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THE PECULIARITIES OF CONTENT OF BACHELORS OF COMPUTER SCIENCE TRAINING AT THE UNIVERSITIES OF JAPAN

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The Peculiarities of Content of Bachelors of Computer Science Training at the Universities of Japan

The most urgent problem of training competitive specialists in higher educational establishments in the conditions of socio-economical dynamics of transformation of Ukraine and its integration into the world society is considered. It is noted that the constantly growing requirements of labour market, rapid technical progress require periodic critical analysis and evaluation of the curricula and fulfilment necessary corrections from higher educational establishments that carry out bachelors of computer science training. On the basis of comparative analysis of American and Japanese educational standards for the development of bachelors of computer science curricula the structure and content of the knowledge volume are defined, the body of knowledge is distinguished, that accordingly determines the requirements to the minimum volume of knowledge of undergraduate students for their future successful professional activity. According to the curricula of leading Japanese universities it is distinguished that content component of the curricula for bachelors of computer science training adapts all the variety of background educational environment. Basic principles of the curricula development of the training of these specialists in the system of higher university education of Japan are distinguished. Special attention is given to the importance of creative analysis and implementation of foreign experience into the training of engineers in industry of information technologies on the territory of Ukraine. Directions for the future upgrading higher education in our country and the prospect for the subsequent research concerning the practice of bachelors of computer science training are outlined.

Key words: curricula, educational courses, professional training, bachelor of computer science.

The organically interrelated priorities that come forward as key in understanding of current development strategy of higher education of Ukraine are the integration of higher education of Ukraine into European and world educational space and the permanent upgrading of quality specialists' training. In the conditions of information society development the content of professional training of engineers in

the industry of information-communication technologies should be constantly improved in indissoluble interdependence with the level of science and technology development, socio-economic, cultural development of society with the corresponding consideration of the prospects of social and economic necessities of development of the country and the necessities of educational training of youth. Thus higher educational establishments that carry out bachelors of computer science training should periodically critically analyze and estimate their curricula and make necessary corrections in the conditions of rapid development of IT industry.

The urgency and necessity of solving this problem is traced at the level of legislative and normative documents of government and the Ministry of Education of Ukraine. In particular in the Letter of the Ministry of Education of Ukraine „Concerning the improvement of the training quality of specialists for IT industry" (the Letter of the Ministry of Education and Science, Youth and Sport of Ukraine from 16.02.2012 No 1/9-119) [1] the necessity is marked to revise the maintenance of normative disciplines that are taught during the training of specialists in the marked field of knowledge in accordance with the current development achievements of information technologies. In addition, in 2010 the Branch standard of higher education of Ukraine for undergraduate training in 6.050101 "Computer science" was ratified, where the requirements for the content and level of a bachelor's degree holder of this direction were defined.

The efficiency of bachelors of computer science training in native practice of higher education requires permanent improvement and increase of the efficiency of educational process with the use of leading world achievements, as theoretical knowledge and practical abilities acquired by students during educational and professional training at higher educational establishments set the fundamental basis for their future competitiveness on the modern labour market.

Many researchers contributed to the problem of the training of engineers in the information communication technologies industry in Ukraine and abroad: A. Gudzhiy, H. Kozlakova, T. Morozova, Z. Seidametova, S. Semerikov, 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 problems of the professional training of specialists abroad are investigated in the research of native scientists in comparative professional pedagogics such as N. Bidiuk, T. Desiatov, V. Kovalenko, T. Koshmanova, K. Korsak, N. Patsevko, L. Pukhovska, A. Sbruieva, N. Sobchak, B. Shunevych, et al. The scientific pedagogical research on the problem of development of Japanese pedagogical theory and practice with the aim of creative implementation of progressive ideas into native educational practice are conducted by Yu. Boiarchuk, A. Dzhurynskyi, V. Elmanov, V. Kudin, I. Ladanov (the modern state of the education system), O. Myhailychenko, Ya. Neimatov, O. Ozerska (the professional training of English language teachers at higher educational establishments), N. Paziura (the theory and practice of intercompany training of specialists), V. Pronnikov, N. Repetiuk (the formation of education in modern Japan), T. Sverdlova (the theoretical fundamentals of the process of education humanization), L. Tsarova (the aesthetic culture of personality in modern school education).

The need in integral and system research of the experience of Japan concerning the organization of bachelors of computer science training and the urgency of its comprehension and creative implementation in native pedagogical practice of higher education have defined the aim of the article – to investigate the peculiarities of curricula structure and content of bachelors of computer sciences training at the universities of Japan.

Such international organizations as ACM, AIS and IEEE-CS developed curricula guidelines for the undergraduate IT degree programs Computing Curricula 2001 [2], where the structure and content of the knowledge volume are defined, the body of knowledge is distinguished, that accordingly determines the requirements to the minimum volume of knowledge for undergraduate students training of different directions of IT for their future successful professional activity. It should be noted that these guidelines are assumed as a basis for the development of academic standards of IT specialists training in different countries of the world.

Accordingly in 2008 on the basis of Computing Curricula 2005 (CC2005) [3] the Information Processing Society of Japan (IPSJ) worked out the Computing Curriculum Standard J07 [4] with taking into consideration the differences in national and cultural peculiarities between countries, that directly influences on denotation of terms and requirements to specialists' training in accordance with the necessities of country and region. Thus, the body of knowledge of computer science academic standard J07-CS is composed of 15 knowledge areas and 138 units, among which 66 units (about 255 lecture hours) are obligatory (table 1).

Table 1

The distribution of units and hours according to the body of knowledge

Knowledge areas	Number of units	Core number of units	Core number of lecture hours (J07-CS)	Core number of lecture hours (CC2005-CS)
DS Discrete Structures	8	7	41	43
PF Programming Fundamentals	5	5	38	38
AL Algorithms and Complexity	10	3	20	31
AR Architecture and Organization	9	7	32	36
OS Operating Systems	14	8	17	18
NC Net-Centric Computing	8	4	14	15
PL Programming Languages	13	6	17	21
HC Human-Computer Interaction	8	2	8	8
MR Multimedia Resources	5	2	3	–
GV Graphics and Visual Computing	9	2	3	3
IS Intelligent Systems	10	2	5	10
IM Information Management	13	5	14	10
SP Social and Professional Issues	10	5	11	16
SE Software Engineering	12	8	32	31
CN Computational Science	4	0	0	0
Total	138	66	255	280

When comparing these two educational standards we can see that new knowledge area “MR Multimedia Resources” is added in Japanese standard, and the American standard is composed of 132 units of necessary knowledge, among which 64 units of knowledge are obligatory at 280 classroom contact hours.

The curricula content of bachelors of computer science training was investigated on the examples of such Japanese universities as: the University of Tokyo, Kyoto University, Osaka University, Tokyo Institute of Technology, Kyushu University, Waseda University, Keio University, Tohoku University, which are among the 200 best universities of the world in the training of specialists in computer sciences and information systems according to the rating of “QS World University Rankings by of Subject 2013 – Computer Science & Information Systems” [5].

The curriculum of bachelors of computer science training of Japanese university is typically composed of three parts: one year general education, two-year technical education for specific major domain and one-year graduation research project.

The content component of the curricula for bachelors of computer science training adapts all the variety of background educational environment and can be relatively divided into two groups: general education courses and professional education course.

The model of the curriculum of bachelors of computer science training is presented by the list of such interrelated cycles as: multidisciplinary courses, professional foundation courses and specialized courses.

To multidisciplinary courses belong humanities and social science, natural sciences, foreign language, health and physical education and professional basic subjects that are studied during the first two years and give students the possibility of deeper understanding of the essence of chosen study and training direction and to make sure of the rightness of their choice.

Professional foundation courses and specialized courses of the curriculum aim on the acquisition of knowledge, abilities and skills from specific major domain by students. Here belong required courses and elective required courses and elective courses that provide the deep study of chosen by student subject domain.

It should be noted that by wish at pleasure a student can also additionally study any courses from afore-named cycles, electing from the several hundred so-called open courses.

The successful mastering of the indicated courses allows future bachelors of computer science to form the following competencies: general scientific, general cultural, interpersonal, societal-system, competencies of individual identification and self-development, instrumental, general professional and specialized professional competencies.

It is worth mentioning that competency approach is the basis for the formation and development of the curricula at the universities of Japan, at which the content of education is displaced from the process of piling up of normatively defined knowledge, abilities and skills into the plane of forming and development in future specialists on computer sciences the ability to practically operate and creatively apply the acquired knowledge and experience in different everyday and professional situations, that becomes of especial urgency in the conditions of high dynamics of modern labour market.

It is distinguished that to the basic principles of the curricula development for bachelors of computer science training in the system of higher university education of Japan belong the following:

1) Individualization. The organization of bachelors of computer science study takes place on the basis of the individually-oriented curriculum, which student forms independently in accordance with his inclinations, tastes and interests every term with the concordance of department and dean's office. Just such orientation on the personality of student in the process of study at the establishment of higher education is directed on the personality potential of future specialist, his professional self-realization, initiativeness, flexibility and professional mobility. It should be noted that in the conditions of decentralization of higher education every university independently establishes the content requirements, amount and sequence of courses study.

2) Electiveness. Except the basic courses, only the determined amount of courses is elective requisite. Student selects others independently from the list of recommended for this stage of study and profile at direct participation of the academic consultant and/or scientific supervisor.

3) Flexibility of the curricula creates the reliable basis for formation by student his own training program and assists the timely change of specialized major domain (specialization) within the general admission system; for simultaneous study at bachelor's and master's degree programs beginning from the fourth year (3 + 2 Dual Degree Program); on condition of good academic results and prominent educational achievements the duration of study for Bachelor's degree can be shortened to three years. Besides this, the flexibility is traced also in the mechanism of content formation of bachelors of computer science training with an orientation on the current requirements of the labour market.

4) Integrativeness. The humanitarization of training of specialists of technical direction aims to form in students the flexible understanding of modern scientific paradigm and thorough analytical approach to understanding and solving of current global problems that are needed at the study of professional and practical courses. It should be noted that considerable attention is given to formation of such skills, as work in team, communicative skills and skills of interpersonal co-operation, ability to make decision, fundamentals of professional ethics, etc. Also the knowledge of contiguous industries do possible the complex understanding by future specialists the problems of chosen major domain.

5) Hands-on approach. Training of bachelors of computer science is done on the basis of indissoluble unity of theory and practice in study. Students acquire practical experience during the participation at laboratory trainings and practical trainings the amount of which substantially increases beginning from the third year. Apart from this, practical training envisages different forms: individual research work in computer laboratories; computational experiments; telecommunication projects; students' participation at complex theoretical and empiric research of the department; field study; participation at various professional societies for research projects,

acquisition of necessary professional experience and increase of professional competence; internship on enterprises and organizations of Japan and abroad.

6) Professional orientation. The concept of professional specialization in Japan somewhat differs from European, as in their prevailing majority the curricula are multiple-discipline, oriented on acquisition by students solid theoretical training for the development of new methods, algorithms and software of the highest quality. However the individually-conducted research graduation Bachelor's thesis indicates the specialization study of certain major domain by student.

7) Involvement of the representatives of IT industry – potential employers – to the development of curricula and degree programs, selection of educational material and the presence of cycle of professionally-oriented courses is the guaranty of future competitiveness of IT profile graduates on the labour market.

The currents results suggest that in the conditions of new strategy of modernization of education content the problem of training of competitive specialists in accordance with the current requirements of the labour market requires special significance. The analysis of legislative and normative base, scientifically-methodical and informative literature allowed to distinguish the peculiarities of organization of bachelors of computer science training in the system of higher university education of Japan, namely: the flexible mechanism of forming of study content with the orientation on current requirements of the labour market, potential employers and personal necessities of students in professional and personal formation; the orientation on the fundamental integrated professional training; the implementation of modern innovative pedagogical technologies into the process of specialists' training; the high level of scientifically-methodical, information and facilities providing; upgrading of the quality of specialists training due to differentiation and individualization of study process. The efficiency of bachelors of computer science training at the universities of Japan testifies the presence of positive approaches and is the evidence for the system analysis and study and structural implementation in native system of higher education.

The content of training of future engineers in industry of information communication technologies in Ukraine stands in the need of further deepening and

development, that is why the study of positive ideas of the experience of Japan concerning bachelors of computer science training will assist the theoretic-methodological substantiation of the ways for improvement of native system of higher education in this domain.

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Пододіменко І. І.

Особливості змісту професійної підготовки бакалаврів комп'ютерних наук в університетах Японії

Досліджено надзвичайно актуальну проблему професійної підготовки конкурентоспроможних фахівців у закладах вищої освіти в умовах входження нашої держави у світове товариство. На основі порівняльного аналізу американського та японського освітніх стандартів для розробки навчальних планів підготовки бакалаврів напряму "Комп'ютерні науки" визначено структуру та зміст обсягу знань, виділено ядро базових знань, що відповідно

визначає вимоги до мінімального обсягу знань випускників ОКР “бакалавр” задля їх майбутньої успішної професійної діяльності. Встановлено, що змістовий компонент освітніх програм для підготовки бакалаврів комп’ютерних наук адаптує всю різноманітність фонового освітнього середовища. Виокремлено основні принципи розробки програм підготовки даних фахівців у системі вищої університетської освіти Японії. Особливу увагу зосереджено на важливості творчого осмислення та впровадження зарубіжного досвіду в підготовку інженерів у галузі інформаційно-комунікаційних технологій на теренах України.

Ключові слова: освітні програми, навчальні цикли, професійна підготовка, бакалавр комп’ютерних наук.

Пододименко И. И.

Особенности содержания профессиональной подготовки бакалавров компьютерных наук в университетах Японии

Исследована чрезвычайно актуальная проблема профессиональной подготовки конкурентоспособных специалистов в учреждениях высшего образования в условиях вхождения нашего государства в мировое общество. На основе сравнительного анализа американского и японского образовательных стандартов для разработки учебных планов подготовки бакалавров направления “Компьютерные науки” определены структура и содержание объема знаний, выделено ядро базовых знаний, что соответственно определяет требования к минимальному объему знаний выпускников ОКУ “бакалавр” для их будущей успешной профессиональной деятельности. Установлено, что содержательный компонент образовательных программ для подготовки бакалавров компьютерных наук адаптирует все разнообразие фоновой образовательной среды. Выделены основные принципы разработки программ подготовки данных специалистов в системе высшего университетского образования Японии. Особенное внимание сосредоточенно на важности творческого осмысления и внедрения зарубежного опыта в подготовку инженеров в отрасли информационно-коммуникационных технологий на территории Украины.

Ключевые слова: образовательные программы, учебные циклы, профессиональная подготовка, бакалавр компьютерных наук.

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