International Journal of Eurasia Social Sciences
Vol: 10, Issue: 35, pp. (19-30).

Research Article

Received: 13.02.2018 Accepted: 19.02.2019

INNOVATIVE SCIENTIFIC - EDUCATIONAL CLUSTER FOR INFORMATION TECHNOLOGY

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ABSTRACT

The purpose of this paper is to analyze, from a theory of planned behavior perspective, the role of IT education and entrepreneurial intention. A conceptual model is developed based on the literature discussing the importance of IT education in global economic and social development. A number of hypothesis are developed based on demographic factors, risk taking propensity, proactiveness and self-efficacy to understand their relationship with entrepreneurial intention.
The paper investigates the issues and challenges related to the variability, mobility of technologies of education, development of the conceptual framework based on modernization of IT education, formation of professional knowledge of future specialists of an IT profile in the system of continuous IT education in the conditions of the educational and scientific complex "school-college-university" and the ability IT expedient of such system of knowledge. The IT efficiency of the system of professional knowledge could be achieved through a scientific justification of the project-creative component that is not investigated enough. And there is necessity to implement this experimental innovative component of the professional IT training.
In the process of the research the author worked out a theoretical cluster system model of economy by applying innovative technologies where intersubjective innovative connections are available. The research results involve clarification of the following concepts essence "modernization of the system of professional knowledge in IT" and "future specialists in the sphere of ITs"; introduction of a project- creative approach in an educational-scientific complex "an IT - school with its specialization – an IT - college – an IT-university" under conditions of the IT education. Future research suggestions are also stated highlighting the importance of fostering an entrepreneurial spirit in university students.

Keywords: Education, knowledge, IT, system, cluster.

INTRODUCTION

In the knowledge-based society, universities are increasingly challenged to become more socially and economically relevant organizations (Nelles & Vorley, 2011). To do so, universities have gone through academic revolutions. The first revolution added the mission of generating knowledge through research to the traditional mission of preserving and transmitting knowledge (teaching), with which universities were established. Then the second revolution made economic and social development a third mission of universities in addition to teaching and research (Etzkowitz, 2003a). This means that the university, as a medial institution, originated for the conservation and transmission of knowledge, but evolved over the centuries into an institution in which knowledge is also created and put to use (Etzkowitz, 2013).

In addition, in order to contribute to socioeconomic development, universities need to closely interact with industry and government, known as innovate claster (Etzkowitz, 2003a, 2003b). The innovate claster refers to the interweaving of university, industry and government with a spiral pattern of linkages to advance economic and social development through the strategy of innovation (Etzkowitz, Webster, Gebhardt, & Terra, 2000). It implies the breaking down of traditional organizational, cultural, and normative barriers that in the past have separated these spheres to the detriment of economic competitiveness and technological progress (Etzkowitz et al., 2000).

Concerning the universities missions, the incorporation of new ones does not mean the replacement of the old ones. On the contrary, universities need to incorporate new activities in order to fulfill the new missions, while continuing doing those activities fulfilling the original missions. The need to fulfill the three missions simultaneously and the need to closely interact with industry and government, implies and requires changes in the function and structure of universities (Etzkowitz et al., 2000; Goldstein, 2010). Realignments include new understandings and metrics for the traditional teaching and research missions, internal organizational changes that are more conducive to interdisciplinarity and collaborations with government and industry, new modes of governance and management, and new institutional capacities (Goldstein, 2010).

Humans entered an innovative type of social progress in the period of intense development when changes in ideas, technologies and knowledge occur quicker than one generation alternates another one. The challenges connected with variability and mobility of technologies contribute to the transformation of a modern IT structure of the Uzbekistan society, the knowledge society in the post-industrial economy, into knowledge-based economy. In a new information society, a competitive system of IT knowledge should be a priority. The formation of which is provided by the training of competent IT experts.

Improvement of educational activity, which began in our country according to the national doctrine based on the personal oriented education completely conforms to requirements of the modern accelerated social development. At the same time there is also a necessity of forming of an extensive system of training during the life for future specialists in the sphere of ITs through the extreme dynamism and variability of modern

global and national - IT and industrial-innovative space that particularly nowadays refreshes the conceptual and theoretical analysis of the issues related to the peculiarities and problems of implementation of IT education throughout life.

Now there is a problem of development of the conceptual framework based on improving of the IT efficiency of Uzbekistan education to the world educational standards, where the important place is taken by urgent issues connected with the formation of the system of future specialists' professional knowledge in the IT sphere. In the process of formation of this system it's essential to take into account the principle of continuity. Besides it presupposes the structuring of thematic units of theoretical and applied and effective interaction of subsystems of specialized, secondary and higher professional IT education. Whereupon the priority is the project - creative approach to the stage – by - stage formation of knowledge economy in the system of continuous IT education under conditions of the educational and scientific complex "school-college-university" (fig.1) (Usmonov and others, 2017).

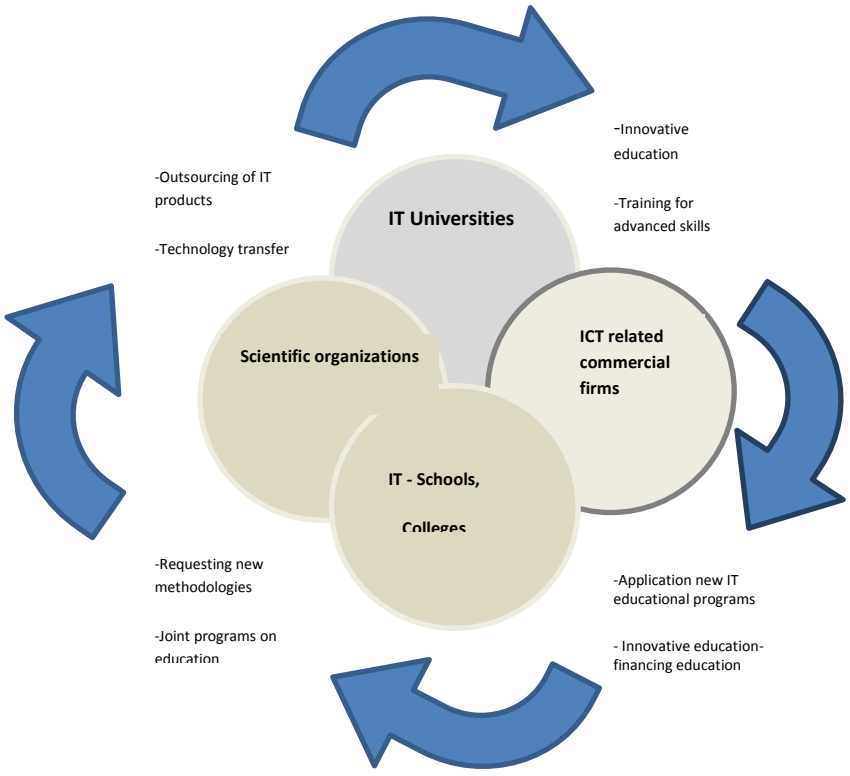

Figure 1. Theoretical Model of the IT - System "School-University-Industry"

In the modern educational process at the institutions of IT education it is necessary to ensure students to get new knowledge and new information, develop the need of self-knowledge and cultural and IT self- realization of personal power potential. IT-student in the XXI century is a person, who studies all life and has the identity of "IT type". IT personality type of the information society is characterized not only by his/her ability to

effective introduction of the system of professional knowledge, but also by the ability expedient of such system of knowledge. IT viable system of professional training is the mutually supplementing set of information resources, in which students become proficient with a minimum of effort. The efficiency of the system of professional knowledge could be achieved through a scientific justification of the project - creative component in such system. Only a modern specialist in the IT sphere whose project-creative competence is shaped will be able to subjectively provide the process of innovative development of the information society which is objectively caused under conditions of globalization processes.

Search of regularities for systematization of the purposes in the pedagogical process always drew attention of teachers. One of the first pedagogical taxonomies is “Taxonomy of Educational Objectives,” which was developed by the American Scientist B. Bloom and his followers. Objectives define the general orientation of the whole system of future specialists’ preparation in the IT sphere.

The ideas of American Scientists J. Carroll (Carroll, 1963) and B. Bloom (Bloom, 1964) became psychological basis of the mastery learning system. Depending on the intellectual abilities of different students it takes different time to master the same learning material. However, traditionally organized educational process ignores this reality and demands from all students to learn all material to the term which is the same for everyone.

It is important to develop pedagogical conditions for complete assimilation of the required teaching material by every student willing and able to learn. The philosophical basis of this system was the idea of student-centered education by the American philosopher J. Dewey (Dewey, 1940). Priority value was gained by self - education and self-control, and also development of the technological training tools which help to such organization during educational process.

Methodology and scientific approaches, which belong to the problem solution related to the formation of the system of future specialists’ professional knowledge in the IT sphere did not single out a project-creative approach into the formation of the system of future specialists’ (who potentially are senior pupils of secondary schools) professional knowledge in the IT sphere, did not pay sufficient attention to the continuity principle of the pre-professional knowledge system formation in ITs in the specialized schools and professional knowledge in IT colleges. It means they did not set themselves the aim to research theoretical and methodological approaches to the professional knowledge formation in the system of future specialists’ continuous education in the IT sphere.

According to the aforesaid, it is necessary to recognize that the project - creative approach to the formation of the system of future specialists’ professional knowledge in the IT sphere remains insufficiently investigated. It becomes more and more apparent that the professional IT training of specialists lacks for an investigative and innovative component which would take into account the requirement of every student's natural abilities development: educational, cultural, project and project - creative. Only a creatively developed specialist can be

an effective personality at the modern labor market. Modern labor market, its development and dynamics of its changes require educational institutions to train professionals with innovative knowledge and skills who are fluent in the theoretical bases of IT knowledge, understand all aspects of application in practical activities of innovative technologies, have the skills to update and improve knowledge throughout life. So, there is a need of further improvement of scientific justification and introduction of innovations, modernizations of the educational sector in general and IT education in particular.

There are important pre-requisites for further research of development of national IT education, improvement of education quality in management and ITs, perfection of modular and rating technology of IT and pedagogical subjects study in the process of system formation of higher educational institution students' professional knowledge. To implement all these, we should more actively involve lectures and scientists who have dealt with a tried-and-tested school of selection and teaching of IT subjects, adapting of their learning programs, extend the practice of training and retraining of research and educational staff at relevant universities for the system of national IT education, determining the IT development of domestic economy.

Uzbekistan education system has some problems that need to be overcome. The important point is improvement of a paradigm of further development of continuous IT education, increasing quality and a role of ICT in development of innovative economy. Defining the ways of achievement of it is the purpose of this paper.

THE INNOVATIVE CLUSTER OF IT EDUCATION SYSTEMs

Development of IT education is predetermined by a new era of "knowledge economy". Therefore, during the era of new social and educational values the problem of formation of "an IT person", and also such key concepts, as didactic principle of IT efficiency of education; key IT competence; IT ability and IT endowments have become essential.

Modern local education needs sharp reorganization of the system of continuous IT education taking into account the competence-based and personally focused approaches.

The author studied the works devoted to theoretical bases of senior students' training with specialization in IT at secondary school. It was revealed that there is not enough attention to competence-based and personal focused approaches to the profile IT training. At interschool industrial training centers the experience of work with gifted senior students of secondary schools was not revealed either.

Pedagogical and psychological diagnostics of gifted senior students, its contents and structural features, scientific justification and formulation of the essence appeared to be beyond the attention of national researchers in the sphere of psychology and pedagogics regardless of the requirements of personal- and competence-based doctrine of the Uzbekistan education, government programs concerning identification and pedagogical support of gifted youth and standards of basic and secondary education.

Researches of a professional knowledge formation problem in IT universities are especially versatile. In the course of modern theoretical sources analysis in economy, based on the principles of person-centric approach the divergence between scientific provisions in education philosophy, requirements of personal- and competence-focused doctrine of the Uzbekistan education and a real state of professional knowledge formation in continuous system of IT education is revealed. So, the essence of competence consists in professional possession of not only knowledge, skills and experience, but also in positive expert's attitude to their requirement and use (Fedorov, 2011). In other words, a competence-focused approach is inseparably connected with a personally oriented one, and consequently with the ability of pupils and students for self-education at all the levels: specialized, secondary and higher. Mainly gifted pupils and students are clever at self-education, self-development and cultural self- realization, at study in the continuous system of IT education and training throughout life.

Gifted specialist is a competent expert who is clever at mastering of professional knowledge in spending minimum of effort and acquiring maximum of academic achievements in the process of continuous IT education. Gifted students of specialized schools, colleges and students of higher schools are notable for well-formedness of ICT competence foreseen by new standards of education. The requirement of the standards is expanding the boundaries of knowledge regarding innovation and global change. Based on this methodology of educational regulatory document it becomes possible to modernize the system formation of professional knowledge of future specialists in the IT sphere who show natural IT endowments and need support for their further development in pedagogically appropriate learning environment. Such pedagogically appropriate learning environment can be educational-scientific complex of an IT profile "school-college-university", which is popular in developed countries.

Economy introduces new conditions of the educational process organization in educational institutions concerning the formation of high professional knowledge of future specialists in the IT sphere. In Uzbekistan reproductive method of teaching does not meet the present. Society needs professionals with creative thinking, the ability to navigate in an increasingly competitive IT market. The secondary school provides the foundation for IT education and development of creative abilities. Except general comprehensive knowledge it is urged to carry out IT education of senior students, to carry out a number of corresponding functions in the process of study, which induce a personality to the choice of profession and orientation in a working career in conditions of IT system. Foundations of elementary IT business, construction and functioning of ICT infrastructure make up a sensitively rational logical component of secondary school seniors' professional knowledge.

Taking into account the existence of a competence-based approach in Uzbekistan education it is important that senior students of a specialized school attain adequate understanding of the concept "IT competence", which in state standards is considered to be among key ones. So it constitutes the totality of knowledge, skills and experience about separated and independent ICT sector of management (economy), which makes production

or provides paid services, strengthened by emotionally positive attitude and aspiration to creation and realization of expedient master - plans, business plans, strategic and marketing plans.

To acquaint senior students with a financial system of market economy a project and technological approach appeared to be effective. It allowed pupils to implement knowledge, abilities and personal experience in educational exploratory activity. Its essence consisted in the development of various financial projects (business plans) by pupils of specialized school. The spheres of the activity these projects concerned are following: person-nature, person- machinery, person-person, person-artistic images, person-sign systems. Projecting is provided in substantial filling of the standard of educational branch of "Technology", in the specialized programme on the basis of ITs approved by The Ministry of Education and Science of Uzbekistan. Pupils have an opportunity to choose personally significant environment for the development of an educational master-plan, business-plan, etc.

Capital as a factor of school production (productive labour of seniors) creates the income, which is the reward for the student-entrepreneur. During the projecting process, seniors should realize that the value of contingent capital is a percentage, i.e. the income on primary capital invested in production. Finally seniors of specialized school have to consider the market as a certain set of the IT relations between various types of the enterprises and individuals concerning purchase and sale of goods and services where is a final recognition of their cost and realization, adequately aware of essence of the competition among producers for the reduction the expenses of production and increase of public usefulness of goods.

Special attention in the content of training of IT colleges needs to be paid to knowledge about immaterial forms of national wealth: the saved-up experience of people, their abilities, requirement, creative talents, and cultural values. The role of this component in the conditions of market economy increases extremely. Pupils are brought to the conclusion about necessity of the development of their own ability to many-sided and cultural self-realization in the society. Yet in a knowledge society a creative (scientific, art, technical) potential of an employee gets powerful IT value as it governs business projects and technological breaks in economy. Therefore, such qualities of the personality as independence and enterprise act are in the forefront.

Taking into account the financial and IT crisis in the world, professional knowledge of college students about the directions of anti-crisis policy in the IT security of the enterprise activity and methods of restructuring, reorganization and bankruptcy are relevant and well-timed.

Market relations complicate the business environment significantly and enhance the competition between IT entities that can worsen their IT situation and, consequently, lead to bankruptcy. Therefore, in market conditions the formation of the knowledge systems to ensure national IT security of national businesses is always an important task.

Notwithstanding the obvious achievements of Uzbekistan IT education, there is a number of questions

concerning the essence of theoretical and methodical bases of the system formation of future specialists' professional knowledge in the IT sphere in the conditions of market economy, which are still investigated insufficiently. It is necessary that students comprehend nature and mechanisms of IT laws nowadays, changes in global IT environment and fierce competition from IT and pedagogical position. So to provide sustainable development of a national IT system based on the latest pedagogical technologies it is important that graduates of higher educational IT establishments receive highly professional knowledge.

In this aspect, in a practical way forming the professional knowledge in the process of continuous IT education in the programme Master's Degree in Tashkent University of Information Technologies (Uzbekistan) train specialists in the field of the theory and practice of computer programming (Usmonov, Radjabov, 2017).

In the context of relevance of this problem innovative development and creativity of youth in the process of IT education is important. Developing IT system has wide infrastructure of the human relations. Instability and the preponderance of labour supply over demand can be noticed in some spheres of activity. It places emphasis on the preparation of creative young people, able to work under conditions of competitive market environment. To all that one should add the preparation of especially creative youth, that will serve as the foundation of national elite in the future.

Conducted researches give a reason to believe that a new paradigm for the development of education in general and IT, in particular, provides the transition from factual learning model to a methodology of "teaching to learn", actualizes the problem of IT education of the young generation, the enrichment of professional knowledge that are necessary in the current globalized economy and education.

The primary and urgent task of educational institutions for the formation of graduates' professional knowledge system is the creation of a constructive variant of studying the disciplines which meet the requirements of the time and first of all, of market economy in the context of which the role of such social values as knowledge, competence, professionalism, the ability to create something new and progressive which ultimately forms the personality, ready for various types of IT activity become important.

Furthermore, qualitative and quantitative parameters of pedagogical educational processes in the system of continuous education, their intensity and productivity depend first of all on the education of the society or on the power of innovative capacity of the society in the course of IT specialists training. Innovative potential of the society is the level of education, of the knowledge, which is gained by the youth in the course of training and in the process of a specialist forming, possessing a high level of professional knowledge in ITs, international global problems, information technologies, foreign languages, intellectual property, and high culture of business communication for working activity in competitive market economy.

In the course of our research we used the latest innovative technologies to develop a theoretical model of a cluster system of knowledge economy. The intersubjective innovative connections in this system serve as a

special component that substantially determines the speed of knowledge transformation into technologies and their diffusion in economy.

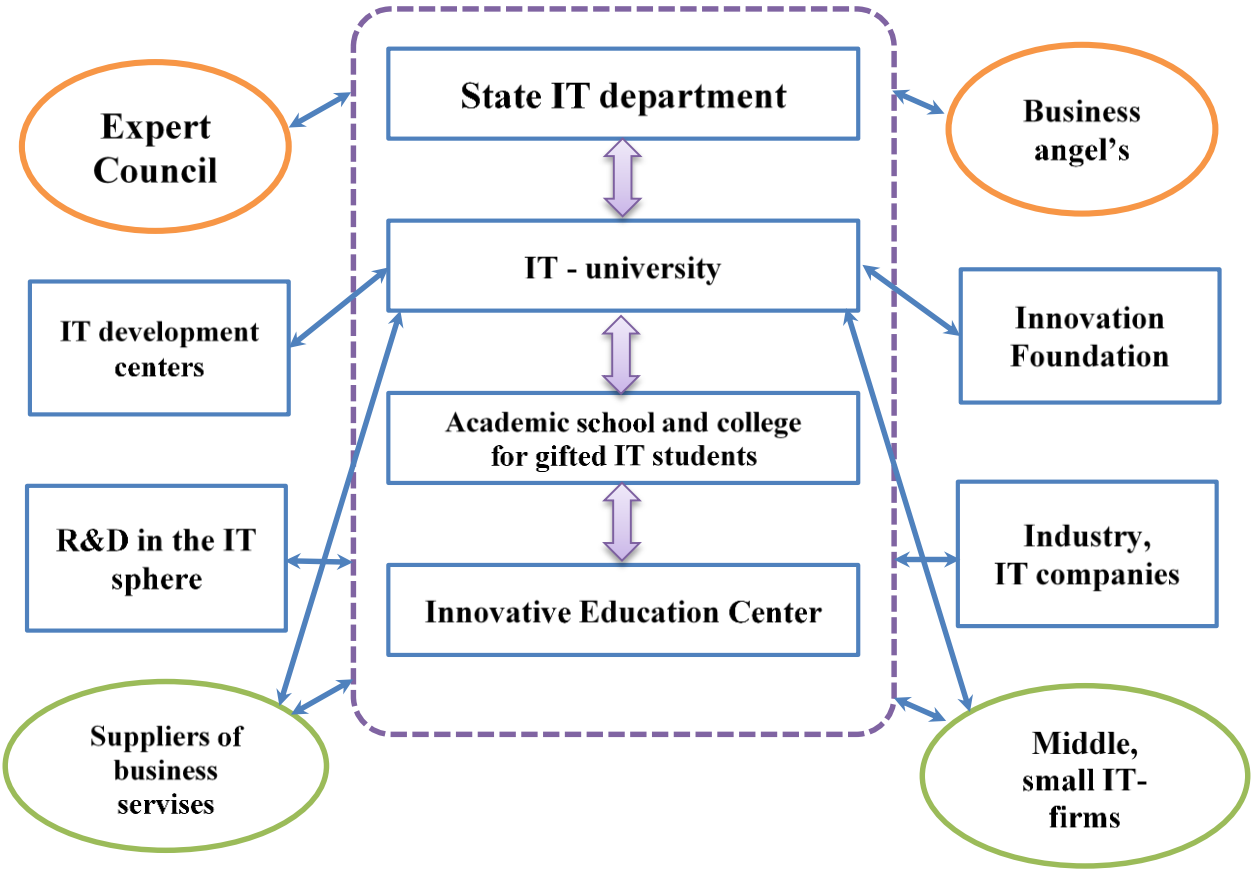

Figure 2. Theoretical model of innovative ICT education and industry cooperation with the inclusion of its main element of the "innovative scientific and educational cluster". *Source: developed by the author*

Fig.2 shows that interconnected components of the knowledge economy are the system of continuous education and its investment and innovation support; the sectors of production, commercialization and practical use of new knowledge; an efficient innovation system of the real economy, which unites and provides information to all market subjects at the state level.

Theoretical model of cluster system of the knowledge economy suggests that "exit" for a secondary school is a higher school, for which, in turn, "exit" is domestic economy, i.e. the enterprise, organization and structure of various types that need specialists with higher education. In other words, the economy should affect the higher education system through requirements on the quality of education and necessary fields of study and etc (G. Itskowitz, 2010).

Having considered issues concerning modern development of the effective system formation of continuous IT education throughout life, transition of national economy based on new knowledge formation, use of the

developed countries experience in preparation and retraining of personnel for the system of IT education, and also positive opportunities of IT education innovative potential, we can draw a number of interconnected conclusions.

CONCLUSIONS AND SUGGESTIONS

Firstly, it is necessary to clarify the concepts “modernization of the system of professional knowledge in ITs” and “future specialists in the IT sphere”. In our opinion, modernization of the system of professional knowledge in ITs consists in the improvement of the training content of specialized school students’ professional knowledge in “Elementary ITs”, IT college junior specialists’ professional knowledge in the production activity of enterprises, higher IT educational institution students’ professional knowledge in international IT relations in the world economy. The result of this process is a hierarchical system of professional knowledge in ITs, which step by step becomes understandable for pupils and students in supportive pedagogical conditions of an educational and scientific complex: specialized school-college-university.

Future specialists of an IT profile are seniors of a secondary school who have the key competence of entrepreneurship as a priority; junior specialists of IT colleges are characterized by the project-creative approach to the formation of professional knowledge on economy, knowledge of students of the higher IT educational institutions is found in the creativity and searches of innovative professional knowledge in ITs.

Secondly, the authors propose ways to modernize specialized study of ITs at the secondary school. Among these ways there is a pedagogically appropriate methodical system, the priority components of which are project- creative methods of pre-professional knowledge mastering in ITs and the formation of key competence of senior pupils’ entrepreneurial activities.

It should be noted that Uzbekistan has already made significant steps towards the introduction of specialized IT education at secondary schools, establishing the fundamental basis for the development of an integral system of continuous IT education, which is at a stage of the difficult but consecutive statement. It is shown in the activity of IT lyceums, gymnasiums, colleges, IT classes at secondary schools, and also at universities and postgraduate education for teachers of technology and teachers of IT subjects who are attracted by specialized school. Today a significant amount of textbooks and manuals are printed. They take into account new standard requirements of personal and competence-based basic and secondary education, which are directed at the formation of future graduates’ high level of pre-professional knowledge in the field of ITs. Therefore, the pedagogical system of pre-professional IT education of specialized school pupils is the main source of the innovative model of economy development.

Thirdly, there is an urgent necessity of the theoretical and methodological foundations improvement of college junior specialists’ personal- and competence-based professional IT education. In the economy based on knowledge, the main resource of development is the innovative potential of a country, which was involved in the regional labour market, small and medium businesses. Therefore, the pedagogical system of professional IT

education of junior specialists is the main source of innovation model of IT development taking into account its regional features.

The significant theoretical basis of college junior specialists' professional IT education is the production activity scorecard content of the enterprises of regional subordination, while the effective methodological basis of the professional knowledge formation of future junior specialists in the IT sphere is the use of active cooperation forms between students and teachers and interactive cooperation forms between students and students, and pedagogically motivated actualization of ITs studying and teaching methods. Fourthly, it is necessary to effectuate innovative theory and methodology of higher educational institution future specialists' professional knowledge formation in order to protect the IT sovereignty of Uzbekistan, the main components of which is the development of productive forces, investment and innovation relations, IT property and IT mechanism. It is important to improve pedagogical conditions favorable for the graduate students who have to become professionals with high creative, intellectual and organizational capacity, which prevents the decrease in intelligence of the nation, contributes to strengthening human capacity in the domestic economy.

All this, under our deep conviction, will accelerate the development of innovative educational policy, and build the economy of knowledge in the system of continuous education in the context of the Uzbekistan entry into the European educational and research collaboration.

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