

Conference Paper

A Methodology for Developing Transprofessionalism in Engineers in the Conditions of Post-Industrial Society

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Abstract

The relevance of the problem under consideration is conditioned by the changes in socio-economic conditions and the socio-technological development of the Russian economy, which has significantly altered the world of professions in the post-industrial society: some professions are disappearing, some are transforming, and others are appearing. Along with the traditional concepts of "profession" and "specialism", a new term has been recently established in the field of professional studies: "transfession", referring to a kind of labour activity realised based on synthesis and convergence of professional competences belonging to different specialist fields. The main professional characteristic of transfessions is transprofessionalism - the ability to perform a wide range of specialised activities. The identification of socio-humanitarian technologies for the development of this integral capacity of professionals in the system of continuous education determines the relevance of this study.

The purpose of the article is to analyse and generalise the grounds and prerequisites for transprofessionalism as an integral quality of the subject of technical professions in a dynamically changing social and professional environment.

The main methods in the study of this problem are theoretical and methodological analysis of the research subject and the research problem based on studying and logically generalising scientific research literature, as well as hypothetical-inductive and project methods. The description of the phenomenon of transprofessionalism was made relying on multidimensional, transdisciplinary, network and project approaches. The article presents the scientific definition of transprofessionalism, its meaningful content, as well as criteria of transprofessionalism manifestation in a dynamically changing social and professional environment.

The relevance of the phenomenon of transprofessionalism is substantiated understood as requirements to the subject and its integral quality, which implies qualitatively new content and technological training for professionals in technical fields. In particular, it is stated that in the course of post-industrial society development the concept of "profession" loses its original meaning as a field of social division of labour, and transprofessionals capable of performing a wide range of professional activities become competitive and popular on the employment market.

The article may be of interest to methodologists, researchers, teachers and those involved in continuing professional education.

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1. Introduction

Significant trends in the development of post-industrial society are information-communication technologies, service sector development, widespread use of electronics in production and total digitalisation of all spheres of human life. Its distinctive features are:

1. transformation of social and professional activities;
2. dominance of the service sector;
3. emergence of a new socio-cultural space that integrates real and virtual reality;
4. widespread digital economy.

These features have significantly transformed the world of professions: it has become more dynamic, uncertain, and unpredictable. Some professions are disappearing, some are transforming, others are only appearing and establishing. This is due to socio-economic and technological changes, the development of digital economies, the modernisation of professional education, the appearance of cyberspace.

Characterising the modern post-industrial society, A.G. Asmolov emphasises its relativistic nature, acceleration of changes, mobility, diversity, complexity, heterogeneity, nonlinearity, multidimensionality and uncertainty [1].

The above dimensions of modernity fully relate to the world of professions, determine its problem area and its trans-disciplinary methodology.

In the post-industrial society, the indicators that characterise the development of high technology, the pace of production reforms, the level of the social sphere development (especially education and health care) and, in general, the service sector, become essential. The basis of this society is determined by the sixth technological order, which already accounts for more than 60% of industrial production in developed countries. The basis of this structure is high technology in the field of engineering, biology, cognitive science, social and humanitarian fields, and the IT sphere. These

technologies, the leading directions of the technological order, will become decisive in the geopolitical competition of the XXI century.

At the same time, it becomes obvious that the requirements to professional training are changing in the new technological order: first, specialisation is becoming more narrow: even within the framework of one profession (for example, engineering), there are more and more different, sometimes very different specialisations and specialisms, and scientific and technical breakthroughs, as a rule, are achieved in very narrow fields; secondly, the rapidly changing technologies lead to the growing need for mastering competences (knowledge and skills) that expand the established functional range of a professional; thirdly, the practical commercialisation of inventions, innovations and discoveries is only possible based on a detailed study of industrial, economic, social, psychological and many other aspects.

Thus, the problem is that objectively new scientific and applied results will be obtained in narrow spheres of science and technology, but the rapid realisation of these potential results is possible only through close and effective interaction of experts not only in one field but those able to delve into problems of other scientific and technical industries and ready to interact productively with professionals in these industries as one team. The specialist will need the widest possible range of competences from completely "foreign" areas, as well as the ability to work in a team consisting of experts from other professional fields. This is of particular relevance when training engineers. After all, in this profession, competences related to various professional fields are already in demand. The future engineer should be a researcher, a practitioner, an organiser and performer, a manager and an analyst, a programmer and a psychologist. Transprofessionalism that extends social and professional boundaries and increases the effectiveness of activities can be the response to this challenge. As a result, the study of transprofessionalism gains special significance and is timely.

Transprofessionalism as a scientific category has conflicting interpretations, and studies of this issue, both in domestic and foreign science - are isolated cases that have a specific, rather than a general nature. At the same time, the lack of holistic methodological concepts of transprofessionalism, of how it is formed, and what personal qualities it determines, makes it impossible to organise and implement professional training of a trans-professional. We consider transprofessionalism as an integral quality of a specialist, characterising the ability to master and perform activities related to different types and groups of professions. With the appearance of specialists focused on

the development of universal cross-cutting competences, one can observe the emergence of a “transprofessional” whose qualifications are based on the development of new key competences that allow for finding complex and unique solutions based on transdisciplinary synthesis of knowledge and inter-professional communication. The study of transprofessionalism using engineering specialism as an example necessitated the creation of a common methodology for transprofessionalism, the definition of its model, the development of the Platform for Transprofessional Education, and the technologies for the development of transprofessional competence in engineers.

The approbation of the model and concept is carried out in Ural Federal University, which is one of the leading universities training engineering personnel in Russia and has close partner relations with all industrial enterprises of Russia and former Soviet countries.

The current foreign literature emphasises the fact that to for the effective innovative solution of the post-industrial society problems it is essential to develop a new form of professionalism, namely transprofessionalism. The need for this form of professionalism, as noted by G. Rasko [18], J. Powell [17], M. Horsburgh [16], and others, is conditioned by the very logic of the post-industrial society development: the intensive development of information technologies requires a professional to expand the range of professional knowledge, flexibility, the ability to quickly adapt to the changing conditions of the professional environment, teamwork skills.

The following terms are actively used in foreign papers: “interprofessionalism”, “multiprofessionalism”, and “transprofessionalism”. Many foreign authors use these terms as synonyms, some, on the contrary, differentiate between them, but rather indistinctly, which, in fact, creates a conceptual ambiguity. But in general, we can say that in foreign literature, a multi-professional, a transprofessional, is a person with not only profound knowledge of their specialism, but also of those adjacent to it, with broad outlook, global thinking, readiness and ability to work in a team.

The important issue that is currently being discussed in many articles is the problem of interprofessional, multi-professional and transprofessional education. Interprofessional training is understood as training for (or teaching for) two kinds of professional activity, whereas multiprofessional training involves three or more kinds of professional activity. M. Horsburgh notes that at present there are comparatively few studies in the field of interprofessional, multiprofessional training, many higher education experts are skeptical about this type of education, since they believe that it can interfere with the students’ mastering their own specialism at a deep, fundamental level [16].

While M. Horsburgh in his work considers interprofessional and multiprofessional education as two parallel tendencies in teaching, R. Harden [15] considers multiprofessionalism, interprofessionalism and transprofessionalism to be the stages of transprofessional education. Harden emphasises that transprofessional education is effective only if a number of conditions are observed, namely: the optimal correlation between the format of education, the level of education and the category of students, clearly defined learning outcomes, and viewing multiprofessional education as a multi-stage process. In general, the analysis of foreign scientific literature shows that today there are quite a lot of studies focusing on the issue of transprofessionalism, but most of them simply state the problem: there are relatively few concrete studies. H. Barr identifies the following problems in this area: there is no clear definition of the concepts of "interprofessionalism", "multiprofessionalism", "transprofessionalism", there are no effective evaluation tools and there is no evidence base. Accordingly, the concept of transprofessionalism should be developed, in Barr's opinion, in the following directions: clarifying the semantics of terms, improving evaluation methodology, creating a theoretical and evidence base [14].

Neither Russian, nor foreign research has a uniform interpretation of the concept of "transprofessionalism". Thus, P.V. Malinovsky, one of the founders of the theory of transprofessionalism in Russia, defines it as a collectively-distributed ability to reflexively connect and organise representatives of various professions to solve complex problems [11]. As we can see, this definition emphasises that transprofessionalism involves a professional's willingness and ability to create and effectively work in poly-professional teams with the aim of solving a number of complex problems, and implies co-creative activity.

E.F. Zeer, E.E. Symanyuk define transprofessionalism as an integral quality of a professional, characterising their ability to master and perform activities related to different types and groups of professions [5]. That is, transprofessionalism means leaving the framework of one profession, enriching it with knowledge and technologies related to other types of professional activity, developing new key competences that allow for finding complex and unique solutions based on transdisciplinary synthesis and inter-professional communications.

The analysis of Russian literature makes it possible to state that some authors consider transprofessionalism primarily in terms of a professional mastering different types and groups of professions, other authors emphasise readiness for teamwork. Maksimova E.A. [10] provides a comprehensive definition of transprofessionalism,

which combines two points: transprofessionalism – as readiness to operate on the borderline of professional areas in the conditions of professional mobility, and the ability to work in poly-professional teams to solve complex problems. There is currently no clear understanding of what competences a transprofessional should have, different authors outline a wide range of requirements that a transprofessional must meet. Thus, P.A. Malinovsky [11] singles out a number of basic transprofessional competences: a narrow specialisation within a certain profession, the ability to implement interprofessional communication and transdisciplinary synthesis of knowledge, the orientation toward combining fundamental research with practical problem solving, teamwork skills, constant development and self-improvement, belonging to professional and transprofessional networks.

A central issue today is developing and assessing transprofessional competences. Whereas attempts are being made in Western literature to propose and justify methods for assessing transprofessional competences, no Russian publications focused on this problem are available.

The need to study and develop transprofessional competences in representatives of technical fields is mainly due to practical requirements. According to L.V. Vakhidova, E.M. Gabitova [3], the introduction of innovative technologies in production forces the management to expand the range of employees' labour functions, so that professionals solve problems that go beyond their specialism. M.V. Tsygulyova emphasises that modern production development requires a professional to solve complex problems, to be able to innovate and implement a wide range of mental operations [12]. S.A. Kudryakov speaks of the currently emerging trend towards joining engineering industries, in particular, aviation and space industries [7]. That is, at present, notes Kudryakov, the interpenetration of professions is intensifying and a modern professional needs competences which previously belonged to different fields of activity.

Thus, it can be stated that to date the phenomenon of transprofessionalism is little developed in both foreign and domestic psychology and there is a wide range of issues that need to be addressed:

1. there is no clear definition of the concept of "transprofessionalism", there is no clear distinction between this and other concepts, in particular, "polyprofessionalism", "transfessionalism", "interprofessionalism", "multiprofessionalism", etc.;
2. the integral concept of transprofessionalism has not been developed, most papers only indicate the relevance of studying this problem;
3. there are no diagnostic tools to measure transprofessional competences;

4. there are virtually no studies focusing on developing transprofessionalism in various professional groups, including engineers.

2. Methodological Framework

The methodological basis for our study was non-classical psychology, explicated in the works of L.S. Vygotsky [4], A.N. Leontiev [8] and A.R. Luria [9]. A.R. Luria's concepts of enriching psyche in the process of performing a variety of activities were taken into account. His key methodological point was the orientation toward personal development, a person's empowerment through enriching their knowledge. Considering a person as a subject of activity, he emphasised the capacity for self-development, self-regulation and self-actualisation. These requirements are fully met by the paradigm of transprofessional education.

The scientific basis of the project and its implementation technologies rely on the concept of a person's professional development and the following methodological approaches: multidimensional, transdisciplinary, network and project approach [6].

The study of the methodology for professional development made it possible to determine the specific design principles. These include:

1. integrated personal and professional self-identification in the professional and educational space;
2. integration - combining interprofessional and transdisciplinary components of social and professional activities;
3. co-development of students' personality, education and professional activity;
4. the principle of complementarity and selectivity, interaction of diverse professions, generating new occupational effects;
5. varying content of professional education, determining individual educational trajectories;
6. combining professional and educational standards with transdisciplinary functions of continuing professional education;
7. the convergence of the educational content and high educational technologies, ensuring the development of transprofessionalism in the subjects of educational activity;
8. expanded interaction of the informal and formal educational environment.

3. Results

The outcome of the conducted methodological research (analysis) is a logical-semantic model of transprofessionalism of professional activity subjects, which consists of five components: transfessional orientation; regulatory component; professional-educational component; information and communication component; humanitarian and technological component (Fig. 1).

Transfessional orientation is a semantic factor that determines the multidimensionality of the professional activity subject: orientation to the realisation of a wide range of activities, readiness to master diverse professional functions, and the ability to simultaneously work with several types of information and communication technologies. The theoretical analysis of professional multidimensionality allowed us to distinguish the following constructs of the component: the I-concept, social-professional adaptability, multidimensional identity, transfessional value orientations, motivation for activity.

The regulatory component is intended to activate the psychological resource of the professional activity subject characterised by the level of the skills of planning, designing, forecasting and evaluating performance. In essence, regulation is a mechanism for mobilising the subject's socio-professional reserve capabilities. What is important in realising this component is the conscious self-regulation of a professional's voluntary activity. The regulatory predictors of voluntary activity include self-organisation, self-actualisation, self-effectiveness, autonomy, regulation of mental states.

The professional-educational component provides for the formation of a multidimensional professional. Its content basis is the competence-based approach; the result is interdisciplinary competence, key competences (hard, soft, and digital skills) and meta-professional qualities of the subject.

The information and communication component reflects the professional's ability to navigate in the informational inter-professional environment, including virtual reality. The constructs of this component are socio-communicative mobility, professional mobility, tolerance of uncertainty, reflection, perceptual adequacy (autocompetence).

The humanitarian and technological component integrates social technologies and those related to humanities, represents the convergence of knowledge and technologies from many areas of professionalism. The variability of these technologies allows for the development of individual trajectories of transfessional development of the labour subjects. The constructs of this component are transdisciplinary knowledge,

socio-cultural competence, social intelligence, cognitive abilities, reflective and evaluative activity.

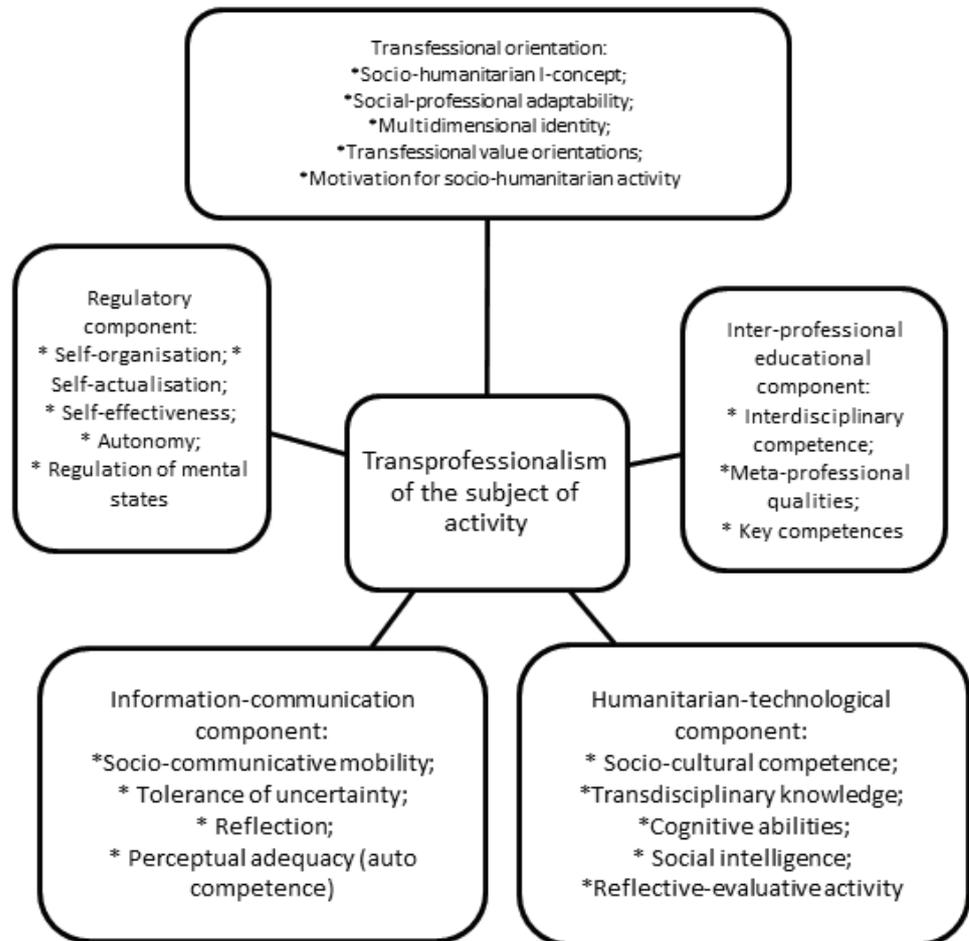


Figure 1: Logical-semantic model of transprofessionalism of the subjects of technical professions.

This logical-semantic model of the professional activity subjects’ transprofessionalism formed the basis for designing the model of professional educational platform for developing transprofessionalism in professional activity subjects.

The main idea of the platform is scientific and methodological support of innovative educational content, choice of effective educational technologies, means of educational process navigation and tools for assessing the students’ achievements.

The design of the platform took into account the tendencies of modernisation of the system of continuous professional education and the actual problems of the modern professional school.

The structural organisation of the platform is block-modular integration of educational content. Modular technology allows for taking into account the tendency of integrated educational content, and also to differentiate training based on individual

students' demands. It is advisable to use short modules, each focusing on developing one or two competences.

This platform realisation allows the individual to differentiate their educational path. A combination of conceptual provisions, methodological approaches and principles has determined the panorama for designing the psychological-pedagogical platform. A brief outline of the platform model is shown in Figure 2.

The informational and educational content of the platform consists of four blocks: base (invariant) - consolidating the individual's psychological and pedagogical competence in the conditions of uncertainty in the educational environment; specialism-oriented, forming multidimensional educational and developmental competences; functional, realising alternative modules oriented to the types of professional activity that are in demand; instrumental, integrating psychological knowledge, skills and competences into practice.

Each block includes one or several modules.

The base block is focused on the actualisation of psychological and pedagogical potential, motivation for learning and the correction of the initial level of professional and psychological competence. The practical and technological training characterises the students' ability to perform labour activities within the framework of generalised labour functions for a particular profession.

The specialism-oriented block includes two alternative modules - methodological and technological, aimed at developing general cultural competences and cognitive, information-communicative and technological (project) abilities.

The functional block is intended to integrate psychological and special competences into professionally-oriented types of professional activity. This block consists of modules that are adequate to the types of professional activity.

The instrumental block consists of special modules focused on particular fields of professional activity and is aimed at integrating the educational content of previous modules into professional practice.

The final evaluation of the outcomes of the educational platform is carried out through monitoring procedures, on the basis of expert assessment. Project versions are selected depending on the predicted professional activity.

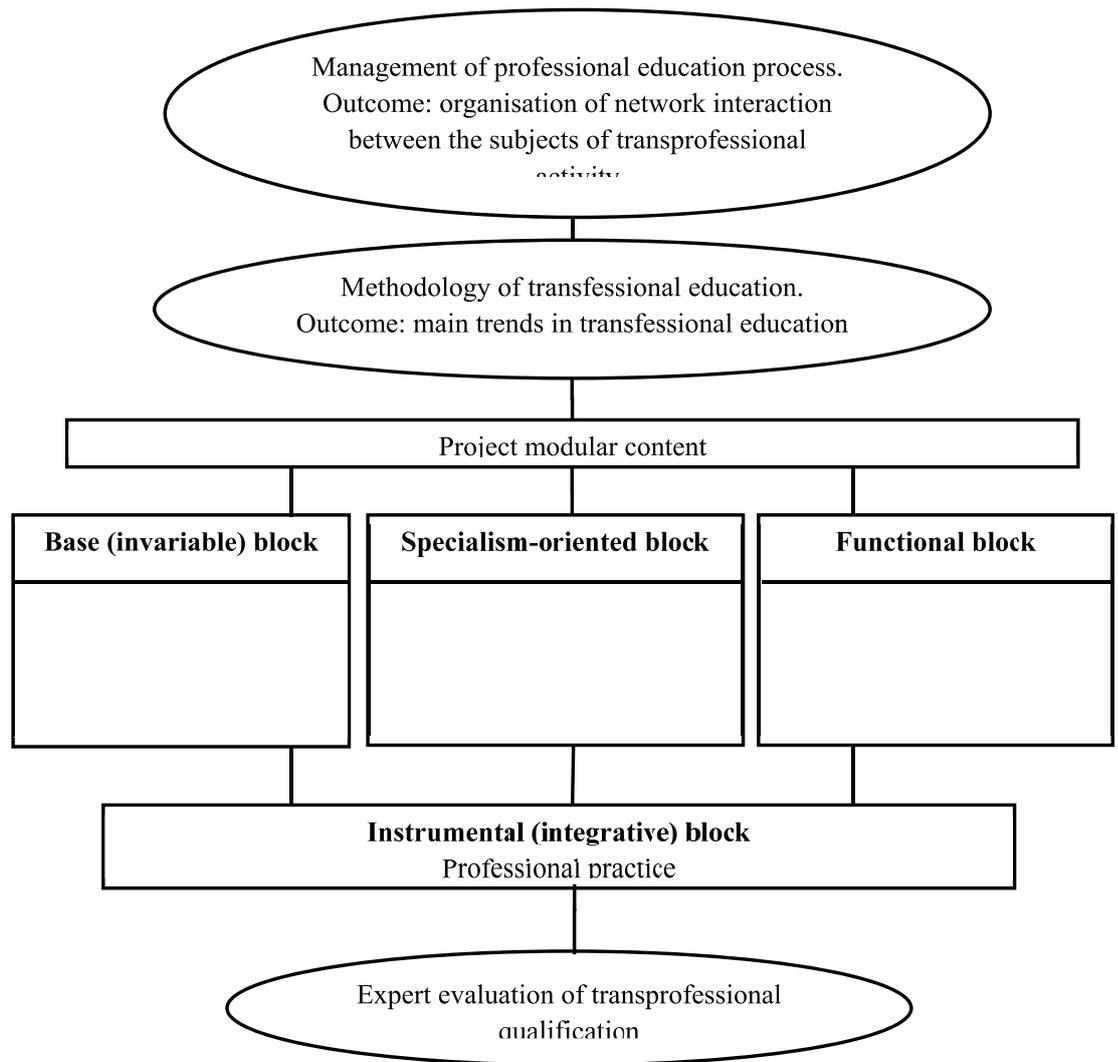


Figure 2: A model of professional education platform for developing transprofessionalism.

3.1. Socio-humanitarian educational platform for developing transprofessionalism in technical professionals

The block-modular structure of the platform allows for designing different versions of educational programmes depending on the level of education and the types of professional activity expected.

The educational programmes are implemented in the system of additional education in the form of full-time, part-time and distance learning, conditioned by the possibility of high degree of independence and co-organisation of all the platform components.

An important role in the development (formation) of transprofessionalism is played by distance learning technologies, projects, real-time diagnostics of competence, etc.

In recent years, the so-called high humanitarian technologies have become widespread in education (theory and practice). They are characterised by the following semantic factors:

1. Humanitarian technologies are nonlinear. As each component of the technology is influenced by many uncertain factors, the sequence of their implementation is not through algorithms, but through heuristic prescriptions;
2. Humanitarian technologies allow for solving educational problems based on interdisciplinary synthesis of hard and soft skills and competences; they imply integration of cognitive and affective (emotional-personal) components of education;
3. Humanitarian technologies are formed based on the structure of the subject of activity and are oriented to their self-development, self-determination and self-regulation, as well as the realisation of the individual's effective-practical resource (potential) [2].

High humanitarian technologies use discussions, project methods, case studies, professional-educational tourism, workshops, etc.

High educational technologies are in line with the strategy of transprofessional education, as they are aimed at achieving the following objectives:

1. actualisation of professional and personal potential;
2. professional development of the individual;
3. acquiring transdisciplinary knowledge, transprofessional competences, meta-professional qualities;
4. gaining hands-on experience of performing professional activities;
5. ensuring subject-subject interaction of all participants in the professional-educational process.

The educational forms and methods of high humanitarian technologies include:

1. technologies for systematisation and visualisation of the presented knowledge;
2. information and communication technologies;
3. technologies of contextual learning;
4. psycho-technologies or developmental educational technologies;

5. problem-searching reflexive technologies;
6. simulation and gaming technologies, etc.

These technologies are implemented in the professional education process under the following conditions:

1. motivational support of the subjects of pedagogical professional activity;
2. a clear objective of education set diagnostically, measurable expected outcomes;
3. presentation of educational material in the form of systematic practical tasks, situations, assignments, projects, exercises, etc.;
4. designated boundaries for rule-bound (algorithmic) creative activity of education subjects, defining permissible deviation from the rules;
5. ensuring openness of training for a professional future, focus on its anticipation.

The summary of the above allows us to give the following definition of high humanitarian educational technologies: it is an ordered complex of actions, operations and procedures aimed at personal development, instrumentally ensuring the achievement of a diagnosed and predicted outcome in professional and pedagogical situations that form the integrative unity of forms and methods of learning and teaching in the interaction between students and teachers in the process of developing an individual style of activity.

This definition emphasises the important points of developmental technologies in transprofessional education:

1. orientation toward personal development;
2. integrative unity of educational forms, methods and means;
3. interaction between students and teachers;
4. individual style of activity of all subjects of education.

4. Discussion

In the post-industrial society characterised by the acceleration of social and professional activity, the variability and uncertainty in the world of professions, the demand for principally new professionals, ready and able to work in the new technological

environment, increases. These changes lead to the transformation of traditional professions and the emergence of new ones. All these changes create the need for qualitatively new skills and qualifications and professionals with integrative, meta-professional competencies, developed on the basis of transdisciplinary synthesis of hard, soft and digital competences.

The conducted study evidences the current need for modernisation of the country's professional training practice in the digital age. The authors definition of the phenomenon of transprofessionalism and the logico-semantic model of transprofessionalism developed based on this concept became the methodological basis for designing a professional educational platform. Developing transprofessionalism in professionals implies the following meta-qualities: social and professional mobility, communicative ability, developed emotional intellect, innovation, tolerance of uncertainty, etc.

Currently, Ural Federal University, one of the participants in the project 5-100, is mastering and partly implementing the innovative concept of training modern professionals: strategic academic units (SAE). Their target orientation is the development of basic professional meta-competences that ensure the competitiveness of engineering professionals, including trans-competences. The scientific and educational platform serves as the methodology for designing strategic academic units of continuing professional education.

The educational content of the platform provides for the design of variable educational programmes for groups of students with various professional orientations. To implement such programmes, fundamentally new approaches to designing educational and syllabus materials, new subjects and courses that meet the requirements of high education (High Ed) are needed.

Minors seem to be a very promising innovation in the implementation of strategic units - technologies for amplifying a person's qualifications, expanding their social and professional competence, actualising self-development and self-regulation of professional activities.

Minors are focused on the development of the individual's transprofessional qualities: socio-professional dynamism, prognostic abilities, readiness for innovation, social and professional mobility, and excess social and professional activity.

5. Conclusion

The establishment of the sixth technological order of economic development leads to the emergence of many new professions and specialisms, which requires fundamentally new qualification characteristics: the ability to master and perform new types of professional activity. Achieving this objective provides for the formation of a new type of professionalism - transprofessionalism - readiness for inter-professional communication and transdisciplinary synthesis of knowledge. Transprofessionals are characterised by high social and professional mobility, capacity for self-development and self-actualisation, overcoming the stereotypes of past experience.

The strategic orientation of the platform is the development and self-development of the individual's professional potential and the formation of transprofessionalism in the professional activity subject.

The Platform applied orientation includes:

1. promoting the development of transprofessionalism in professional activity subjects;
2. developing transprofessional (soft, hard, and digital skills) competences and meta-professional qualities;
3. scientific and methodological support of continuous professional education and transprofessional development of the subject;
4. designing individual educational trajectories and forecasting the subject's professional future.

Summarising the above, it can be stated that the cardinal changes in the socio-cultural and technological environment of professional education necessitate the search for a fundamentally new methodology for professional education, oriented toward designing the man of the future. A professional educational platform should ensure the formation of a specialist with professional multidimensionality. In order to realise oneself in the system of multidimensional interaction of science, education and production, the subject of professional activity must be able to perform various professional functions at a high level. Targeted formation of such a professional is possible with the implementation of transdisciplinary, network and project approaches. The basic orientation for their development is multidimensional competence, the so-called key meta-professional merits [13]. These include: socio-professional and virtual mobility; communicative competence; practical intelligence; responsibility;

collectivism; working capacity; corporative spirit; innovation, etc. In a post-industrial society, the personality itself acts as a qualification characteristic.

In conclusion, it should be emphasised that the article presents a foresight project to modernise the practice of training engineering personnel in the country. The systemically important factor of the project is the professional educational platform associated with practical and technological (field-based) training. The integration of scientific and applied disciplines (subjects) of the platform is carried out through implementing didactically-oriented mini-projects and minors. The meaningful concept of the platform is transprofessionalism developed in an engineer.

The methodology we have presented for the development of transprofessionalism in engineers in the conditions of post-industrial society does not exhaust all aspects of the advancing development of professional education. Some provisions are open for discussion; others require more detailed analysis or expert evaluation.

The article describes the phenomenon of transprofessionalism and notes the current need to modernise the established practice of professional training and education in the country. In order to do this, the authors suggest using the professional-educational platform they have developed taking into account the field of studies and training.

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