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*SMART-EDUCATION TECHNOLOGIES IN UPGRADING ADDITIONAL EDUCATION OF SCIENTIFIC AND TECHNICAL TYPE**

SUMMARY. The article considers ways of using Smart-education for additional education upgrading of children and young people.

It presents the results of a data analysis based on a sample survey of children and young people, their parents, teachers and administration of additional education institutions in the Tyumen region. The survey regarded issues of preference and satisfaction with the quality of scientific and technical additional education. The results show that the majority of respondents find applied sport and technical facilities more attractive. In order to promote and develop additional sci-tech education, it is suggested to upgrade it with the help of computer technologies (ICT). Using smart-education technologies on the principles of integration and openness of educational resources can help to build a system of open continuous education in the natural sciences, engineering and technology. The article describes a pilot educational programme of additional education in net technologies implemented with the help of smart-education technologies at the Institute of Mathematics and Computer Sciences of the Tyumen State University.

KEY WORDS. Additional education, continuous education, information technologies, Smart-education.

In Tyumen region the system of additional education of children and youth (CYAE) has been functioning for a long time. It is affiliated to various departments and comprises one of the most important components of the educational sector. The role of CYAE as multiple-option and multilevel educational system is difficult to overestimate. It implements traditional (instructional, developing, didactic, social) functions of education, and also represents a natural experimental platform for development and implementation of the innovative teaching technologies, programs

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of talent development, social adaptation and professional self-determination for children and young people, including those with disabilities and those from risk groups. Another very important opportunity of CYAE, which is not yet exploited to the full, is revealed due to the modern information technologies. It is the development of the system of open continuous education on the basis of the CYAE system. But to make it possible, CYAE is to be seriously upgraded in accord with new conditions and challenges of the information society.

The main feature of CYAE is non-formal education [1]. Theoretically, additional education should make students or\and their parents free to choose any CYAE institution and educational program, schedule and level, as well as type of the cognitive activity. Non-formal communication, possibility of different age-groups interaction, self-expression and creative initiative combined with training to solve specific practical problems are of vital importance.

The sci-tech area is especially significant in CYAE nowadays, as its development will allow to include additional education (as the primary stage) into the system of continuous education, taking into account all the priorities in science and technology, meant to modernize and technologically develop the economy and adjusted to the educational system. Besides, within the evaluation system of the USE tests, students have to memorize and reproduce ready-made answers and solutions. Today a school teacher does not teach to solve unconventional tasks, to search and analyze the essence of the phenomena or to interpret the information. However, the informal and flexible CYAE programs, implemented in the specific and pedagogically convenient conditions, may improve the situation to some extent.

The priority areas of science and technology development should be considered when determining the key directions of CYAE development in the sci-tech area and while designing definite educational programs. These areas include research in the field of information and telecommunication networks, new materials, nano- and optoelectronics, biotechnologies and ecology [2]. Theoretically, the sci-tech additional education should focus on these areas in order to prepare would-be researchers, engineers and technologists with unique skills – *innovative activity competences*. Such competences include [2; 19]: ability and readiness for the continuous education, constant improvement of professional and personal qualities, occupational mobility, critical thinking, creativity, initiative, teamwork skills and individual abilities for achieving the collective goal. The question arises as to whether the CYAE system is ready to implement the appropriate programs and whether learners are prepared to master them.

By the beginning of 2013 in Tyumen region more than 100 thousand children and young people mostly aged 6-18 were engaged in the additional education institutions affiliated to various departments. But only about 2% of them received the sci-tech additional education (leaving out of account sporting-technological programs). The number of students attending technical study groups in schools is also small. The sampling study of people's preferences and of the sufficiency of the sci-tech additional education system was conducted. Within the study students of CYAE system

institutions (401 people) and their parents (158 people) were interviewed. The research showed the following results.

Being asked: "What subjects do you find the most interesting in sci-tech additional education?", most students mentioned the following applied subjects as priority: "Automobile and motorbike composition and driving" (23%), "Sport and techniques designing (auto-, ship-, aircraft-)" (21%), "Photography, filming and editing" (17%), "Computer graphics and web-design" (17%), "Cinematography and television" (16%), "Computer science and programming" (12%), "Computer systems and networks, cyber security" (10%), "Robotics" (9%) and "Electronics and radio engineering" (8,5%).

The major reason, why the respondents don't get the additional education in the areas they are interested in, is the absence of specialized institutions of additional education, classes, groups, clubs and project teams of their interest (72%). Most of the additional education services are provided by the municipal institutions of additional education (70%). A part of the respondents also attends school groups (27%), a considerably less number of them (about 12%) attends private centers, clubs and studios. The least number of respondents gets additional education services remotely, via the Internet (6%).

Being asked: "Why is sci-tech additional education necessary?", the parents answered: "to develop intellectual and creative abilities" (50%), "to upgrade technical competence and culture" and "to get involved into positive and interesting hobby" (44%). Much less number of parents treats additional education as a means of socialization. The parents as well as their children are mostly interested in the applied disciplines: "Automobile and motorbike composition and driving" (26,5%), "Sport and techniques designing (auto-, ship-, aircraft-)" (26%), " Computer graphics and web-design" (18%), "Robotics" (16,5%).

The survey showed that parents are mostly interested in their children attending CYAE institutions at primary and secondary school ages. As for children, they get interested in additional education services in the secondary school and stay interested till graduating from school. After graduating they lose their interest in additional education. It happens because their interests change and also due to the lack of opportunity to get the continuous education.

The comparative study of the survey results proved that the most popular disciplines, according to all groups of the respondents are "Automobile and motorbike composition and driving" and "Sport and techniques designing (auto-, ship-, aircraft-)". Besides, teachers single out multimedia disciplines: "Photography, filming and editing", "Computer graphics and web-design" and "Cinematography and television". Interestingly enough, the respondents almost completely ignored the CYAE programs on studying Physics, Chemistry, Medicine, Ecology, Meteorology, Computer Design, Engineering simulators and Game modeling. These data correlate with the results of the poll conducted by "Public opinion" fund [3]. Within that poll people were asked: "What professions and occupations are most necessary in Russia and in the society?" Only 9% of the respondents answered "engineers" and 4% answered "scientists".

Moreover, almost twice less number of people (4% and 2% correspondingly) believes these professions preferable when choosing a career for their children and grandchildren. The increasing demand of sci-tech additional education in terms of social mandates of different levels (state, local business) confronts the lack of its popularity (for various reasons) among children and their parents.

The problems and specifics of the CYAE system in Tyumen region are not unique. They comply with the all-Russian situation in science and technical education and are connected with the poor quality of teaching Physics, Chemistry, and Computer Science (even judging by the results of the elective USE) in school. Consequently, the respective programs of professional education also lose popularity. Thus, the USE grade point average of the entrants of technical universities in Russia in 2012 was 61.6. Only the entrants of the teacher-training and agriculture universities had lower points (61 and 53.7 correspondingly) [4]. Natural science departments are much less popular among the university entrants than management and economics ones (even in MSU) [5].

In such a situation institutions of higher education develop sci-tech additional education via interest groups, junior academies, summer schools and others, and try to deal with the issue of career guidance apart from the CYAE system. The former, unfortunately, is reluctant to promote the relations with the potential social and business partners that are of vital importance for improving the education quality and popularizing disciplines crucial for innovative development of the country.

Other sore spots of additional education are: facilities, courseware, staff and etc. At the same time modern information technologies could play a significant part in CYAE modernization, namely in Tyumen region. Prominent work was done to develop the information space. The ICT make it possible to solve many issues of additional education modernization and to develop the system of open continuous education in science, techniques and technologies. What is meant here is the creation of the educational system of "Smart Education Systems" (SES) type [6]. In other words, such a system is founded on the integration of schools and teachers, attraction of all the interested organizations and individuals for joint educational activity on the Internet. Meanwhile, all the SES educational resources are free (including remote virtual or\and real equipment). First such systems appeared in the USA and Western European countries. Now they start to function in Russia within the system of higher education, for example in MESI [7] and OmSPU [8]. The common standards for the applied technologies enable all the participants of the educational process to create, develop and use the education space resources cooperatively [9].

With the help of Smart-education technologies the main goals of sci-tech CYAE modernization can be achieved: improving the quality and accessibility of additional education innovation programs, variability of resources and education technologies for social adaptation, creative development and personal fulfillment of the younger generation, forming of values and skills for professional and general self-determination, forming of demands and opportunity of continuous education and self-education. These goals are quite possible to achieve if definite requirements are met, the ones

that fully agree with the idea of Smart-education with its key principles: *integration* and *openness*.

Integration of the educational resources (general and additional education, professional education) into the common education space, while preserving the specifics of the resources and educational technologies of each educational level, improves the quality, accessibility and mobility of the continuous educational programs. Inter-agency and inter-industry cooperation will enable to develop the contents of additional education programs, the forms and technologies of the educational process in correspondence with changing demands of children and their parents and implementation of the federal and regional education development programs. It will become possible to introduce cutting-edge pilot multilevel educational programs meant to develop the innovative activity competences, including those that are top-priority disciplines in science, technique and technology. Inter-agency integration will help to prevent the "wash-out" of the most resource-intensive and expensive educational programs in the field of technical and scientific research of students, those programs that are so important for the innovative development of the economy.

"Internet access" should be guaranteed for all who are interested in promotion and development of additional education in order to organize and support various children and youth public scientific groups within the popular social networking sites (VKontakte, Odnoklassniki, Moi Mir, Facebook, Twitter and others). Pedagogical assistance and participation of teachers, scientists and business partners will stimulate efficient positive activity in the socially significant projects in top-priority disciplines. Such projects could partially compensate the lack of the CYAE programs for working with senior secondary school students, students of institutions of primary and secondary vocational education and children (and adults) with disabilities.

Open continuous education (advanced training, professional development) of teachers in the CYAE system and their participation in research projects in the institutions of higher education, research institutions and in-company training centers in the framework of the system of distant methodological support for the specialists of the additional education system will help solve the staff issues. This system will be provided with professionally skilled specialists ready to handle update professional tasks.

Pilot projects play the most important role at the development stage of any education modernization program, as it is of vital importance to "provide forward-looking research experimenting, check advanced models of educational institutions and systems before introducing them to the public" [10;9]. Pilot educational programs, based on intensive use of ICT, are essential from the point of view of motivation and immediate assistance for students mastering basic skills [11], and later research skills [12].

An example of a pilot educational sci-tech program, aimed at priority technologies development, is an additional education program on the net technologies, realized with the help of Smart-education technologies in the Institute of Mathematics and Computer science in the Tyumen State University. The training courses of the company

Cisco Systems, adjusted for various levels, provide flexible, variative and continuous specifics of additional education based on the innovative character of the educational contents and forms meant to develop the scientific and technical creative abilities. The program includes the interconnected consistently implemented modules that presuppose the gradual realization of long-term individual educational routes. Training could be started from the age of 14-15, after a student have acquired the basic skills necessary for successful and effective work with the computer, computer networks and the Internet (sub-program CCNA Discovery). It allows to begin one's professional activity as a network equipment set-up specialist or a system manager. CCNA Discovery is continuous and gradual and includes four parts: "Networks for home users and small enterprises"; "Work in small and medium-sized enterprises and for Internet services providers"; "Introduction to routing and commutation at an enterprise"; "Development and support of computer networks". Despite the fact that the names of the parts signal about their practical slant, great attention is paid to motivation encouragement – the further fundamental study of network technologies and pursuing careers in this area. Training technologies use interesting interactive approach that helps receive practical experience while working with virtual and real equipment that could be distantly controlled, participating in webinars and carrying out projects. The follow-up sub-programs on network technologies (wireless technologies, IP telephony, information security and so on) gradually provide students with enough knowledge to be a network technologies instructor with the right to hold official examinations for a professional certificate.

This continuous educational program is inter-agency and international. It is implemented within the certified network academy of the Cisco Systems Corporation that has been working successfully in the Tyumen State University for more than 10 years. This academy is one of the biggest in Russia and CIS countries by the number of students. The quality of training is verified by the official certificates of the participants, by their winning the contests in network technologies held by the Cisco Systems Company and by the professional development of the students and graduates. It seems appropriate to recommend the introduced pilot educational program as the basis for the development of continuous sci-tech additional education programs, as it provides the most important characteristics of Smart-education. However, it should be noted here that educational programs for early age training require detailed psychological and pedagogical study and students' support.

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