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The content of bachelors of computer science professional training in the system of higher education of Ukraine

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Abstract. In the article the content of bachelors of computer science professional training in the system of higher education of Ukraine is considered. The curriculum structure of undergraduate program 6.050101 "Computer Science" for obtaining a bachelor's degree is analyzed. The content part of the cycles of disciplines is characterized that the future information technology specialist must obtain in the process of professional training in higher educational establishment of Ukraine. It is ascertained that the efficiency of professional training of future specialists in computer science depends upon as far as to what degree the peculiarities of their future professional activity are taken into account in the process of training at higher educational establishment. It is found that the content of training incompletely takes into account the newest tendencies in didactic theory and practice that is why the curricula need permanent modernization and correction. The expediency of revision of the content component of undergraduate training of specialists in computer science is emphasized, in particular, its orientation on the professional and scientifically-research training with taking into consideration the best standards of foreign experience, in particular Japanese one.

Keywords: *content of professional education, bachelor of computer science, system of higher education of Ukraine, curriculum, academic subject*

Introduction. The modern native information technology industry in new globalization and socio-economic conditions feels the sharp deficit of highly skilled human recourses, prepared to realization of productive functions in the solving-problem situations of professional activity, apt to active, creative, purposeful professional actions. In the light of necessity of modernization and reformation of the national system of higher education, quality assurance of professional training of the future engineers in information and communication technologies industry there is an urgent need in implementation of pedagogical innovations and improvement of existent undergraduate programs and curricula of bachelors of computer science training.

The efficiency of professional training of future specialists in computer science depends upon as far as to what degree the peculiarities of their future professional activity are taken into account in the process of training at higher educational establishment. The theoretical knowledge, acquired by students during professional training in higher educational establishment and multiplied by practical skills, provide a reliable foundation for their future successful professional activity as specialists in information and communication technologies industry. Thus, the content of education is the basis of their professional training and at the same time is the basic element of the educational system.

The content of professional education must constantly improve depending on the level of the development of science and technology, socio-economic, cultural development of society with taking into account the youth' needs in educational training and prospects of social and economic needs for the development of the country, i.e., social order, society queries and competitiveness of future engineers in information communication technologies industry both on the national and world labour market. The situation becomes complicated because the volume of new knowledge from all sciences is doubled approximately every 3-6 years. The necessity of changes of the content of modern education is the best illustrated by the words of minister for education and science of Ukraine academician V.H. Kremen: "It is the education content that requires changes… Also it is necessary to regulate the mechanism of systematic update of the education content in accordance with the development of science and acquisition of new knowledge by humanity. The education content must represent all wealth of rational knowledge of humanity" [3, p. 233].That is why it is quite important at forming of the education content of specialists training to choose from a large array the information that is the result of the newest scientific achievements and will become the base for the formation of specialist from the point of view of the prospect of his professional activity.

The problem of the development of new and improvement of already existent curricula of bachelors of computer science training is recognized as urgent for solving by academic community and employers of Ukraine and the world.

The aim of the study. To substantiate the content and analyze the components of the future bachelors of computer science professional training in the system of higher education of Ukraine: academic subjects, the content component of the cycle of subjects in which the future information technology specialist must become proficient in the process of professional training.

Theoretical framework and research methods. Many researchers contributed to the problem of the training of engineers in the information communication technologies industry in Ukraine and abroad. The problem of the training of future professionals in the field of computing is investigated in the dissertations of A. Gudzhiy (the teaching of programming at higher education), H. Kozlakova (the continuous training of specialists in computer systems) [2], T.Morozova (the theoretical-methodological fundamentals of higher information technology education) [4], Z. Seidametova (the methodical system of continuous training of specialists in information technologies) [5], S. Semerikov (the basics of fundamentalization of computing courses teaching), et al.

The study of foreign experience acquires great importance for the training of highly skilled, competitive specialists in the conditions of globalization and integration processes. The problems of the professional training of specialists abroad are investigated in the research of Ukrainian scientists in comparative professional pedagogics such as N.Bidiuk, T.Desiatov, V. Kovalenko, T. Kosh-

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manova, K. Korsak, N. Patsevko, L. Pukhovska, A. Sbruieva, N. Sobchak, B. Shunevych, et al.

The research works of V. Bykov, B. Vulfson, O. Karelina, I. Kozubovska, V. Kukharenko, N. Nychkalo, P. Stefanenko, N. Syrotenko, et al are dedicated to the aspects of lifelong education and distance education.

The theoretical analysis of scientific works shows that the problem of the professional training of bachelors of computer science and also the necessity of development of modern teaching methods on the principles of positive ideas of foreign experience has not been investigated and developed in theoretical and practical aspects on the appropriate level that makes this problem rather urgent.

Results. The correspondence of the content of specialists training on undergraduate program 6.050101 "Computer Science" to the requirements of state educational standards, the problems of labour market and peculiarities of solving the questions concerning continuity, sequence and gradation specialists training for the complete term of study in higher educational establishment of Ukraine are determined by the documents concerted in the Institute of innovative technologies and education content of the Ministry of Education and Science of Ukraine, the Scientific methodical commission on information technologies and the Department of higher education of the Ministry of Education and Science of Ukraine, as the following [1]:

– the educationally-qualifying description (EQD) for the corresponding level of training of educationally-qualifying level "bachelor" on undergraduate program 6.050101 "Computer Science", ratified as the Industry-standard of Higher Education of Ukraine (ratified ratified by the Ministry of Education and Science of Ukraine by the Order No. 485 from May 26, 2010);

– the educationally-professional program (EPP) for bachelor's degree training;

– the curriculum for bachelor's degree training;

– the programs of academic subjects.

By the educationally-professional program is set the following:

– the obligatory education content, informative volume and level of mastering in the process of training in accordance with the requirements of the educationally-qualifying description of educationally-qualifying level "bachelor" on undergraduate program 6.050101 "Computer Science";

– the list of academic subjects;

– the forms of state attestation;

– the terms of study.

A curriculum is the basic document of higher school where the bases of specialists training are laid. The curriculum of specialists training of educationally-qualifying level "bachelor" on undergraduate program 6.050101 "Computer Science" is developed on the basis of the educationally-professional program (EPP) and concerted in accordance with the requirements of the Ministry of Education and Science of Ukraine.

By the valid curriculum of specialists training of educationally-qualifying level "bachelor" on undergraduate program 6.050101 "Computer Science" the principle of continuity of training is realized and the study of various subjects that are divided into several cycles are envisaged: humanitarian and socio-economic training, mathematical and naturally-scientific training, professional and practical training by the list of the educationally-professional program (cycles consist of the blocks of obligatory and optional subjects); cycle of subjects by independent choice of educational establishment, cycle of subjects by independent choice of students. The distribution of the academic subjects of bachelor of computer science training is the following: Obligatory subjects: the cycle of humanitarian and socio-economic training – 25 ECTS credits, the cycle of mathematical, naturally-scientific training – 63 ECTS credits, the cycle of professional and practical training – 63,5 ECTS credits; Optional subjects: the cycle of humanitarian and socio-economic training – 5 ECTS credits, the cycle of mathematical, naturally-scientific training – 41 ECTS credits, the cycle of professional and practical training – 52,5 ECTS credits, including: practical internship – 4,5 ECTS credits, diploma research – 4,5 ECTS credits, the diploma project – 9 ECTS credits.

40 ECTS credits of the curriculum belong to the subjects by independent choice of educational establishment, 20 ECTS credits – to the subjects by independent choice of students. However the analysis of the practice training of the future specialists of undergraduate program "Computer Science" has shown that de-facto Ukrainian students are deprived of the right to elect subjects independently, as a rule, it is done by higher educational establishment, which does not allow the students to realize their right on formation of individual curriculum for own tastes, inclinations and interests to full degree.

The volume of theoretical study that provides the obtaining of basic qualification in computer science is 105 ECTS credits. Theoretical study includes lecture, laboratory, seminar and practical classes of subjects. The curriculum envisages the completion of 4 term papers and 1 term project (5 ECTS credits). From 33 to 67 percent of academic hours in the curriculum belong to the independent study of separate themes and parts of subjects. The correlation of academic hours by different groups of subjects and class hours and independent study hours corresponds with the requirements. The list and content of academic subjects envisaged by valid curricula provide wide and various training of specialists with deep special knowledge.

In recent years greater role at the training of specialists in computer sciences in the higher educational establishments of Ukraine belong to students' research work which has individual character and is conducted, as a rule, after research directions of the department.

Undergraduate program 6.050101 "Computer Science" is based on four blocks of subjects that provide mathematical, programmatic, technical and system-technical education. The solid mathematical training and also training in theoretical, methodical and algorithmic fundamentals of information technologies are necessary to the future information technology specialist for using of mathematical base for solving of the applied and scientific tasks in the field of information systems and technologies. The solid training in the field of programming, possessing the algorithmic thinking, software engineering methods will provide the realization of software taking into account the requirements to its quality, reliability and production descriptions. The basic knowledge in the field of system research and ability to apply them at the management IT projects, systems design, object-oriented system analysis,

decision making, methods and intelligence systems development is methodological basis of any system. Knowledge in field of computer engineering to high degree is necessary for understanding of basic principles of organization and functioning of modern systems devices of information processing, basic descriptions, possibilities and application of computer systems of different purpose.

The distribution of subjects by terms is done so that the subjects from each of blocks are studied during all study period. The block of mathematical training is provided by such package of obligatory subjects: "Higher mathematics", "Discrete mathematics", "Probability theory, probabilistic processes and mathematical statistics", "Theory of algorithms", "Mathematical methods of operations research", "Methods and intelligence systems", "Numerical methods", "Theory of decision making".

The block of programmatic training consists of such subjects: "Algorithmization and programming", "Object-oriented programming", "Software design", "Operating systems", "Databases and knowledge bases organization", "WEB programming", "Cross-platform programming", "Computer graphics", "WEB design".

The system-technical block of obligatory subjects includes such subjects as: "Systems analysis", "Systems simulation", "Data mining", "Information systems design", "Computer-aided design technologies", "IT project management", "Information protection technologies".

And finally the technical block consists of the following obligatory subjects: "Physics", "Electrical and electronics engineering", "Computer circuit design and computer architecture", "Computer networks".

Thus, the analysis of the practice of bachelors of computer science training in higher educational establishments of Ukraine has shown that all subjects, envisaged by the curriculum of specialists training of educationally-qualifying level "bachelor" on undergraduate program 6.050101 "Computer science" are provided with work programs, that determine their information volume, level of formation of skills and knowledge, tasks for students' independent work, list of recommended textbooks, other methodical and didactics materials, criteria of academic success and tools of academic success diagnostics.

The academic load responsible for the cycle of professional and practical training of bachelors of computer science is not enough for acquisition of practical skills and knowledge to solve difficult tasks that would appear in the process of their future professional activity. In fact the acquisition of practical abilities and skills by future information technology specialists depends, first of all, upon the volume of academic subjects laid in the curriculum (the cycle of subjects of professional training) and also upon the effective cooperation of higher educational establishment with the objects of future professional activity (bases of practical training). It is necessary to increase the volume of subjects of the cycle of professional and practical training at the expense of hours, envisaged by the cycle of subjects of independent choice of educational establishment and hours given for students' independent work.

Also the analysis of the content of professional training of bachelors of computer science in Ukrainian higher educational establishments has allowed us to ascertain that the content of training is incompletely takes into account the newest tendencies in didactic theory and practice that is why the curricula need permanent modernization and correction by means of the implementation of new academic subjects or full extraction or partial modernization of already existing ones.

Conclusions. Having analyzed the training of future engineers in information communication technologies industry in higher educational establishments of Ukraine on the modern stage, the current findings suggest that the content of bachelors of computer science training incompletely satisfies the requirements of modern society, employers and requires immediate changes. Taking into consideration all above-mentioned, it is quite important and necessary to reconsider the content component of undergraduate program in computer science, in particular, its orientations on professional and research training with taking into account the best examples of foreign experience, in particular Japanese one. The important task of native higher educational establishments is to improve the teaching quality of professional courses, specialized disciplines related to them, provide the methodological and material-technical providing and high tech learning environment and also involve leading specialists of the information technology industry to the development of educational and professional computing standards, curricula, educational programs, etc. that requires further research. Exactly this problem appears before us for further study in the following research.

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Пододименко И.И. Содержание профессиональной подготовки бакалавров компьютерных наук в системе высшего образования Украины

Аннотация. В статье рассмотрено содержание профессиональной подготовки бакалавров компьютерных наук в системе высшего образования Украины. Проанализирована структура учебного плана подготовки образовательно-квалификационного уровня "бакалавр" направления подготовки 6.050101 "Компьютерные науки". Охарактеризована содержательная часть циклов дисциплин, которыми должен овладеть будущих специалист по информационным технологиям в процессе профессиональной подготовки в высшем учебном заведении Украины. Установлено, что эффективность профессиональной подготовки будущих специалистов по компьютерным наукам зависит от того, насколько полно особенности их будущей профессиональной деятельности учитываются в процессе подготовки в высшем учебном заведении. Выявлено, что содержание подготовки не полностью учитывает новейшие тенденции в теории и практике обучения, потому учебные планы нуждаются постоянной модернизации и корректировании. Отмечено целесообразность пересмотра смысловой компоненты бакалаврской подготовки специалистов по компьютерным наукам, в частности, ее ориентации на профессиональную и научно-исследовательскую подготовку с учетом лучших образцов зарубежного опыта, в частности японского.

***Ключевые слова**: содержание профессионального образования, бакалавр компьютерных наук, система высшего образования Украины, учебный план, учебная дисциплина*