

## Specificities of technology-enhanced learning in technology and entrepreneurship

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**Abstract** – One of the guidelines for the development of modern education is to improve the quality of the educational process through modernization and digital transformation. The integration of digital information and communication technologies in the practice of education in the subject "technology and entrepreneurship" is the main means of its updating and optimization. Modernization is sought in the rational synthesis of classical and computer-based pedagogical technologies, application of new methods and forms of learning, new approaches to learning and teaching. Network connectivity and computer-mediated communications are changing the model of secondary level technology education.

The peculiarities of the technology and entrepreneurship curriculum and the practical-applied nature of the learning process determine specific requirements when designing variants of pedagogical design, organization of the learning environment and applied management interactions. Computer-assisted learning is identified with a new integrative communicative learning system. The article presents a structural schematic model of the learning process in technology and entrepreneurship with information and communication technologies integrated to varying degrees. Based on the classic information management models, the proposed version recreates the complex multidirectional interactions between participants in the learning process, having disparate digital tools and Internet services. The model reflects variations of different forms of e-learning and hybrid learning, providing personalized and constructivist learning in technology-enabled, augmented or ubiquitous learning environments.

Technologically enhanced education in technology and entrepreneurship has a complex nature and requires coordination of methodical, didactic and technical means and resources aimed at stimulating greater independent cognitive activity of learners. The use of ICT changes the functions performed by the teachers and places high demands on their digital pedagogical competences.

*Keywords – Technological Training, Technologically Enhanced Training, ICT, Computer-Mediated Training*

### I. INTRODUCTION

Digitization of the learning process is a key element of the modern school through which the learning process is optimized, its efficiency increases and the introduction of ICT-based innovations is supported [7].

The integration of ICT in the practice of learning in individual subjects is a social necessity determined by technological development and the

need to meet the educational needs of modern learners.

One of the priority areas for the development of Bulgarian education is "Educational innovations, digital transformation and sustainable development". Innovations in education aim to change the culture of teaching and create a more attractive learning environment, as well as increase the efficiency of the educational process [7].

ICT-based pedagogical technologies represent a complex of methodological, psychological, pedagogical, program-technical and organizational means for training or learning management, designed to intensify the independent cognitive activity of students and the implementation of human-machine solutions to educational and practical tasks [5].

The learning process where the activities are supported by ICT is identified in the scientific literature as technology-enhanced learning (TEL). In this sense, the term TEL can be used as a synonym for E-Learning, but TEL focuses on pedagogical approaches, on the interaction between educational activities and relevant information and communication technologies.

The optimization of learning with electronic means implies a reasonable synthesis of classical and ICT-supported pedagogical technologies. Balanced use of digital educational solutions and traditional learning is an essential task for the national educational practice.

In terms of content and process, the training in "technology and entrepreneurship" is a type of educational school activity with a specific mission regarding the preparation of adolescents. The objectives of the subject are related to the formation of basic technological literacy, initiative and entrepreneurship. The educational process in technology and entrepreneurship creates prerequisites and offers rich and diverse opportunities for the application of different forms of learning through computers or other modern technologies, but also integrated with traditional pedagogical technologies, under the guidance of the teacher.

Computer-mediated forms of learning and teaching can be operationalized as specific structural elements or peculiar teaching methods in individual types of lessons. The practically applied nature of technological learning implies a specific organization of the educational environment, complex interactions, new functions and roles and specific requirements when drafting a pedagogical design.

Digital technologies, the global network and cloud information services create conditions and prerequisites for the confirmation of new strategies for teaching and learning management, the construction of a new integrative communicative

system of learning, the implementation of a new educational model supported by ICT means.

## II. MATERIALS AND METHOD

In the modern information society, also defined as the knowledge society, technological knowledge and skills are the main resource of the individual, the enterprise and economy in general, technological culture is an essential element of literacy. W. Dugger [2] defines technology as the innovation, change or modification of the natural environment to meet human needs. In this sense, technology is not identified only with ICT, but has a much wider scope.

The standards adopted by the International Technology and Engineering Educators Association (ITEEA) in 2020 state that technological literacy is not limited to the ability to use digital tools [3]. A technologically literate person uses system orientation, understands how technologies interact with the technological world, how this interaction affects people in society and the environment. Technological literacy is the ability to use, manage, define and understand technology. It includes knowledge, abilities and their application in real work situations [3].

As an element of the general educational training system, technology and entrepreneurship training is oriented towards acquiring knowledge about the factors of social well-being and skills to achieve it. Educational activity is aimed at forming students' technological literacy and competence, as an essential element of their general culture.

The specific goals of the Technology and Entrepreneurship training at the secondary school stage (grades 5-7) are:

- building students' basic technological competence,
- starting the formation of the "initiative and entrepreneurship" key competence,
- forming an attitude towards a healthy and safe lifestyle and work,
- creating conditions for a conscious choice of education and profession.

Technological competence is associated with the use of techniques for manual and machine processing of materials, independent development of projects through the application of accessible software products and digital means of communication and control. For the manifestation of initiative and entrepreneurship, entry into a real

economic environment, study of good entrepreneurial practices, expression of entrepreneurial initiative is foreseen [10].

In secondary level technological education, ICT is the object of study and a means of practically applied activity of the learners. They are an important element of the educational environment and a tool for digital learning.

Constructing a design for computer-mediated learning in technology and entrepreneurship is closely related to the construction of a learning-supportive, technology-rich subject information educational environment. Managing learning in this environment requires complex coordination, optimal distribution of the functions of the teacher, the students and digital technologies. An important condition for the effective integration of pedagogical and information and communication technologies are the means of management in the technologically provided classroom.

The educational environment is defined by Dimov [1] as an integrative, communicative system of functionally related material and didactic means, enabling the teacher and the student, using active learning methods, to carry out productive activities.

The diversity of digital technologies provides opportunities for self-construction of knowledge, but poses different didactic management challenges.

Interpreted from a cybernetic point of view, the learning process of computer-assisted learning in technology and entrepreneurship is a complex of interacting elements.

A number of schematic models have been created in order to depict the complex interactions between the participants in the learning process carried out in the computer-provided learning environment. In

many of the models, part of the teaching functions are performed by computer training programs. These models, however, characterize only some of the forms of e-learning. The model should reflect the procedural nature of the integration process and describe options for using various forms of e-learning.

Most of the structural schematic models described in the scientific literature present the learning process as a relatively closed system. The global network, mobile technologies and cloud resources and services allow enormous expansion of the educational space. Mobility enables ubiquitous access to information, resources and tools.

Leading approaches to technology and entrepreneurship education are learning by doing, learning by inquiry, project-based learning. The implementation of these approaches implies the use of various tools, appliances, devices, some machines, various construction materials. In other words, an important element of the educational environment is the means and objects for practical activity, and in the learning process complex interactions between teachers, students, ICT, means and tools for practical activities are realized.

### III. RESULTS

The process of technological learning with integrated digital information and communication technologies can be represented by a model reflecting the complex nature of the integration process and the peculiarities of the dynamically changing educational environment. The model is visualized graphically as follows:

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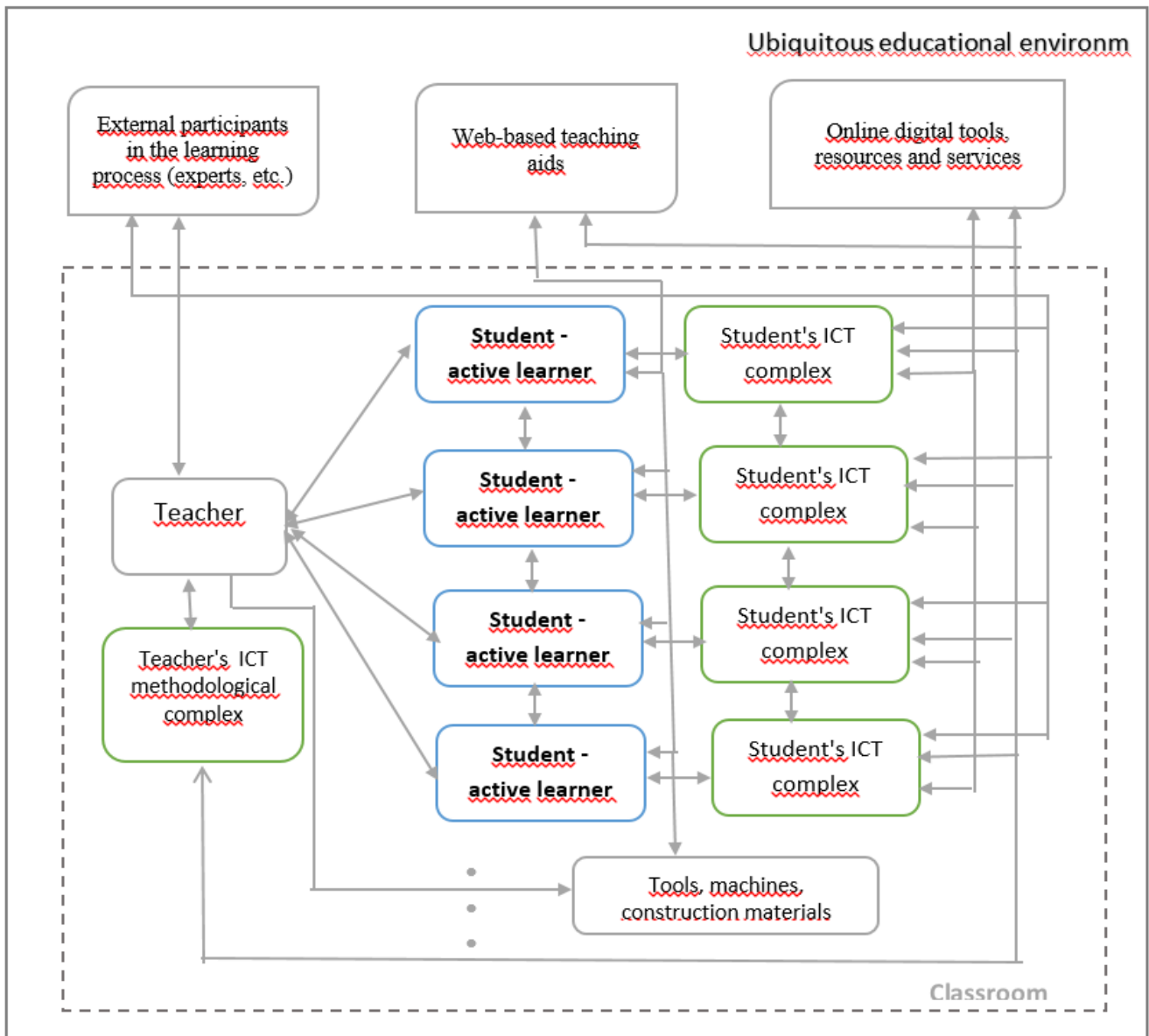


Fig. 1 Model of technology-assisted learning in technology and entrepreneurship

Students' ICT complexes contain a variety of digital tools and resources selected depending on the set didactic goals, the personal preferences of the learners and other factors determining the choice. For educational purposes, program pedagogical tools, reference and information tools, digital tools for practical informational and creative activity, applied software for solving design, technological or project learning tasks and many other digital technologies can be used.

The complex ensures the systematic use of ICT elements when learning certain educational content or performing educational cognitive, practical, project or research tasks.

For each organizational form, the teacher situates a methodological complex of ICT through which he/she implements successful teaching, effective

electronic communications, organization and management of the educational cognitive activity of the learners. Digital technologies can also be used to assess learning outcomes.

The teacher's methodological complex also includes some specialized pedagogical tools such as methodological developments and resources, digital tools for the design of didactic materials and training tools, learning management systems, electronic educational resources, applied software for managing project activity and learning, etc.

At the center of learning is the individual learner who is expected to actively acquire knowledge in joint activity with other students. Jonassen [4] believes that ICT should be "an intellectual partner" stimulating learners to use their mental potential to

the maximum in the process of cognition and in taking greater responsibility for their own learning.

The information-subject environment covers the means and technologies for collecting, storing, processing and transmitting educational information, the means of presenting and extracting knowledge, the means of training ensuring mutual connection and functioning of organizational structures of pedagogical interactions. This environment creates conditions conducive to the disclosure, development and realization of the intellectual potential of the individual in accordance with the learning objectives.

The teacher organizes the functioning of the management system. He/she predicts, models, guides and coordinates the activity of students in a complex environment with different time and place communication impacts. The pedagogue selects and combines a system of appropriate technological means for training, a program resource and other digital tools that meet certain didactic requirements. The pedagogical functions of the teacher are more indirect. The teacher facilitates the learning process and stimulates personalized learning for individual learners.

The learning environment is expanded. External participants in the learning process (specialists, experts, other teachers, students, etc.) can be included in the training through electronic communications. Technology allows the educational space to go beyond the classroom using a variety of e-learning tools, digital artifacts, virtual objects, augmented reality, etc.

In the process of learning technology and entrepreneurship, complex interactions between students, teacher, various technological means and products, tools, materials - information and communication technologies take place.

The relationship is multidirectional and includes classical and ICT-enabled activities and communications. The Web enables, through communication and sharing, the creation of a wide variety of dynamic and interconnected resources and the creation of personal, personalized learning environments [6].

The formation of students' competencies is carried out through research, doing, developing projects and other methods of active learning.

#### IV. DISCUSSION

The created model reflects the theories of constructivism and personalized learning and places the student at the center of the educational process.

The specific features of the educational process in technology and entrepreneurship are reported. In addition to ICT, an element of the educational environment are also means ensuring the implementation of active learning approaches, such as learning by doing, by research, project-based learning, modular integrative approach. Specific organizational and management decisions in planning the technological learning process with computer-mediated activities arise when applying the project method. D. Mitova [9] indicates that it is an activity-oriented model for the organization of technological training, defined as "project-oriented technological training".

The developed model reflects learning that can go beyond the confines of the classroom.

The learning environment is variable, and its situation depends not only on the teacher, but also on the learning results or preferences of the learners. With the inclusion of heterogeneous tasks and preferences selected according to specific goals, ICT provides adaptability to the needs of individual students and opportunities for active cognitive and practically applied activity.

The model of technology-enhanced learning in technology and entrepreneurship is dynamic and establishes changed functions of participants in the learning process. The relationships between the participants in the learning process are complex, multi-directional and can have a network character. According to the theory of connectivism, the educational environment is dynamic, diverse, constantly changing and developing [6].

The variety of digital tools available to students and teachers provide opportunities for applying innovative teaching methods and constructing pedagogical design options with a dynamic structure.

Mobility and access to the global network require and stimulate students' active acquisition of global citizenship competencies.

The scheme of interactions between the participants in the learning process in a digitally enhanced educational environment and their two-way nature shows potential opportunities for combining classical and electronic communications

and applying a variety of classical and computer-based learning methods.

## V. CONCLUSION

The achievements of digital and network technologies and their rapid dynamics create prerequisites for rapid change and development of the elements of educational environments and their methodical use. The computer saturation of the educational environment requires complex coordination in order to optimally distribute the functions of the teacher, students and learning resources.

The modernization of technology and entrepreneurship education in the changing technoworld requires achieving high levels of ICT integration and applying new computer-mediated methods and forms of learning, new educational models.

Managing the educational process in a technologically enabled interactive environment that can go beyond the classroom space is an extremely complex, dynamically changing process that requires further in-depth research.

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