза; разработке учебных материалов для слушателей курсов повышения квалификации.

Ключевые слова: высшее образование, техническое высшее образование, технический университет, будущие инженеры, преподаватель технического вуза, профессиональные компетенции, профессиональная деятельность, инновационные изменения, деятельностный подход, готовность преподавателя.

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