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CURRENT REQUIREMENTS OF THE SOCIETY TO THE PROFESSIONAL TRAINING OF SPECIALISTS IN INFORMATION TECHNOLOGY INDUSTRY IN JAPAN

ABSTRACT

The problem of professional training of skilled human personnel in the industry of information communication technology, the urgency of which is recognized at the state level of Ukraine and the world, has been considered. It has been traced that constantly growing requirements of the labour market, swift scientific progress require the use of innovative approaches to the training of future IT specialists with the aim to increase their professional level. The content of standards of professional training and development of information technologies specialists in foreign countries, particularly in Japan, has been analyzed and generalized. On the basis of analysis of educational and professional standards of Japan, basic requirements to the engineer in industry of information communication technology in the conditions of competitive environment at the labour market have been comprehensively characterized. The competencies that graduate students of educational qualification level of bachelor in the conditions of new state policy concerning upgrading the quality of higher education have been considered. The constituents of professional competence in the structure of an engineer-programmer's personality, necessary on different levels of professional improvement of a specialist for the development of community of highly skilled IT specialists, have been summarized. Positive features of foreign experience and the possibility of their implementation into the native educational space have been distinguished. Directions for modernization and upgrading of the quality of higher education in Ukraine and the prospects for further scientific research concerning the practice of specialists in information technologies training have been suggested.

Key words: vocational training, information technology specialists, skill standards, educational standards, certification, qualifications framework, competence, competency, knowledge, skills and abilities.

INTRODUCTION

The formation of knowledge based society, modern scientific and cultural progress, dynamic development and improvement of information and communication technologies determine IT industry as one of the priority directions in economic development of Ukraine. At such conditions formation of engineering human resources that would answer the requirements and necessities of modern life is an urgent task and necessary condition of the modernization of higher education system in Ukraine. The rise of demand and sharp lack of highly skilled competitive information technology specialists increase the requirements to the quality of their professional training in higher educational establishments and come forward as a powerful factor of change and adaptation of the native system of education.

The important source for the formation of new strategy for the national system of IT education development, in the conditions of which the professional training of engineers in



the industry of information and communication technology is fulfilled, is an objective study and analysis of experience of foreign countries that play a leading role in international educational space. In this context the study of rational ideas of Japanese experience on the issue of professional training of information technology specialists in accordance with the requirements of present time causes considerable interest and can become a valuable source for comprehension and creative use in the native educational theory and practice.

THE AIM OF THE STUDY

In the suggested article it is put as the aim to analyze the requirements of society to professional training of specialists in the industry of information technology in Japan, to distinguish positive features of foreign experience and the possibility of their creative use in the native pedagogical practice.

THEORETICAL FRAMEWORK AND RESEARCH METHODS

Many researchers in Ukraine and abroad contributed to the problem of training engineers in the information communication technologies industry: A. Gudzhiiy, H. Kozlakova, T. Morozova, Z. Seidametova, S. Semerikov, et al. The specifics of setting and solving tasks in the field of programming and the issue of professional qualities of programmers in different time are studied by pedagogues and psychologists F. Brooks, E. Deijkstra, S. Macconell, B. Shneiderman, M. Smulson, O. Tihomirov, H. Tseitin, H. Veinberg, N. Wirt, et al. The analysis of peculiarities of IT specialists' training is conducted in works of V. Akimenko, L. Hryshko, S. Semerikov, O. Spivakovskiyi, et al. The research works of V. Bykov, O. Karelina, I. Kozubovska, V. Kukhareenko, N. Nychkalo, P. Stefanenko, N. Syrotenko, B. Vulfson, et al. are studied on the aspects of lifelong education and distance education.

Problems of professional training of specialists abroad are revealed in the research of Ukrainian scientists in comparative professional pedagogics, such as N. Bidiuk, T. Desiatov, K. Korsak, T. Koshmanova, V. Kovalenko, N. Patsevko, L. Pukhovska, A. Sbruieva, N. Sobchak, B. Shunevych, et al. Scientific pedagogical research on the problem of development of Japanese pedagogical theory and practice with the aim of creative implementation of its progressive ideas in the native educational practice is conducted by Yu. Boiarchuk, A. Dzhurynskyi, V. Elmanov, V. Kudin, I. Ladanov (modern state of the education system), O. Myhailychenko, Ya. Neimatov, O. Ozerska (professional training of English language teachers at higher educational establishments), N. Paziura (theory and practice of intercompany training of specialists), V. Pronnikov, N. Repetiuk (the formation of education in modern Japan), T. Sverdlova (theoretical fundamentals of the process of education humanization), L. Tsarova (aesthetic culture of personality in modern school education).

At the same time theoretical analysis of scientific works shows that the problem of professional training of specialists in computer sciences on the principles of positive ideas of Japan's experience has not been researched and developed in theoretical and practical aspects on the appropriate level yet, what makes this problem rather urgent.

RESULTS

In the report "Towards the enhancement of undergraduate education" of the Central Council for Education (Central Education Council, 2008) the list of competencies that the graduates of undergraduate level should acquire in accordance with current requirements of market ("Reference guideline for learning results common among bachelor courses") is offered, namely: 1) knowledge / understanding – systematic understanding of the basic knowledge of a chosen field of major, understanding of other cultures, ethics, social norms and natural environment; 2) general-purpose skills – general scientific, socio-personal and general professional competencies: communication skills, computer literacy, logical thinking



and problem-solving skills, numerical competence; 3) comprehensive learning and its application – ability, with the help of which a person can comprehensively utilize knowledge, skills, peculiarities of behavior, experience to solve old and set new tasks.

In the educational standards for undergraduate IT specialists' training (Computing Curriculum Standard J07), worked out by the Information Processing Society of Japan (IPSJ) on the basis of US educational standards Computing Curricula 2005 (CC2005), the characteristics that successful IT school graduates should possess are defined as follows: 1) system-level perspective on the discipline / field; 2) appreciation of the interplay between theory and practice; 3) familiarity with common methods of computer science (abstraction, complexity, evolutionary changes, etc.); 4) significant project experience; 5) adaptability (Information Processing Society of Japan, Computing Curriculum Standard J07, 2008).

Students who study at computer science undergraduate degree program must develop a wide range of professional capabilities and skills that can be divided into three general categories:

1) cognitive capabilities relating to intellectual tasks specific to information technology industry:

- knowledge and understanding – demonstration of knowledge and understanding of essential facts, concepts, principles, and theories relating to computer science and software applications;

- modeling – use of such knowledge and understanding in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoff involved in design choices;

- requirements – identification and analysis of criteria and specifications appropriate to specific problems, and planning strategies for their solution;

- critical evaluation and testing – analysis of the extent to which a computer-based system meets the criteria defined for its current use and future development;

- methods and tools – deployment of appropriate theories, practices, and tools for the specification, design, implementation, and evaluation of computer-based systems;

- professional responsibility – recognition and guidance by social, professional, and ethical issues involved in the use of computer technology;

2) practical skills relating to information technology industry:

- design and implementation – specification, design, and implementation of computer-based systems;

- evaluation – evaluation of systems in terms of general quality attributes and possible tradeoffs presented within the given problem;

- information management – application of the principles of effective information management, information organization, and information-retrieval skills to information of various kinds, including text, images, sound, and video;

- human-computer interaction – application of the principles of human-computer interaction to the evaluation and construction of a wide range of materials including user interfaces, web pages, and multimedia systems;

- risk assessment – identification of any risks or safety aspects that may be involved in the operation of computing equipment within a given context;

- tools – deployment of effective tools used for the construction and documentation of software, with particular emphasis on understanding the whole process involved in using computers to solve practical problems;

- operation – effective operations with computing equipment and software systems;



- 3) additional skills of general nature:
- communication – making succinct presentations to a range of audiences about technical problems and their solutions;
 - teamwork – being able to work effectively as a member of a development team;
 - numeracy – understanding and explanation of quantitative dimensions of a problem;
 - self-management – management of one’s own learning and development, including time management and organizational skills;
 - professional development – keeping abreast of current developments in the discipline to continue one’s own professional development.

Beside this in the educational standard J07 other important key competences are also stated, in particular: 1) business: law and ethics, business strategy and organization, human resource management, environment analysis, accounting, marketing, decision making, operation; 2) communication: reading, writing, presentation, foreign language competence, practical skills, negotiation; 3) information and ethics: computer literacy, intellectual property, information ethics, law on IT. Besides, competences necessary for a society member were developed by *Ministry of Economy, Trade and Industry (METI)* – “Fundamental Competencies for Working Persons”: 1) behavior: ability to act positively, influence people, set goals and act; 2) thinking: ability to analyze current status, planning ability, creativity; 3) team work: flexibility, ability to express one’s opinion, listen carefully, understand circumstances, keep rule or promise, manage stress.

On the basis of analysis of the row of documents of the Japanese Accreditation Board for Engineering Education (JABEE), the determinant aim of which activity is the estimation of quality of educational programs of competitive specialists in engineering industry training, the main requirements to the specialists in computer sciences should be formulated as the following: 1) knowledge of design characteristics, limitations and potential possibilities of information systems application; 2) thorough knowledge of fundamentals of computer sciences in relation to programming, computer architecture, data structure, computer systems and networks, as well as ability to apply them in practice and in non-typical situations; 3) abilities to analyze, encode and test the requirements of software for new and existent systems; 4) skills to diagnose and eliminate problems in hardware and software work at an enterprise, company and so on; 5) thorough knowledge of probability theory and mathematical statistics; 6) perfect knowledge of specialized terminology not only of computer sciences but of other contiguous industries; 7) ability to design complex hardware and software systems and computer networks with application of the newest technology of the software engineering; 8) good analytical capabilities and skills of analysis, synthesis and problem solving; 9) ability to adapt oneself in rapid changing conditions of computer industry development; 10) ability to generate new ideas, think creatively and critically; 11) knowledge of professional ethics and ability to work in a team; 12) capacity to self-development, self-improvement, self-education and continuous knowledge gaining (Japanese Accreditation Board for Engineering Education, 2012).

As S. Hayashi and T. Kurikawa noted, IT human personnel should be categorized by the METI classification as “solution-oriented human resources” (Hayashi & Kurikawa, 2009). Besides, scientists make accent on the importance of such prospective employers’ qualities as ability to work in a team, ability to make decisions, level of communication skills, creativity, etc. And in the opinion of K. Mutara and Y. Orito, the observances of copyrights, work with legal software, and rapid capture of certain major field are important personal qualities of an engineer-programmer in the conditions of present time (Mutara & Orito, 2008).



To develop world-class IT human resources, Information Technology Promotion Agency (IPA) has established “The Common Career/Skill Framework” to serve as a reference model for Information Technology Engineers Examination (ITEE) and three skill standards – Embedded Technology Skill Standards (ETSS), Skill Standards for IT Professionals (ITSS), mentioned above, and Users’ Information Systems Skill Standards (UISS). This framework serves as the foundation for developing highly skilled IT human resources (IPA: Common Career/Skill Framework, 2008).

The conducted analysis of documents of the IPA allowed summarize the constituents of professional competence in the structure of an engineer-programmer’s personality necessary for seven levels of professional development (table 1). It should be noted that the level of IT school graduate should be equal, at least, to the level of a trainee-beginner.

Table 1

Professional competence in the structure of an engineer-programmer’s personality

Level	Knowledge, skills and abilities	Qualities
Trainee, beginner	Knowledge and experience in technology of programming	Perception of new information. Persistence. Attentiveness. Responsibility. Ability to search new information. Initiative. Ability to work in a team. Ability to understand programs
Developer	Ability to see farther than a developed program. Ability to combine the known methods of programming and typical algorithms. Ability to summarize typical situations and modify program	Critical thinking. Thinking operability. Rapid capture of a certain field industry. Ability to debug programs
Leading developer	Ability to see a project in general. Ability to make decision independently. Ability to determine the stages beforehand	Broad mind. A high capacity and care in labour. Ability to modify programs. Ability to make decision in the conditions of a limit time. Attention to details
Consulting manager	Basic knowledge of project conduct, organization of work in a team, methods of control and assessment of results, quality management. Understanding of business processes. Understanding of user necessities. Ability to estimate the ergonomics of certain forms of interface	Communicability. Leader qualities. Ability to work under stress. Goodwill. Tolerance
Architect	Knowledge of different models and experience of developing software. Ability to define program architecture. Ability to see a task on different levels of detail. Ability to imagine a designed process in dynamics	Ability to disengage oneself from a task and ways of decision
Analyzer	Ability of formalization, knowledge of system analysis, ability to formulate requirements and estimate possibilities	Flexibility and critical thinking. Creative thinking
Project manager	Knowledge of risk management, work with inferiors and clients	Flexibility and critical thinking. Ability to work under stress



CONCLUSIONS

The realities of the present put forward fundamentally new requirements to professional training of skilled engineers in the industry of information communication technology. Having analyzed the requirements to information technology specialists in Japan we can assert that in the process of competitive IT specialists' training in institutions of higher education, built on principles of competency-based approach, the accent should be displaced from the formation of a certain set of professional knowledge, skills and abilities in the field of programming to the formation of such qualities, as work in a team, leader qualities, responsibility, reflection capacity, capacity for independent study and life-long mastering of new technologies, self-education, activity planning, logical and algorithmic thinking, purposefulness, persistence, ability to make decision independently, quick adaptation to new tasks, broad mind in a major field.

The problem of such specialists' training requires a further study, as its separate aspects haven't been considered to a full degree, in particular: the improvement of educational programs and curricula, search of effective forms and methods of educational activity organization, search of possibilities for the implementation of progressive foreign experience, in particular of Japan, concerning the professional training of computer science bachelors in the native educational practice. Under such conditions the problem of these specialists' training acquires special attention and its solving needs changes in higher education system of Ukraine.

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