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TO THE PROBLEM OF REALIZATION STEM-EDUCATION IN UKRAINE

ДО ПРОБЛЕМИ РЕАЛІЗАЦІЇ STEM-ОСВІТИ В УКРАЇНІ

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Urgency of the research. *STEM-education in Ukraine is in the stage of formation, its implementation is through the reform of school education, namely, the reform of the "New Ukrainian School". Digital technologies, as an integral part of STEM-education in modern life, occupy a special place in the educational space for the sake of accessibility, integrity, relevance and openness of information. The relevance of the topic is due to the lack of research on STEM-education productivity in Ukraine, which would allow for a developed system of competencies, advantages, perspectives and problems in the process of education of lifelong learning.*

Target setting. *Paying attention to the material, technical and methodological support of secondary education in Ukraine, the question arises whether the effective and productive process of implementing STEM-education even as a pedagogical experiment.*

Actual scientific researches and issues analysis. *The following scientists were investigating STEM-education in Ukraine: V. Voronkova, O. Kyvlyuk, S. Kutsepal, V. Nikitenko and others. In the world, STEM-education was consider as the driving force of the future R. Andryukyitene, M. Midga T. Perrault, and others like that.*

The research objective. *Among the challenges, facing STEM-*

Актуальність теми дослідження. *STEM-освіта в Україні знаходиться на етапі становлення, її впровадження відбувається шляхом реформування шкільної освіти, а саме реформи "Нова українська школа". Цифрові технології як невід'ємна частина STEM-освіти сучасного життя посідають особливе місце у освітньому просторі задля доступності, цілісності, актуальності та відкритості інформації. Актуальність тематики викликана відсутністю досліджень продуктивності STEM-освіти в Україні, що дозволило б сформовану систему компетентностей, переваг, перспектив і проблему процесі освіти впродовж життя.*

Постановка проблеми. *Звертаючи увагу на матеріально-технічне, кадрове, методичне забезпечення середньої освіти в Україні, постає питання чи є дієвим та продуктивним процес впровадження STEM-освіти навіть як педагогічний експеримент.*

Аналіз останніх досліджень і публікацій. *STEM-освіту в Україні досліджували наступні науковці: В. Воронкова, О. Кивлюк, С. Куцепал, В. Нікітенко та інші. У світі розглядали STEM-освіту як рушійну силу майбутнього Р. Андрюкайтене, М. Мідга Т. Перро тощо.*

Постановка завдання. *Серед завдань, що постають*

education in Ukraine is the definition of the capabilities of a "universal" teacher of STEM disciplines in modern realities.

***The statement of basic material**. There is currently no specific mechanism for the implementation and implementation of STEM-education, which would provide a continuous process for preparing the "human of the future". Given the concept of Nursing, it can be argued that STEM-education is a significant place among its main provisions.*

Considering STEM-education as a whole, it is clear that the Ukrainian educational space is a basic system for achieving the main goal of reform, which is possible in the ideal educational environment.

***Conclusions**. One of the conditions for the formation of an ideal educational space is the preparation of a "universal" teacher of STEM-disciplines in modern realities.*

Experimental STEM-education in Ukraine requires the development of new techniques and educational and professional training programs for STEM-discipline teachers.

***Keywords:** STEM-education, reform of school education, lifelong learning, "universal" teacher, "human of the future", STEM-discipline teachers.*

перед STEM-освітою в Україні є визначення можливостей підготовки "універсального" вчителя STEM-дисциплін у сучасних реаліях.

***Виклад основного матеріалу.** Зараз не існує конкретного механізму впровадження та реалізаціїSTEM-освіти, який би забезпечив неперервний процес підготовки "людини майбутнього". З огляду на концепцію НУШ, можна стверджувати, що STEM-освіта посідає значне місце серед її основних положень.*

Розглядаючи STEM-освіту в цілому, зрозуміло, що український освітній простір – це базова система для досягнення основної мети реформи, яка уможливлюється за ідеального освітнього середовища.

***Висновок.** Однією з умов формування ідеального освітнього простору є підготовка "універсального" вчителя STEM-дисциплін у сучасних реаліях.*

Експериментальна STEM-освіта в Україні потребує розробки нових методик та освітньо-професійних програм підготовки вчителя STEM-дисциплін.

***Ключові слова:** STEM-освіта, реформа шкільної освіти, безперервне навчання, "універсальний" вчитель, "людина майбутнього", вчитель STEM-дисциплін.*

Urgency of the research. Digital technologies as an integral part of STEM-education of modern life occupy a special place in the educational space for the sake of accessibility, integrity, relevance and openness of information in the process of education throughout life. The relevance of the topic is due to the lack of research on STEM-education productivity in Ukraine, which would allow for a developed system of competencies, advantages, perspectives and problems.

Ukrainian education is at the stage of innovation. The key features of STEM education are important for the preparation of the "human of the future". In Ukraine, STEM-education is aiming at the accessibility and practical direction of obtaining knowledge and competencies from the disciplines of the natural and mathematical cycle for any student. Although such an educational system is not perfect in terms of in-depth study of mathematics, physics or chemistry, since the acquired knowledge has an applied synthesized character without adequate theoretical substantiation.

Target setting. As the conditions of a modern Ukrainian school for the introduction of STEM-disciplines, professional skills and abilities of a modern teacher, methodological tools meet the concept of NUS. Given the realization of STEM-education in Ukraine, there is a certain problem: the change of teaching methods of disciplines, material and technical, staffing, methodological support, etc.

Actual scientific researches and issues analysis. Scientists from different fields in their work consider the problems and tasks of STEM-education in Ukraine and in the world. In the opinion of V. Voronkova, O. Kyvlyuk, STEM education is one of the main trends of the information and innovation society (S - science; T - technology; E - engineering; M - mathematics) includes the preparation of creative personality's necessary for the cultivation of society, innovative, which by nature is a smart-society [1]. S. Kucepal believes that STEM-education provides an opportunity to implement integrated, interdisciplinary and design approaches to learning [3]. Not only does M. Midga, who proposes to actively use computer-learning video games in the process of STEM-education [6], consider the educational aspect. Unlike STEM-education, T. Perrault, STEAM-education, which combines STEM-education with art, becomes a new education [7].

The research objective. The current state of STEM-education is closely link to digital learning technologies. It is necessary to establish a link between the global trends in the implementation of STEM-education and the implementation of this program in Ukraine in accordance with the methodological recommendations developed by the Ministry of Education and Science of Ukraine. Explore the prospects for STEM-education as a conceptual component of digital technology in the context of creating the ideal conditions for the provision of appropriate educational space.

Among the challenges, facing STEM-education in Ukraine is the definition of the conditions for the development of the competences of the "universal" STEM-teacher and the analysis of the psychological, pedagogical and professional skills of the modern teacher, which they should be in the context of universality.

The statement of basic material. The real state of affairs shows that with every day in most of society there is a need to use ICTs that have become an integral part of everyday life. In this case, the fact that

the overwhelming majority uses ICTs for their own enjoyment (social networks, video resources, virtual games, etc.) deserves special attention. ICT is one of the leading means of learning that enables the processes of informatization of education.

According to O. Kyvlyuk, informatization of education has led to the emergence of a socio-cultural phenomenon of lifelong learning or life-long learning, which is realize through self-education and distance learning [2]. Continuing education stimulates the self-development of each person, promotes the development of competencies in a particular industry or system, helps to adapt to fleeting social changes and creates the optimal conditions for the development of personal characteristics.

In works written by V. Voronkova and O. Kyvlyuk STEM-education is consider as "innovation, which combines the traditions of natural and mathematical education, is based on the principles of fundamentalism and science-intensive, combines technological, organizational, material and technical resources and human capital" [1, p. 172].

STEM education is innovative for the Ukrainian educational space. With this thesis, one cannot but agree. The formal combination of natural and mathematical disciplines into a coherent structure makes it possible to solve most of the problems of teaching and perception by students of natural and mathematical disciplines at school. According to the principles of STEM-education, everyone has the opportunity to master STEM-disciplines through a practical aspect.

However, according to S. Kucepal, STEM-education provides "the autonomy of the one who receives knowledge (pupil, student, master student), the consequence of which is the development of autonomy and responsibility for their own decisions, the ability to perceive their mistakes as a springboard for future success; the solution of the problem is not in a theoretical plane, but in a practical one; comprehensive teaching of disciplines (natural sciences, mathematics, computer science); use of game and training techniques" [3, p. 11].

The specialists of the Ministry of Education and Science of Ukraine developed methodical recommendations for the implementation of STEM-education, which provides an explanation for the definition of the concept itself. "STEM-education is a category that defines the appropriate pedagogical process (technology) for the formation and development of mentally-cognitive and creative qualities of youth, whose level determines the competitive ability of the modern labor market: the ability and readiness to solve complex problems (problems), critical thinking, creativity, cognitive flexibility, cooperation, management, implementation of innovation activity" [4, p. 2].

In a broad sense, STEM-education is a program aimed at developing personal qualities, through which a high level of competitive ability of the "human of the future" is form. After all, the integrity of thought from different sides to the same problem gives the opportunity to solve the practical task as quickly as possible. Of course, the realization of such a

project is not possible within one or several years, this requires much more time. There is a hope that attracting private sponsors will accelerate the stages of formation and development of STEM-education, with sufficient level of material, technical, methodological, staffing, etc.

World experts see that the STEM-education project has a perspective, so many countries offer certified state educational programs in the scientific and technical field and train STEM-specialists. STEM-education is traditionally define as an approach to the educational process, which facilitates the acquisition of knowledge through practical understanding of concepts and processes. The practical aspect makes it possible to go deeper into the concepts that are consider during the study. It is the practical part of the training that plays an important role in the educational reform of the "New Ukrainian School".

In our opinion, realization of the basic principles of the "New Ukrainian School" is possible only under ideal conditions. Even in physics, the notion of "ideal state" is not use, since such a state does not exist in any environment. Consequently, we cannot argue that the reform under the name of NUS will be effective and effective. A large-scale reform process requires constant adjustments, clarifications, and recommendations.

In order to introduce STEM-education in the secondary and high school from the point of view of didactics, methodical recommendations, teaching aids, textbooks, visual aids, etc., with which the preparation of the "human of the future" is carry out, is necessary. In addition, it is necessary to provide schools for STEM-discipline teachers, which requires changes in the educational process of higher education institutions.

To successfully implement the reform of the "New Ukrainian School" it is necessary to prepare "universal" teachers of STEM-disciplines. To solve this problem, there are several possible options: teachers with many years of experience are refined through self-education, self-development; young specialists can receive refresher courses, second higher education, principles of continuity in education; introduction of educational-professional programs in the pedagogical institutions of higher education on the preparation of the "universal" teacher of STEM-disciplines.

Educational programs of institutions of higher education are attempting to issue specialists of interdisciplinary branches for several years. For example, the National Pedagogical Dragomanov University has educational programs in which graduates receive qualifications not only in one specialty such as: "Mathematics, Physics, Informatics", "Informatics, Mathematics/English", "Biology/geography/chemistry, Foreign Language" and others. Perhaps such trends in the development of interdisciplinary specialists are promising, but the quality of knowledge does not disappear with a large number of multidisciplinary disciplines.

The question arises as to how it is necessary to create at least STEM-course teacher-training courses at the initial stage of STEM-education implementation; the answer is obvious - yes. In the future, it is possible to create educational programs “STEM-education” for the second level of higher education with the term of study 1 year 10 months as a cross-entry, that is, the second higher education at the level of the master's degree. The main task of such an educational program should be to prepare a specialist in STEM-disciplines and to write qualifying papers that will become pilot sites for the development of teaching methods for STEM-education in schools of the future. This will ensure a sufficient level of teacher training, which will work in the Ukrainian school and implement the principles of STEM-education.

According to the authors of the concept of the “New Ukrainian School”, the changes are based on the following factors: “According to expert estimates, the most successful in the labor market in the near future will be professionals who can learn throughout life, think critically, set goals and achieve them, work in a team, communicate in a multicultural environment and possess other modern skills” [5, p. 8].

At this stage, a modern Ukrainian school has a transitional aspect with elements of STEM-education. Schools cannot provide a complete transition to the preparation of a “human of the future”, since there is no definitive teaching and methodological and logistical support, and any educational, scientific or educational activity should begin with this.

The real condition of the educational space of Ukraine shows the shortage and staffing of schools and institutions of higher education, most modern educators themselves cannot think critically, do not have modern information technology teaching. The classical psychological and pedagogical principles of teacher training do not satisfy the needs of modern society in the education of the “human of the future”.

Conclusions. Given the current stage of education in Ukraine, the question is whether it is too early to introduce STEM-education even as a pedagogical experiment. It is not yet clear how and who should work in schools in the context of the reform of the “New Ukrainian School”, as STEM-education. What should be the teacher who prepares the “human of the future”? You may need to deviate from the classical principles of teacher training and introduce new training methods in STEM-teacher pedagogical institutions.

How is the educational process, selection of personnel and implementation of STEM-education implemented through the reform of the “New Ukrainian School”? Let us try to answer these and many other questions in the next scientific research.

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