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### «STEM-EDUCATION» AS ONE OF THE MAIN TRENDS OF INFORMATIONAL AND INNOVATIVE EDUCATION OF THE POST- COLONIAL WORLD

«STEM-ОСВІТА» ЯК ОДИН З ГОЛОВНИХ ТРЕНДІВ  
ІНФОРМАЦІЙНО-ІННОВАЦІЙНОЇ ОСВІТИ

V. H. Voronkova, V. O. Nikitenko

**Актуальність дослідження**  
обумовлена процесами глобалізації та  
переходу суспільства на вищий рівень

**Urgency of the research** is  
conditioned by the processes of  
globalization and the transition of the

розвитку – «цифрове суспільство», що характеризується високотехнологічними змінами в різних сферах життєдіяльності людини.

**Постановка проблеми.** Яке місце та значення STEM-освіти в процесі культуротворчості та формування креативної особистості.

**Аналіз останніх досліджень і публікацій.** Вивченню STEM-освіти та цифрового суспільства присвячені праці таких іноземних та вітчизняних вчених, як: Андрюкайтене Р., Пэлфри Дж., Смолл Х., Г., Хойслінг Р., Фукуяма Ф., Кивлюк О., Олексенко Р., Рижова І., Соснін О.

**Постановка завдання.** Визначити ряд практичних рекомендацій щодо формування концепції STEM-освіти.

**Виклад основного матеріалу.** Проаналізовано STEM-освіту як сучасний соціальний та культурний феномен, який є фундаментальним в сучасній освіті інформаційно-інноваційного суспільства. Stem-освіта розглядається як основа підготовки висококонкурентних спеціалістів, здатних стати креативною основою формування інноваційно-інформаційного суспільства, яке є високотехнологічним, високорозумним, що потребує виховання креативної особистості, креативної освіти, креативної творчості.

**Висновки.** Доведено, що в основі STEM-освіти процеси культуротворчості, яка є основою проективно-конструктивістської діяльності, метою якої є створення нових об'єктів, що задовольняють потреби людини.

**Ключові слова:** STEM-освіта, культуротворчість, суспільство, SMART-суспільство, людина.

society to a higher level of development such as "digital society", which is characterized by high-tech changes in various spheres of human life.

**Target setting.** What is the place and importance of STEM-education in the process of cultural creation and the formation of a creative personality.

**Actual scientific researches and issues analysis.** The works of such foreign and national scientists as R. Andriukaitene, Dzh Pelfri, H. Smoll, R. Khoislynh, F. Fukuiama, O. Kyvliuk, R. Oleksenko, I. Ryzhova, O. Sosnin, are devoted to the study of STEM-education and digital society.

**The research objectives.** To identify a number of practical recommendations as to the conceptualisation of STEM-education.

**The statement of basic materials.** STEM-education was analyzed as a modern social and cultural phenomenon, which is fundamental in the modern education of the information and innovation society. STEM-education is considered as the basis for the preparation of highly competitive specialists who will be able to become the creative basis for the formation of an innovative information society, which is high-tech, advanced intelligence, which requires the education of a creative person, creative education, creative activities.

**Conclusions.** It is proved that cultural creativity processes, which is the basis of a projective-constructivist activity underlie the STEM-education. The purpose of a projective-constructivist activity is the creation of new objects that can satisfy human needs.

**Keywords:** STEM-education, cultural creativity, society, SMART-society, human.

**Urgency of the research** is conditioned by the processes of globalization and the transition of the society to a higher level of development

such as "digital society", which is characterized by high-tech changes in various spheres of human life.

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**The research objectives.** To identify a number of practical recommendations as to the conceptualisation of STEM-education.

**The statement of basic materials.** Stem-education is an innovation that combines the traditions of natural and mathematical education and is based on the principles of fundamentalism and research intensity, combining technological, organizational, material and technical resources and human capital. As a result of stem-education development and thanks to ICT, business processes and governance are changing and management is being reformed, taking economic, social and managerial processes at a higher level of the society quality.

Two more terms have appeared on the basis of stem, which include:

- 1) steam - science, technology, engineering, art, mathematics;
- 2) snntrem - science, technology, robotics, engineering, mathematics.

Stem-education is one of the main trends of the information and innovation society (S-science; T-technology; E-engineering; M-mathematics) and it includes training of creative personalities necessary for cultivation of the information and innovation society, which is a smart society by its nature.

Stem-education is the basis for training of highly-qualified specialists who can become the creative basis for formation of the innovation and information society, which is high-tech and highly intelligent, which needs upbringing of a creative personality, creative education, creative creativity. These processes are the main trends of the world development and the main trends of the innovation and information society, which evolves into the noosphere society (the society of mind, intelligence, science, morality, justice, creativity).

Cultural cultivation is related to the work with large volumes of analytics data (Big Data) needed for creativity, and to the use of an array of unstructured knowledge (Data Mining) for decision-making in various fields of activity and for creativity. To make the processes of cultural cultivation fundamental at school (higher, secondary), the person must acquire the foresight to build such activity that would allow a person to get a guaranteed (necessary) result.

Cultural cultivation of stem-education is based on the reflection of the structure of project and constructivist activity, which is based on the

management of creative activity projects of (robotics, nanotechnology). The purpose of stem-education is to receive innovations for the needs of the man and it is suitable for design and creative activity, since it is based on the design or construction of an object. The instrumental model we are working on is a cognitive artifact, which is based on:

- 1) the conceptual (explanatory) ideal model, removed by the notion of "design";

- 2) the design model (praxeological), which complements the conceptual one and merges into a constructive and creative methodology that combines theory and practice.

Stem-education is not only a scientific and cognitive theory, but also practice that helps to regulate cognitive activity, in the basis of which there are the processes of cultural cultivation [1].

The constructive methodology of cultural cultivation is a methodology of creative activity, which should be cultivated by school and to be based on design and construction of the process of cognition and its objects. The basis of the constructive methodology is the model and process of construction, which is considered as a cognitive artifact and includes a conceptual (explanatory) and instrumental (prescriptive) components of the creative and cognitive process.

A model as a project of an object includes not only a reflection or a copy of a certain state of affairs, but also a representation of future practice. Therefore, the author of the object must move from the ideal model of design to the solution of problems in a particular historical and cultural or industrial sphere. The instrumental model of the constructed object acts as an additional value (intellectual value) to the conceptual one and represents a system of specific procedures for the transition from "the existing to the right one". From the point of view of philosophy, the conceptual model of the object is a theoretical justification of an instrumental model that allows reconstructing various fields in the direction of the information and innovation society formation, that is, introduction of innovations.

Stem-education is the basis of the smart society formation, that is dictated by the system of competitiveness of both education and the state, and serves as the basis for transforming society from information to the "knowledge society", and from it to the "smart society", to serve as the basis for high-tech development of the society and it needs training of highly competent and creative personalities. And this is the key task of higher and secondary schools, which require the formation of an effective educational environment and highly qualified specialists in all spheres of activity.

Activation of stem-education development is the key to solving many problems of school reform under the conditions of globalization, information

society and "knowledge society". In the United States, the activity of stem is coordinated by the so-called stem-education coalition, which includes more than one thousand highly professional specialists that combine such areas as biomedicine, computer and information technology, nanotechnology, mathematical biology, bioinformatics, computer security, mathematics, economics, finance, international affairs, social behavioral sciences and others that general improve the effectiveness of Stem-education. In the United States, the following areas require stem-education specialists: automotive, construction, financial services, national security, transport, aerospace, biotechnology, advanced industrial technology, energy, healthcare, information technology, and others. On July 6, 2009, the US Congress adopted the STEM Education Coordination Act of 2009. There are suggestions for such centers to be created in Ukraine at leading educational institutions of Ukraine and at the Ministry of Education, which is interested in forming stem-education. Therefore, we want to suggest some advice that would help shape the concept of stem-education.

It is necessary to form stem-competency, because stem-professions will have to have sufficient stem-skills: creativity, non-standard thinking, critical and system thinking, critical attitude to information, innovative thinking, ability to form own judgments, ability to work analytically, social and civic competences, intelligence.

In addition, stem-competency requires the use of design and programming, design research information and communication technologies, life-long learning skills, ability to work in the information space and work in the team, predict own activities from stem-education to stem-career, manifest maker`s ability (maker is a person who creates something), promoting self-realization of personality.

The main thing is to form stem-competences and then to head to the stem-profession, using foreign languages, mathematical competence, research competence, ability to work in a team, information and digital competence, relevant information culture and the corresponding level of research work.

Stem is an orientated approach to learning, which means the technology of forming and development of intellectual, cognitive and creative qualities of the youth, the level of which determines their competitiveness on the modern labor market. Stem-education is carried out through an interdisciplinary approach to building curricula, and learning is based on creativity, living imagination, ability to make decisions quickly when circumstances change and have a well-developed intuition. Foreign scholars point out that the future belongs to three key areas: IT, biology and agriculture. It is expected that in 2025 employment in stem-professions, that are based on knowledge and require

high qualification, will increase significantly throughout the world. In addition, the requirements for qualification of specialists in the majority of branches will increase too. Attracting 1% of the population to stem-professions increases GDP by 50 billion dollars.

### **Practical recommendations**

1. To develop and implement a Strategic Plan of Stem-Education every 5 years, which should include short-term and long-term priority scientific directions and programs, to determine common dimensions of the country's progress and its International development indices in achieving its goals.

2. Encourage investment in the development of Stem-education, attracting advanced scientific forces and the youth in this field, contributing to financing of scientific projects on the identified issues.

3. To introduce the specialty of smart-manager and Stem-education with junior specialist diplomas and to extend the training to the master's educational level with Stem-education, expanding new disciplines from the specified profile and providing their teaching by highly skilled personnel.

4. To prepare qualified pedagogical staff able to work in the field of Stem-education, aimed new economy formation.

5. To establish a close relationship between schools, universities, institutes and academies that would work and carry out joint scientific programs and projects and would perform training in these areas, by implementing the "effect of spreading knowledge in Stem-education in breadth".

6. Involve young people in research work for the needs of the new economy, which would be actively involved in research projects and the latest innovative technologies.

7. Each of the academic centers of educational institutions should develop clear standards for nano-science and nano-technologies in order to add them to the following options for changing the curriculum of the school system.

8. Educational institutions should develop new national standards responsible for developing new national standards for Stem-education, develop nano-disciplines and implement them in the school system, cultivating creative thinking and creative personalities.

9. Develop new information and communication technologies that can promote the transition of the information society to the "knowledge society" and the "smart society", which cultivates Stem-education, broadband networking opportunities, distance education, e-learning (education) as a tool for training highly specialized and highly qualified educators.

10. To form a creative personality capable of working in the innovation-information-noosphere society.

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### ГЛОБАЛІЗАЦІЯ ЯК ПЕРЕДУМОВА І КОНТЕКСТ КОМПЛЕКСНОГО ВПЛИВУ НА РОЗВИТОК ОСВІТИ *GLOBALIZATION AS A PRECEDENCE AND THE CONTEXT OF A COMPREHENSIVE IMPACT ON THE DEVELOPMENT OF EDUCATION*

О.С. Кондур

**Актуальність дослідження.** Відзначається, що освіта повинна бути реконструйованою до вирішення завдань науково-технічної революції, а глобалізація і технологічна революція мають бути використані для радикальної перебудови освіти у напрямку її демократизації і прогресивних соціальних змін, оскільки у вирішенні цих проблем необхідно зробити освіту суспільним інститутом в інтересах соціальної більшості як це і пропонують представники сучасної педагогіки.

**Постановка проблеми.** Усі процеси сучасної світової системи освіти функціонують в умовах глобалізації. Тому важливим є розглянути тенденції освіти та її моделі й інститутів у контексті глобалізованого суспільства сучасності та особливості взаємовідношення освіти і соціуму, людини і держав.

**Аналіз останніх досліджень і публікацій.** Проблема глобалізації освіти розглядалась у працях С.Джіл, К. Ліссмана, Д. Козол, Б. Ліндсі, П. Кругмана, Д. Стігліца, Д. Варвік, М. Квик та інших. Теоретико-методологічними напрацюваннями з даного напрямку як основи дослідження є перш за все –

**Urgency of the research.** It is noted that education should be reconstructed to meet the challenges of the scientific and technological revolution, and globalization and technological revolution should be used to radically reorganize education in the direction of its democratization and progressive social changes, since in solving these problems it is necessary to make education a public institution in the interests of the social majority, as it is suggested by representatives of modern pedagogy.

**Target setting.** All processes of the modern world education system function in the context of globalization. Therefore, it is important to consider the trends in education and its model as well as institutions in the context of the globalizing society of our time and features of the relationship between education and society, person and the state.

**Actual scientific researches and issues analysis.** The problem of the globalization of education was considered in the works such scientists S. Dzhill, K. Lissmana, D. Kozol, B. Lindsy, P. Kruhmana, D. Stihlitsa, D. Varvik, M. Kvyk and a lot of other. Theoretical and methodological developments in this area as the basis of