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THE DEVELOPMENT OF FUTURE ENGINEERS' PROFESSIONAL MOBILITY

Keywords: professional mobility, intellectual competencies, intellectualization of engineering education, continuing vocational education, developmental situations, developmental tasks.

The theoretical and technological aspects of the formation of future engineers' professional mobility were considered. The main characteristics and content of professional mobility were revealed. The approaches to the design of educational situations which underlay technological ensuring of professional mobility's development were grounded.

Ключевые слова: профессиональная мобильность, интеллектуальные компетенции, интеллектуализация инженерного образования, непрерывное профессиональное образование, развивающие ситуации, развивающие задания.

Рассмотрены теоретические и технологические аспекты формирования профессиональной мобильности будущих инженеров. Выявлены основные характеристики и содержание профессиональной мобильности. Обоснованы подходы к проектированию образовательных ситуаций, лежащих в основе технологического обеспечения развития профессиональной мобильности.

For the last decade requirements for the quality of training of technical colleges graduates became much more complicated. This is associated with a complex of serious changes that have happened in the information society: in social sphere and labor market. This conversion represents fast development of technologies that change: 1) the character of labour market; 2) the character of engineers' labour organization. New technologies require intellectualization of the engineering labour. New paradigms of the labour organization are based on variety, flexibility and quality. Intellectual competence and professional mobility – it is important results of engineering education [1,3,4,6].

In the current context of globalization, technical universities' students and graduates are increasingly integrated into a common educational space. They are due to have mastering information skills in order to solve cognitive and professional problems [1,2].

Graduates that had been prepared for only one specialty nowadays have a high risk to remain without skilled work, if they are not able to redirect and learn a new specialty, which is more required in the society. Low level of development of the professional mobility and intellectual competencies can be the cause of unemployment and also it can be the cause of serious problems of the individual. The high level of unemployment among young people threaten the new «lost generation» [1,3,7].

The high level of unemployment among young people it is the consequence of social and economic events, the result of lack of high-level of vocational education. Along with professional (technical competencies) increases the need for core competences («mobility» competencies).

Professional mobility is dynamic integrative intellectual quality of the individual [1]. The selection of intellectual competence as a basic element of professional mobility due to the fact that intellectual competence are the basis of the individual style of human cognitive and metacognitive activity, they promote personality self-actualization and professional self-determination [5].

Professional mobility of individuals enables to respond adequately to current changes, to professional difficulties and also enables to maintain your professional, creative and the social potential. Professional mobility determines openness and flexibility in perception of new information, also it helps to develop the variation and diversity of different thinking ways for solving problems of different difficulty levels in the information society [1,8,11].

Professional mobility promotes flexible multivariate perception of current changes, it actualizes intellectual potential during the choice of possible life solutions and professional problems, planning personal intellectual activity goals and ways of its realization. Professional mobility can also promote to modify our actions, forecaste professional self-realization strategies and self-development ways. Intellectual competence provides success and adaptation flexibility to professional activities changes. Of course, it provides development of the future engineers' professional mobility.

Processes of knowledge obsolescence accelerate in the information society. These processes promote accumulation of negative stereotypes of thinking, also we could say about ineffective and unpractical brainwork methods. Problem complication is associated with information overload, cognitive and communicative barriers. Types of information overloads and their causes:

- The informational dependence
- Oversaturation of the information
- "The spreading of the information"
- Fear of the information

The informational dependence – this is the dominance of another's information over the individual and the continued dependence on it. The dominance of another's information over the individual can lead to the "informational slavery" if it is not understood deeply, comprehended, connected with the problems of the own research. "The spreading of the information" – this is the constant increase in the volume of the information, the growth of number of sources, the appearance more and more facts. They take place if it necessary to assimilate large information volumes, but there is no

special system of effective work with information. These problems are aggravated. [8,9,10].

The information society creates supportive environment for continuing education. In the current context of rapidly changing professional activity content, the engineering training system goal is development of graduates key competencies that ensure their competitiveness. This goal actualized in a last few years.

Scientific interest growth in the problem of engineers' professional mobility development is associated with increasing its importance - the most significant characteristics of social development processes. Ensuring continuity of education requires constant review and change goals, objectives and educational system functions. The fundamental skills and knowledge base do not only expand but also deepens, transformed and converts to the competence stage. Key competencies allow the engineer (who works in particular industry) to put forward new ideas, new ways of solving professional problems, to transfer technology into new areas of activity [1,3,6]. The professional mobility and intellectual competence ensure success and flexibility of adaptation to changes in professional activities.

Studies show that a conformance level of students informational culture and environment information richness decreases a lot, also we could say that the general level of intellectual competencies and readiness for lifelong learning which is necessary for graduates and their successful professional and social adaptation in real life [1,6,12,].

The response to change adequacy, the internal change ability and ability to adapt in new environmental conditions are speed appearing and braking factors of the human brain nerve processes. As stated earlier there is need of characteristics' the "intellectual competence" concept understanding with the help of psychological knowledge. Intelligence is defined in many different psychological studies like a form of the individual mental experience organization that provides the productive perception possibility, understanding and explanation for what is going on [4,5,6,8,12].

The individual mental experience - it is a set of intellectual activity techniques (methods), own competence skills assessment, control of behavior, the target search, planning, individualization of activity tactics and strategies, and with their help a student can consciously control his own intellectual activity [1,5].

The level of intellectual development depends on the ability to concentrate, ready to perceive new information for effective problem solving. This readiness actualizes a number of mental processes like attention, memory, thinking, speech, perception and imagination. Professional mobility involves the ability to actualize accumulated knowledge and skills in fullness of time, and also to use them during professional features activation [2,5.6.8,9].

However, key positions of the traditional educational technology are not sufficiently take into account psychological mechanisms of perception development, thinking, memory; enrichment of the individual cognitive style and the individual experience of the self-managed learning. The analysis shows that the technical colleges have not developed enough psycho-pedagogical support of the process of students professional adaptation [7,8,13]. And also there are not sufficiently structural support and understanding in terms of familiarizing the students to research and labor activity [2,3,13]. Among the problems of vocational training for specialists should be noted the lack of attention to creative thinking development, culture of the headwork, research competencies, and readiness for lifelong learning [2,8,9,10,13].

Requires a whole new perspective on the concept of vocational training intellectualization for specialists. That is why is so important to find out new approaches to vocational training intellectualization The peculiarity of the concept of vocational training intellectualization is that content, methods, vocational education organizational forms should be directed to invariant intelligent structures development. First of all, self-development and enrichment of specialists' intellectual sphere should be in compliance with psychological laws and intellectual development mechanisms of intellectual development. And the second is that it should be in compliance with individual powers cognitive needs of each student.

The basic principles of selecting the content of developmental education are:

- The principle of taking into account the psychological mechanisms of intellect development
- The enrichment principle of the individual trajectories of self-education and self-development learning
- The principle of fundamentalization of VET (Vocational Education and Training)
- The principle of metacognitional basis of education [12].

The technological aspects of the formation for the engineers professional mobility and intellectual competence – this is approaches to technologies design.

The peculiarity of technologies are:

- The intellectual competence can be manifested and developed only in the organic unity of interests and values, individual powers and cognitive needs of each student
- Developed on the basis of different forms of integration of formal, informal and non-formal learning education
- The main property of intellectual competence is the ability to link existing individual mental experience and ever-changing life situations, taking into account meaning subjectively attached to each situation.

For effective professional mobility development it is necessary to organize students educational-cognitive activity through making the broad range of developmental situations. They require of participants to formulate and solve problems of different difficulty levels. These situations are: professional; educational; subject; communicative; life, moral, legal, environmental, interpersonal, communicative, moral, environmental, aesthetic [1,6,15].

The main content of developmental situation is a developmental tasks system that is aimed at overcoming educational-cognitive, informational problems and barriers of thinking, and understanding. An important place belongs to tasks for techniques development complicated information understanding. Tasks that are aimed at students' mastering understanding techniques were developed by us. These tasks promote students' development of different verbal and special complicated information understanding methods. Also, it's important to say that in that case these students use information technology.

We could see here tasks for understanding methods development:

- Tasks where you need to find out and define recognize algorithms of studying sign concepts
- Tasks where you need to define key elements
- Tasks where you need to deduce the general rule
- Tasks where you need to deduce the same principles, laws and conclusions
- Tasks where you need to define connections between different concepts and ideas
- Tasks where you need to construct schematics, diagrams, schemes, mind maps
- Tasks for comparing, classification, systematization
- Tasks where you need to transform from one encoding method to other.

These tasks were introduced in teaching process of a higher mathematics course for engineers [8].

However, not every developmental situation can be personality-developmental. It becomes so only when it is focused not only on necessary properties development of cognitive activity. Mainly, it becomes so when it promotes internal mechanisms integration of the individual and students' intellectual development. It happens when students take into account with their values, meanings, significances and the individual mental experience that is typical for them.

The developmental educational situations construction suggests the possibility of transition to higher semantic levels by particular-subject to general-subject and meta subject. As a condition of the professional mobility formation it is necessary to use situations that will require manifestation of the intellectual activity individual style, personal experience in dealing with a variety of professional and life problems.

The main content of developing situation is a system of developmental tasks aimed at overcoming the educational-cognitive, informational, interpersonal, communicative, moral, legal, environmental, aesthetic problems, barriers and development of the relevant components of the intellectual sphere [7,8,10,11].

In our research marked out and grounded following types of developmental situations:

- Situations of stimulation of value-semantic spheres of the students, the need for continuing education and self-development both as individually significant.
- Situations of actualization of individual mental experience of students, promoting self-knowledge, the disclosure of individual intellectual styles.
- Situations of understanding of the value lifelong education, lifelong learning, personal and professional self-development as a tool for constructive overcoming educational, cognitive, professional and life problems as a tool for overcoming life crises.
- Situations of reflection aimed at the students' awareness of individual intellectual resources, strengths and weak aspects of the intellectual sphere, difficulties and barriers of educational, cognitive, and professional activities
- Situations of activation of independence which create the conditions for the construction of individual trajectories of lifelong education, self-education and self-development.
- Situations of revision and correction of individual system of working with information, analysis and revaluation of out of date technologies working with information.
- Situations of enrichment of individual mental experience of students who, based on modern technologies of intellectual activities promote the overcoming outdated stereotypes of thinking, barriers of perception and negative patterns of communication [3,7,8,9,11].

This paper points to the necessity of intellectualization of engineering education in the information society. The methodological, theoretical, psychological and pedagogical aspects of intellectual competencies development and technical colleges graduates professional mobility are presented there. The concept of engineering education intellectualization is suggested, methods and forms of developmental education are grounded, approaches to the design and implementation of educational technologies which provide effective development of the future engineers professional mobility are displayed.

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