New standards of engineering training at Ufa State Petroleum Technological University

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Abstract. The article proposes a competency-based approach to the training of engineering specialists. It is revealed that at present, supra-professional skills are a priority. The authors identified five groups of trans-professional competencies and four groups of digital competencies. Within the framework of the educational policy of the Ufa State Petroleum Technical University under the program of the Ministry of Education and Science of Russia "Priority 2030" a system for assessing super-professional and digital competencies is developed. The peculiarity and uniqueness of the project lies in the development of a new system for assessing and assigning statuses in accordance with the new competency model for an advanced technology engineer. The combined assessment method is based on a combination of five effective methods for assessing super-professional skills. The article describes a pilot student rating based on the advanced technology engineer competency model carried out at the Faculty of Technology. The "golden standard of engineer" model was replicated within the framework of the Eurasian Polytechnic School of the University.

1 Introduction

Currently, industrial enterprises are paying attention to the predominance of super-professional skills among university engineering graduates. In this regard, the need arose for a methodological study of the competency-based approach in the training of engineering specialists in order to develop a model of the competencies of an advanced technology engineer at a university.

The content of various concepts that determine the set of combinations of competencies and skills of a graduate engineer is presented in Table 1.

Table 1. Analysis of concepts defining a set of combinations of competencies, skills of an engineering graduate.

Concept / author	Competencies and skills
CDIO: concept for improving engineering education [1]	1. Disciplinary knowledge and fundamentals (basic knowledge of mathematics and science; core knowledge of engineering fundamentals; advanced knowledge of engineering fundamentals, methods and tools).

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	2. Professional competencies and personal qualities (analytical reasoning and problem solving, experimentation, research and knowledge acquisition, systems thinking, position, thinking and cognition, ethics, justice and other types of responsibility). 3. Interpersonal skills: teamwork and communication (teamwork, communications, communication in foreign languages). 4. Planning, design, production and application of products (systems) in the context of the enterprise, society and the environment (social and environmental context, entrepreneurial and business context, planning, systems engineering and management, design, production, application, leadership in an engineering enterprise, engineering entrepreneurship)
P.G. Shchedrovitsky [2]	According to the division of labor system (SLT) according to P.G. Shchedrovitsky, an engineer must have special skills. P.G. Shchedrovitsky distinguishes the following types of engineers: sociotechnical engineer; system engineer; requirements engineer; architectural engineer; engineering manager; testing engineer; safety engineer; configuration control; data integrator. The engineering position map includes applied research, developer, technologist, systems engineer, technology arbiter.
N.A. Moiseeva, T.A. Polyakova [3]	They are quite mobile and quickly navigate the digital environment and understand how to use innovative technologies in their professional activities. Competencies: 1. Information and data: viewing, searching, filtering; grade; management, control. 2. Communication and cooperation: interaction; exchange, communication; cooperation; netiquette; digital identity management. 3. Digital content creation: development; integration and processing; copyrights and licenses; programming. 4. Security: technical means of information protection; personal data protection and confidentiality; health-saving technologies; environment protection. 5. Problem solving: solving technical problems; identification of needs and technological responses; creative use of digital technologies; identifying gaps in digital competencies
Oil and gas companies	Integrity and compliance with ethical standards. Respect for the interests of others. Constructive resolution of controversial issues based on common goals. Customer focus. Priority to customer satisfaction. Self-development; resourcefulness in finding solutions. Willingness to solve new problems. Encouraging innovation. Initiative. Intolerance for violations. Safe behavior. Ability to assess potential risks
T.A. Lipaeva [4]	List of key competencies of the digital economy: 1. Communication and cooperation in the digital environment. Competence presupposes the ability of a person in the digital environment to use various digital tools that allow him to achieve his goals in interaction with other people. 2. Self-development in conditions of uncertainty. Competence presupposes the ability of a person to set educational goals for emerging life problems, to select methods for solving and means of

	developing (including using digital means) other necessary competencies. 3. Creative thinking. Competence presupposes the ability of a person to generate new ideas for solving problems of the digital economy, to abstract from standard models: to rebuild existing methods of solving problems, to put forward alternative courses of action in order to develop new optimal algorithms. 4. Information and data management. Competence presupposes the ability of a person to search for the necessary sources of information and data, perceive, analyze, remember and transmit information using digital means, as well as using algorithms when working with data obtained from various sources in order to effectively use the information received to solve problems. 5. Critical thinking in the digital environment. Competence presupposes a person's ability to evaluate information, its reliability, and build logical conclusions based on incoming data. The digital economy and digital society present a voluminous, dynamically changing set of requirements for graduates of the vocational education system, on the basis of which two types of didactic goals (expected educational results) can be formed. At the same time, secondary vocational education is focused on achieving both types of goals
D.S. Konstantinova, M.M. Kudaeva [5]	Three groups of approaches to in-demand competencies in the modern world. Representatives of the first approach recognize the importance of only behavioral competencies. The second approach to the in-demand competencies of Industry 4.0 involves the presence of both behavioral and digital competencies. The third approach involves looking at digital skills. Digital competence is based on basic skills in the field of information and communication technologies (the use of computers to search, evaluate, present, store and exchange information, communicate via electronic means and the Internet). Digital competencies and their assessment in education: 1. Professional responsibilities of teachers in the context of the spread of digital technologies. 2. Digital resources. 3. Teaching and learning involve the teacher's ability to create, plan and implement digital technologies at various stages of learning. 4. Student assessment involves the use of digital tools to implement existing methods of assessing students and providing students with feedback and analysis of their activity in the digital environment. 5. Expanding the rights, opportunities and independence of students in the educational process. 6. Development of digital literacy of students
Data from the Ministry of Education of Russia [6]	The need for practical application of acquired knowledge. Ability to work in a team and manage projects. Management of remote teams. Knowledge of modern technologies. Creative thinking. Ability to react and adapt quickly in a rapidly changing world
Top-career journal [7]	Ecological thinking. Project management. Systems thinking. Work with people. Working under conditions of uncertainty. Programming, artificial intelligence, robotics. Artistic creativity skills. Multilingualism and multiculturalism.

	Intersectoral communication. Customer focus. Lean
HR-Portal magazine [8]	Systems thinking. Intersectoral communication. Project and process management. Working with IT systems. Customer focus. Working with people and working in a team. Working under conditions of uncertainty. Multiculturalism and openness. Mindfulness. Communication
Russian Society "Knowledge" [9]	The ability to use knowledge to produce some new value with an obligatory creative component. Soft skills and hard skills. The ability to increase knowledge through creativity, the ability to do something new. Physical and mental labor

The results of the study indicate that the following competencies and skills of a graduate engineer are currently the most in demand in engineering training:

1. Team building and distribution of roles.
2. Advanced skills for technical areas of training.
3. Systemic and non-standard thinking.
4. Ability to conduct applied research.
5. Key competencies of the digital economy:
   - communication and cooperation in the digital environment: competence presupposes the ability of a person in the digital environment to use various digital means that allow him to achieve his goals in interaction with other people;
   - self-development in conditions of uncertainty: competence presupposes the ability of a person to set educational goals for emerging life tasks, to select methods for solving and means of development (including using digital means) of other necessary competencies;
   - creative thinking: competence presupposes the ability of a person to generate new ideas for solving problems of the digital economy, to abstract from standard models: to rebuild existing methods of solving problems, to put forward alternative courses of action in order to develop new optimal algorithms;
   - information and data management: competence presupposes the ability of a person to search for the necessary sources of information and data, perceive, analyze, remember and transmit information using digital means, as well as using algorithms when working with data obtained from various sources in order to effectively use the information received to solve problems;
   - critical thinking in the digital environment: competence presupposes a person's ability to evaluate information, its reliability, and build logical conclusions based on incoming information and data.

It should be noted that super-professional skills occupy key fundamental positions in the modern portfolio of an applicant for a position in a company in the oil and gas industry, energy, mechanical engineering and other key priority areas of the economy.

2 System for assessing trans-professional and digital competencies

Assessing supra-professional skills is a difficult task. Traditional methods hardly work. The procedure for assessing advanced skills at an interview also does not bring the desired results, because these days candidates fanatically prepare for a meeting with a potential employer and learn to "meet expectations." Additionally, many employers oversimplify the process and ask applicants direct questions, such as, "Are you a good team player?" Few people think of answering such a question in the negative, so there can be no question of an adequate assessment.

Recommendations from previous jobs most often turn out to be meaningless, since the person giving the recommendation usually confirms what is written in the resume. This is why the best companies use other methods to assess candidates' advanced skills. Here it is better to use a different type of tool, where the task model describes continuous actions that occur over time, rather than their individual components. For example, these are tools based on scenario-type tasks, games, and simulations.

The experience of overcoming this kind of difficulties, existing in Russia and abroad, was analyzed in the report of the Institute of Education of the National Research University Higher School of Economics "Assessment of universal competencies as results of higher education", presented at the XXII April International Scientific Conference, organized jointly by the National Research University Higher School of Economics and Sber [10].

Advanced methodological technologies exist to develop such tools. One of them is Evidence-centered design, or "a systematic approach to the development of measurement instruments" (ECD) which includes the following steps:

- operational definition of a construct – content that is measured by a specific instrument;
- a description of the structure of what is assessed through the actions of respondents;
- formation of a task model: determination of specific actions of the test taker;
- development of a scoring system and measurement model.

The advantage of this methodology is that it builds the logic of instrument development from ideas about the construct to observed behavior.

In 2015-2018, the international project "Supertest" (Study of Undergraduate Performance) was conducted, aimed, among other things, at measuring the critical thinking skills of engineering students in Russia, China, India and the USA. One of the conclusions of the study is the alarming situation with the development of critical thinking among future engineers. It turned out that Russia, China, and India lag behind the United States in the development of this skill [11].

In Russia, psychometrically verified and high-quality tools for assessing critical thinking for any level of education are practically absent. Competency centers have been opened in higher educational institutions of the country to test students and assess the level of trans-professional skills and digital competencies. The experience of the most advanced and successful centers is analyzed.

For example, methodologists of the presidential platform "Russia – the Land of Opportunities" have developed a set of necessary diagnostic tools for the most accurate and complete assessment of students' abilities. The methodology is based on the "competency constructor". It structures a certain set of competencies, including through indicators for them. This allows all parties (employers, universities, students) to work in the same semantic field, and therefore to speak "the same language" [12].

In particular, in 2021, at the Career Center of MISIS University, a Center for the Assessment and Development of Trans-professional Competencies was created - a digital platform for interaction between students, graduates, employers and authorities that help

resolve personnel issues. The initiator of the project is the presidential platform "Russia – the Land of Opportunities" [13].

The Center for Assessment and Development of Management Competencies of MISIS University allows the University to:

- use tools for assessing and preparing graduates in accordance with the requests of the university's HR partners;
- introduce additional educational programs and modules for the development of management competencies and advanced skills;
- prepare students and graduates competitive in the labor market, adapted to the tasks and needs of employers.

Based on the results of the study, a team within the framework of the educational policy of the Ufa State Petroleum Technical University under the program of the Ministry of Education and Science of Russia "Priority 2030" [14] developed a system for assessing supra-professional and digital competencies. The peculiarity and uniqueness of the project lies in the development of a new system for assessing and assigning statuses in accordance with the new competency model for an advanced technology engineer. The combined assessment method is based on a combination of five effective methods for assessing super-professional skills, including the use of a simulation interactive simulator, made in a game form, including:

1) cases;
2) testing;
3) diagnostic tasks;
4) as well as the use of such assessment methods as assessment of individual achievements;
5) observation.

An interactive simulator in a game form for assessing the advanced skills of students in undergraduate and graduate programs, developed at the Ufa State Petroleum Technical University, is an online simulator for the development of advanced skills (time management, ability to work with information, presentations, public speaking, conflict resolution and negotiations, etc.). The online trainer is a simulator of life situations, a combination of theory and practice to work on the professional skills of an advanced technology engineer. The interactive simulator tests the ability to negotiate with clients, suppliers, own employees and family members, build environmentally friendly relationships with colleagues and loved ones, resolve conflicts and protect one's boundaries, including from manipulation, develop emotional intelligence by working with emotions in communications. The student (user) becomes the hero of a complete story, with characters and plot. Participants must be immersed in the context of situations, and the reliability and effectiveness of training must be ensured. The interactive simulator should describe situations that are close to reality: negotiations, conflicts, manipulations. The user becomes the hero of the story and goes all the way. All this time, he enters into the dialogues of the story and answers questions, receives a theory and consolidates it in further exercises, always related to the hero's story.

To implement this simulator, methodologists were involved who developed the system and evaluation criteria, a detailed description of the methodology for analyzing the results of completing interactive simulators, and test tasks in a game form. During the development, the effectiveness and adequacy of interactive simulators, testing tasks in a game form were substantiated, validation and verification were carried out to test super-professional skills in the training of engineering personnel. The authors developed a script that links all game situations into a single plot, wrote the texts of plot transitions, performed a detailed analysis of existing gaming platforms for implementing the simulator, and selected suitable, adequate, effective interactive simulators and test tasks in a game form to assess super-professional

skills. A software implementation of the game was carried out based on the scenario and situations. Certificates of state registration of computer programs have been received.

The tool developed measures super-professional skills in the online environment, including critical thinking, the student's ability to analyze beliefs, assumptions and arguments, build cause-and-effect relationships, select logically correct and convincing arguments, find an explanation, draw conclusions and form their own position in solving problems in an online environment. The content of scenario tasks is not related to a specific area of study as the tasks are the same for everyone. The test simulates a situation where a student encounters information from his everyday life.

Thus, super-professional skills are assessed as competence for real life and activities. Within the framework of one tool, a transfer was made to solve problems of different content and goals. Students are offered a set of situations for analysis, presented in the form of an interactive simulator with case situations, with the most detailed description, connected by a single story, plot and logic.

The case is not simple, it contains a large amount of data and conditions so that the student understands and considers all the details. All answer options are equivalent, and not completely correct or incorrect. It is intended that all responses demonstrate a soft skill, but to varying degrees. Logical chains of answers have been designed, when after choosing one answer, the participant in the assessment sees how the story unfolds further, what consequences the previous answer led to.

Management skills are also assessed. In one of the situations, a person makes a decision. In the next story, he sees what this led to and how the character reacted. This development of the story gives emotional immersion in the situation and allows soft skills to emerge.

Cases are tied to activities, to workflow. The assessment comes from what we want to see in the end and is based on the business outcome we need. This impact of soft skill on business performance is difficult to pinpoint. But one needs to understand what value the development of soft skills brings to a business and how they relate to performance indicators.

Based on the results of testing and completion of an individual learning path, a digital profile of the student is formed, which is displayed in the student's personal account, as well as in the form of a competency map presented in the diploma appendix, agreed with the employer, which will allow students and graduates to find suitable vacancies and internships. This will allow the employer to attract young, competent personnel who meet the needs of a particular company to occupy a specific position. Employers get access to a graduate's competency map, which contains information about the level of mastery of cross-professional skills and digital competencies of students who have successfully passed diagnostics using valid and reliable assessment tools, as well as managed to work on their weaknesses and emphasize their strengths.

Thus, entering the labor market after graduating from university, each graduate who has passed the assessment and developed his/her supra-professional skills, based on the results of successful testing, will receive an additional diploma of the established form with the appropriate application (digital certificate in the form of a card of supra-professional competencies), which is taken into account by employers when applying for employment at work.

For this project, the Ufa State Petroleum Technical University (USPTU), as well as the universities of the Network Energy Consortium, plan to assess the level of mastery of competencies by students in accordance with the "gold" standard model," which includes the procedure for assigning the status of advanced technology engineer - engineer, focused on cutting-edge end-to-end technologies with the skills of a researcher using a project-based approach to solve problems under conditions of uncertainty.

The developers of the model defined the following definitions.

Competence is a comprehensive characteristic of a graduate's readiness to apply acquired knowledge, skills and personal qualities in standard and changing situations of professional activity.

The competency indicator (indicators of achievement of competencies) clarifies and reveals the formulation of the competency in the form of specific actions performed by the graduate.

Additional educational programs are an additional set of courses that allow students to individualize their educational path at their own request.

Advanced Technology Engineer - an engineer focused on advanced end-to-end technologies with the skills of a researcher who uses a project-based approach to solve problems under conditions of uncertainty.

The purpose of creating the model is to describe the target image of a competitive graduate-engineer of advanced technologies, unified for the areas of training of UGSN 13.00, 18.00 and 21.00 (according to the List of specialties and areas of training of higher education for undergraduate programs, specialty programs, master's programs, residency programs and assistantship-internship programs) in the logic of the competence approach.

Model creation tasks:

- to identify groups of competencies that allow a preliminary assessment of the graduate's level of competitiveness;
- to develop a list of indicators of the development of competencies that play a key role in solving the production problems of industrial partners;
- to formulate educational results that correspond to the indicators of competence development and the level of higher education;
- to specify the grounds for the formation of a differentiated (by levels) personnel reserve of advanced technology engineers.

Competencies and indicators of a future in-demand graduate. The authors identified five groups of super-professional competencies:

Communication skills help develop relationships with people, maintain a conversation, and behave effectively in critical situations when communicating with others, including:

- the ability to clearly express thoughts and defend one's point of view with arguments, create vivid interactive presentations;
- the ability to maintain the required level of professional competencies through interpersonal communication in compliance with ethical standards and taking into account the interests of others, constructively resolving controversial issues based on common goals.

2. Effective thinking, including creative thinking, critical thinking, strategic vision and systems approach:

- the ability to solve logical problems and choose the optimal way to solve a given problem, based on available resources and the planned time frame for completing the task, create and design systems, their components or processes in accordance with the assigned tasks, apply skills and modern engineering methods necessary for engineering activities, be resourceful in finding solutions;
- the ability to build effective algorithms for solving engineering problems when working with data obtained from various sources, readily accepting new tasks and encouraging innovation;
- ability to consider aspects of problems from a global point of view and apply appropriate theoretical and practical methods to the analysis and solution of engineering problems;
- the ability to work with uncertainty methodically, carry out a step-by-step description of the problem situation, analyze the actors involved, subjects playing a significant role in the project;

- the ability to generate new ideas for solving engineering problems, abstract from standard models, rebuild existing methods of solving problems, introduce new content, put forward alternative courses of action in order to develop new optimal algorithms, showing reasonable initiative;
- the ability to formulate a project development plan, motivate and inspire communities and large teams, form local and then global trends for the implementation of plans.

3. Emotional intelligence – the ability to recognize emotions, intentions, motivation, desires of oneself and other people and manage them, conflict management:

- the ability to apply methods for resolving conflict situations, striving to expand the boundaries of one's managerial responsibility and/or professional expertise, quickly acquiring new experience and knowledge, learning from one's own mistakes, and taking specific actions for self-development;
- the ability to recognize and manage the emotions of other people to solve practical problems and achieve goals in life and at work;
- ability to manage conflicts, methods of resolving conflicts and contradictions when working in a team;
- skills in preventing and resolving conflict situations when working in a team;
- ability to use techniques for effective time management;
- the ability to choose solutions and means of development (including using digital means) of other necessary competencies;
- ability to achieve goals in a short time.

4. Team building – the ability to manage individual talent for organizational purposes, achieve team goals and lead in team development and effectiveness:

- the ability to evaluate the work of team members without reducing motivation and without disrupting the work mood and schedule; work effectively in a team;
- skills of planning and distribution of work in a team;
- ability to manage projects and transfer experience and knowledge "on the job", including within the framework of practice; give high-quality feedback to team members and organize reflection, contributing to the development of team members and employees; application of tools of the "lifelong learning" concept (training, mentoring and coaching); the desire to expand the boundaries of one's managerial responsibility and/or professional expertise; rapid assimilation of new experience and knowledge; learning from your own mistakes; sensitivity to criticism; taking specific actions for self-development;
- the ability to apply self-management skills and analyze the situation, act in accordance with it, adequately respond to criticism, questions and comments; meeting within the team and with the mentor to achieve the goal;
- the ability to identify areas and zones of ignorance, lack of information, use argumentation tools and motivate each team member for personal development while working as efficiently as possible;
- the ability to organize and manage the work of a team, developing a team strategy to achieve a set goal, and defend a leadership position in the discussion;
- possession of skills in developing leadership qualities and using them in team management.

5. Entrepreneurial skills and project management – the ability to manage business processes, define goals, plan and control business processes, manage projects:

- the ability to choose the optimal ways to achieve a goal, using competent management, planning and monitoring the progress of tasks;

- ability to draw up a work schedule, project calendar and network schedule, timelines and Gantt charts for the project;
- ability to use search engines for marketing purposes and manage relationships with counterparties, taking into account customer satisfaction as one of the highest priorities;
- possession of skills in assessing the effectiveness of technologies, selecting the optimal portfolio of technologies necessary to ensure the competitiveness of products, skills in drawing up plans for the development of new technologies;
- the ability to use technical information and statistics, draw up a budget and plan expenses for the implementation of an engineering project, observing established rules and regulations, norms and safety standards, taking responsibility for the timing and quality of their work;
- ability to prepare press releases and work with corporate media, apply business planning tools, financial modeling, understanding marketing processes, using tools and mechanisms for business promotion and reputation management, developing and making decisions;
- the ability to support an engineering project, taking into account the level of competence of the team and resource availability, and to apply methods of reflection and self-analysis at all stages of the project life cycle.

In addition, the model separately highlights the presence of the following competencies and skills in a job applicant:

- integrity and adherence to ethical standards;
- respect for the interests of others;
- constructive resolution of controversial issues based on common goals;
- customer focus;
- priority to customer satisfaction;
- self-development;
- resourcefulness in finding solutions;
- willingness to solve new problems;
- encouraging innovation;
- initiative;
- intolerance for violations;
- safe behavior;
- ability to assess potential risks.

The authors identified four groups of digital competencies:

General professional digital competencies, including:

- ability to determine methods and software for information processing to solve applied problems in the professional field;
- possession of skills in using information processing software to solve applied problems in the professional field.

2. Digital competencies in the field of artificial intelligence, including:

- ability to read, understand and develop regulatory, technical, technological and design documentation in the field of information technology;
- possession of skills in developing regulatory, technical, technological, design and technical documentation in the field of information technology and research projects in the field of information technology;
- possession of software designed to solve problems of development and research activities;
- ability to use various data representations and artificial intelligence algorithms;
- ability to use data storage and/or processing systems;

- knowledge of software development methodology for solving problems in the field of artificial intelligence.

3. Competencies in the field of modeling and software development, including:

- ability to use specialized computer modeling software products and libraries of programming languages to solve professional and knowledge-intensive problems;
- ability to participate in software development in one of the programming languages to solve science-intensive problems;
- possession of skills in developing (modifying) and testing control system integration program code;
- ability to organize joint work on the project code using a version control system;
- knowledge of methods for managing team software development, forming technical specifications, choosing a team methodology for developing the project's program code.

4. Competencies in the field of designing the architecture of information systems, end-to-end digital technologies and decision-making under conditions of uncertainty, including:

- ability to develop models and solve problems of modeling business processes, information and network infrastructure in standard notations;
- knowledge of the methodology for designing the information architecture of a project and enterprise;
- ability to use at least one end-to-end digital technology in proposed design solutions and scientific research;
- possession of software for conducting research using system analysis and decision-making methods under conditions of uncertainty.

Specialists from USPTU together with universities of the Network Energy University consortium, have developed a system for assessing competencies and obtaining the status of engineering graduates "Model of an advanced technology engineer - the "gold" standard." It will allow teachers to assess the strengths and weaknesses of each student and determine whether their qualifications match the needs of industrial and technological enterprises.

The advanced technology engineer competency model has been approved by the Ministry of Energy of the Russian Federation (Ministry of Energy of Russia) and leading oil and gas companies of the Russian Federation

The advanced technology engineer model and the procedure for assigning statuses were formed and developed with the direct participation of not only representatives of universities of the Network Energy Consortium, but also industrial partners, i.e. potential employers for future graduates.

The participation of employers demonstrates the interest of industrial partners in creating a unified base of graduates from the oil and gas, chemical, construction and energy industries, sustainable formation of a personnel reserve of potential managers who understand the current challenges facing the company, as well as in effectively solving specific practice-oriented case tasks from production with implementation of the results of project activities into the company's technological process.

Additions have been made to the competency achievement indicators and learning outcomes recommended by employing companies, including PJSC NK ROSNEFT, PJSC ANK BASHNEFT, PJSC GAZPROM NEFT.

The procedure for forming a graduate rating to determine the level of mastery of competencies and assigning statuses was developed to stimulate the educational and research activities of students, increase the activity of students in social, cultural, creative and sports activities, as well as the integration of higher educational institutions and the use of a unified methodology for assessing the level mastering competencies.

The goal is to prepare a new competitive engineer with advanced technologies who meets the norms and standards of employers and can adapt to the rapidly changing demands of the labor market.

Tasks:

- formation of a unified model of advanced technology engineer competencies in order to create a platform for the generation of scientific knowledge and translation in their professional fields;
- a detailed description of the ideal final result - a portrait of a graduate who is academically successful, takes part in social, socio-cultural activities and sporting events, possesses high-level super-professional skills, is able to solve problems in conditions of uncertainty, has professional and general professional competencies relevant to the requirements of employers. Relevance to employers' requirements is determined by preliminary examination and review of the advanced technology engineer competency model;
- creation of a unified database of graduates from the oil and gas, chemical, construction and energy industries. Determination of professional, general professional, universal (super-professional), digital and business skills and competencies of graduates with the issuance of digital certificates on statuses and levels of mastery of competencies for the purpose of employment and building a successful career;
- formation of a personnel reserve at the early stages, including a reserve of potential managers who understand the current challenges facing enterprises (organizations) in the future;
- upon admission to master's/postgraduate programs at Consortium universities – the assignment of significant additional points for the "golden" graduate of a bachelor's/specialist/master's degree (the "green corridor" concept).

3 The competency model of an advanced technology engineer developed by the Ufa State Petroleum Technical University

The project evaluates students' achievements in educational, research and other activities during their graduation year.

The model is a set of competencies (groups of universal (super-professional) skills and digital competencies) with indicators and educational results ("know", "be able", "possess"). Based on an assessment of the level of their formation, a graduate of a bachelor's, specialist's and master's degree can be assigned one of the statuses (with the corresponding level):

- "bronze" graduate (high level);
- "silver" graduate (highest level);
- "golden" graduate (outstanding level).

All statuses (levels) require high-level possession of universal (supra-professional) skills and digital competencies.

Universal (cross-professional) skills: communication skills, effective thinking, emotional intelligence, team building, entrepreneurial skills and project management.

Digital competencies: general professional digital competencies, digital competencies in the field of artificial intelligence, modeling and software development, design of information systems architecture, end-to-end digital technologies and decision-making under conditions of uncertainty [15].

Over-professional skills in the USPTU advanced technology engineer model are universal skills, which include five groups: communication, creative (thinking skills), emotional intelligence and leadership/management skills, team (teamwork skills) and entrepreneurial.

Advanced cross-professional skills are called a key success factor in priority sectors of the economy. Super-professional skills increase the competitiveness and demand of graduates in both the Russian and international labor markets.

The plan for the development of advanced professional skills of students of the Eurasian Polytechnic School of USPTU includes a set of disciplines and online courses in a free-choice format for mastering the relevant skills. Among which, for example, are the features of teamwork in a business environment, the technology of effective team building in a business environment, the basics of team building in business development, team management in business, team building for startup development, business team development in entrepreneurship, the development of emotional intelligence through communication practitioner.

In the curriculum of the training areas of the Eurasian Polytechnic School of USPTU, supra-professional universal skills are acquired in the learning process in the 1st and 2nd years in a separate module of universal supra-professional and personal skills. In the 3rd and 4th years, students will master professional competencies with the integration of trans-professional skills in an interdisciplinary format.

For this project, USPTU plans to conduct a "Rating of students according to the "gold" standard," which includes a procedure for assigning the status of an advanced technology engineer - an engineer focused on advanced end-to-end technologies with the skills of a researcher who uses a project approach to solve problems under conditions of uncertainty. All statuses are characterized by a high level of proficiency in universal (super-professional) and digital competencies [15].

Graduates can qualify for bronze (high), silver (advanced) and gold (outstanding) graduate status. Depending on the level of training, bachelors are divided into "bronze", "silver" and "gold".

Accounting for results (levels of competency development) is organized as follows. The status (and the corresponding level) is determined and assigned upon compliance with the requirements and assessment criteria based on the results of passing test and/or case assignments to assess the level of universal (super-professional) and digital competencies. When assigning statuses, a student may be awarded additional points for individual achievements for the entire period of study (if any). All statuses are characterized by a high level of proficiency in supra-professional and digital competencies.

To obtain the status of "bronze" graduate (high level), a student must have:

- the average score in the disciplines and practices of the curriculum according to the grade book is not lower than 4.0;
- test results on the development of universal (super-professional) skills of at least 45 points;
- test results on the development of digital skills of at least 35 points.

To obtain the status of "silver" graduate (advanced level), a student must have:

- the average score in the disciplines of the curriculum according to the grade book must be at least 4.5;
- test results on the development of universal (super-professional) skills of at least 60 points;
- test results on the development of digital skills of at least 50 points.

To obtain the status of a "golden" graduate (outstanding level), a student must have:

- the average score in the disciplines and practices of the curriculum according to the grade book is not lower than 4.75;
- test results on the development of universal (super-professional) skills of at least 85 points;
- test results on the development of digital skills of at least 75 points.

The status of a “golden” bachelor assumes that the student is engaged in research activities. Such a graduate will be able to enroll in a master's program without entrance exams or receive priority in placement for employment at leading enterprises in the oil and gas, chemical, construction and energy industries.

Criteria for assessing the graduate rating. An applicant for status/level and/or nomination must meet all three evaluation criteria (Tables 2, 3, respectively).

Table 2. Criteria for assigning statuses (levels) to applicants.

Level Criteria	Bronze (high)	Silver (advanced)	Gold (outstanding)
Average score in disciplines and practices of the curriculum according to the grade book, not lower	4.0	4.5	4.75
Results of testing on the development of universal (superprofessional) skills, no less than points	45*	60*	85*
Results of testing on the development of digital skills, no less than points	35*	50*	75*

*when forming a graduate/student rating and assigning statuses (levels), the applicant may be awarded additional points for individual achievements: no more than 15 points in total for universal skills and no more than 15 points in total for digital skills.

Table 3. Criteria for awarding nominations to undergraduates.

Level Criteria	Mentor	Innovator	Expert
Retraining diploma (certificate) in mentoring program, project management	+	-	-
Grant, filing applications for inventions, utility models, registration of computer programs and databases, awards for results in scientific research, performing research (for supporting document see Table 4)	-	+	-
Defense of the thesis in the form of a startup, commissioned by a legal entity, victory in the final stage of the competition under the UMNIK program or under the Student Startup program of the Innovation Promotion Fund (supporting document: extract from the preliminary defense, review from the supervising department, diploma of the winner of the competition under the program "UMNIK" or under the "Student Startup" program). Defense of a research project at the request of the title partner (successful defense with an “excellent” or “good” rating). Internship with successful defense of an internship report	-	-	+

Students enrolled in master's programs can additionally apply for nominations that characterize their leading type of activity - master's mentor (support of project teams), master's innovator (research activities) and master's expert (introduction of innovative technologies).

When forming a graduate/student rating and assigning statuses (levels), an applicant for a status/level and/or nomination (hereinafter referred to as the applicant) may be awarded

additional points for individual achievements (no more than 15 points in total for universal (soft) skills and no more than 15 total points for digital skills). Regardless of the number of diplomas, diplomas, certificates, etc. for one category (universal or digital skills) a total of no more than 15 points are assigned.

Nominations for masters (in addition to statuses):

- master-mentor;
- master-innovator;
- master-expert.

These nominations are awarded upon completion of training, during which the graduate carried out the relevant activities: project activities as a mentor, research activities as an inventor-innovator, practical activities as an expert.

Master-mentor is a master student who accompanies project teams in various fields with projects of different levels of complexity and is responsible for introducing project participants into project activities (translating the norm of project activities), developing project schools, offices, technology clubs, assessing the individual contribution to the implementation of each project team member and uses online tools for monitoring project status, planning project stages throughout the entire life cycle, taking into account the achievement of project results in their interrelation, and performing a comprehensive assessment of compliance with criteria and requirements during project implementation. For a master's mentor, a mandatory criterion is the availability of a retraining diploma in a mentoring program and project management.

Master-innovator (researcher) is a graduate whose main activity in the learning process is research activity, which includes active participation in fundamental and applied research, consulting undergraduate students, including as part of a scientific school, organization and participation in scientific events, publication of scientific results in leading publications, including international ones, in journals recommended by the Higher Attestation Commission, in collections of scientific articles of international and all-Russian conferences, in scientific and technical journals included in the RSCI. For a master's innovator, a mandatory criterion is the presence of indicators related to research activities (receiving a grant, filing applications for inventions, utility models, registering computer programs and databases, awards for results in scientific research, performing research work).

Master-expert (practitioner) is a graduate engaged in engineering surveys, practical activities for the implementation of innovative technologies, scientific developments based on practical experience, a comprehensive assessment of compliance with criteria and requirements when implementing projects from a technical, design and psychological-pedagogical perspective, to ensure the unity of technical, design and psychological-pedagogical content of the project. For a master's expert, a mandatory criterion is the defense of a thesis in the form of a startup, commissioned by a legal entity, at the final stage of UMNIK, within the framework of the received grant.

When assessing masters, teachers identify the professional competencies of students. Thus, to obtain the status, a master's expert must defend his final thesis in a startup format commissioned by an enterprise, an innovator master needs to obtain a patent for an invention or a grant for the implementation of a research project, and a master's mentor has universal competencies and knows how to conduct project activities.

The status (level) is assigned upon compliance with the requirements and assessment criteria based on the results of solving test and/or case assignments, as well as individual achievements of students. When assigning statuses, a student may be awarded additional points for individual achievements for the entire period of study (if any). Preliminary assessment is carried out in the 2nd year of a bachelor's/specialist's degree and in the 1st year of a master's degree in order to issue recommendations on the choice of disciplines that form the level of competencies required to obtain statuses.

The final assessment is carried out in the final year, records the achieved level of competencies and is the basis for the decision to assign status. This assessment is carried out throughout the entire period of study and ends with the issuance of an additional supplement to the diploma - a competency card. Based on the results, a diploma of the established form is issued to confirm compliance with the standard and a diploma supplement in the form of an electronic certificate, which confirms that the graduate has mastered competencies according to the standard in accordance with the requirements of employers.

Preferences for students. Assigning the status also provides the following benefits for students: the possibility of admission without passing entrance tests for a "golden" bachelor's graduate to a master's program (the "green" corridor concept), employment in leading companies in the oil and gas, chemical, construction and energy industries, a point-rating system for comparative evaluation activities and stimulation of students.

Indicators of individual achievements considered when assessing a graduate's rating are given in Table 4. Regardless of the number of diplomas, diplomas, certificates, etc. for one category a total of no more points is assigned than indicated in the table in the corresponding column.

Table 4. Indicators of individual achievements considered when assessing the graduate rating.

Categories	**Meaning, in total, no more than, points***	**Confirmation document**
Communication skills	5	Participation in the conference with a report (diplomas of winners and/or prize-winners, diplomas, certificates of participants, certificates and other documents confirming participation in the conference with a report)
	3	Additional education (certificates of additional additional education aimed at developing communication skills). Additional education (certificates of completion of online courses aimed at developing communication skills)
Effective thinking	5	Olympiad (diplomas of winners or prize-winners of the international or all-Russian Olympiad). Competition (diplomas of winners or prize-winners of an international or all-Russian competition, competition, contest, other event aimed at identifying the educational achievements of students)
	5	Awards for results in reseach and scientific work (award for the results of a student's research work)
	5	An article of a scientific nature (scanned copies and output data (link to publication, name and number of the journal/collection, date of publication) of publications in scientific (educational, scientific, educational and methodological) international, all-Russian or departmental publications). Monograph (scanned copies of the title page and the sheet with the monograph's imprint). Study guide (scanned copies of the title page and the sheet with the imprint of the study guide)
	5	Exclusive right to invention (a document certifying the student's exclusive right to the scientific (scientific-methodological, scientific-technical, scientific-creative) result of intellectual activity achieved by him (patent, certificate: scanned copy and output data (link to invention, name, number and date of registration)). Registration of intellectual property (a document certifying the student's exclusive right to the scientific (scientific-methodological, scientific-technical, scientific-creative) result of intellectual activity achieved by him (patent, certificate: scanned copy and output data (link to the result of intellectual property, name, registration number and date))
	3	Additional education (certificates of completion of additional education aimed at developing effective thinking).

		Additional education (certificates of completion of online courses aimed at developing effective thinking)
Emotional Intelligence	3	Additional education (certificates of completion of additional educational programs aimed at developing emotional intelligence, including trainings, seminars on conflict management). Additional education (certificates of completion of online courses aimed at developing emotional intelligence)
Team building	3	Additional education (certificates of additional additional education aimed at developing skills in personnel management). Performing the functions of a group leader. Sports team captain certificate. Project manager in case-in
Entrepreneurial skills and project management (entrepreneurship, effectiveness, proactivity)	7	Educational work (project) implemented in production (including graduate work as a startup: extract from pre-defense, feedback from the supervising department). Prize/grant for the development of a scientific project (diplomas of winners, certificates of participants in the UMNIK, Student Startup, START competitions, certificates of accelerator participants). Participation in the implementation of research work, service agreements (agreements of the winners of the FSI competitions "UMNIK", "Student Startup", START)
	5	Additional education (diploma of retraining, certificate or certificate of assignment of a working profession)
	3	Additional education (certificates of additional additional education aimed at developing entrepreneurial skills and project management)
	3	Additional education (foreign language certificates)
	3	Possession of a sports title (certificate and photo of the badge). Availability of rank (ID and photo of badge). Participation in the university team (ID and photo of badge)
Digital skills	5	Additional education (diploma of retraining under the "Digital Departments" project)
	3	Additional education (certificates of completion of additional educational programs related to digital skills). Competition (diplomas for hackathon winners in digitalization and artificial intelligence, modeling and software development, information systems architecture design, end-to-end digital technologies and decision-making under conditions of uncertainty)

*Regardless of the number of diplomas, diplomas, certificates, etc. one category at a time.

4 Conclusion

A pilot launch of student ratings based on the advanced technology engineer competency model was carried out at the Faculty of Technology of USNTU. The model "golden standard of USPTU engineer" was replicated within the framework of the Eurasian Polytechnic School of USPTU.

Thus, the competency-based approach to assessing the transprofessional and digital competencies of a graduate engineer, considered by the authors, has certain advantages and will allow the successful implementation of a new model of competencies for an advanced technology engineer at a university.

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