DEGREE OF DIGITAL TECHNOLOGICAL INTEGRATION IN THE BULGARIAN SECONDARY TECHNOLOGICAL EDUCATION

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Abstract: Global informatization is one of the dominant trends in contemporary social reality. Digital information and communication technologies have enormous innovation potential for the overall modernization and transformation of education and the enrichment of pedagogical sciences. Realizing this potential requires technologies to be fully integrated into educational practice. A high degree of integration is a prerequisite for the implementation of constructivism, increasing autonomy, personal responsibility of learners and the opportunity for personalized learning.

Digital technological integration is a progressive change of education to a degree of transformation. In the process of gradual merging of information and communication and pedagogical technologies, innovative pedagogical practices are created, and they cannot be realized without modern technological means. The characteristics of the methods of teaching and learning with digital technologies determine different degrees of integration which are entry, adoption, adaptation, infusion, and transformation.

The current features of the applied methods for using Information Communication Technology (ICT) in the Bulgarian secondary education in technology, and entrepreneurship (grades 5-7) were studied by surveying 127 pedagogues teaching this subject. A questionnaire is attached examining the goals, frequency use of digital tools in the educational process, and the applied management decisions for choosing the digital tools and working with them. The analysis of the obtained data showed that ICT was used, but the degree of integration was low and corresponded to the initial levels of entry and initial adoption of the integration process. In isolated cases, lessons were held according to how students performed in activities specific to their level of adaptation.

UDC Classification: 37.04, **DOI:** <https://doi.org/10.12955/pss.v1.87>

Keywords: integration, digitalization, technology education, information and communication technologies, learning, teaching

Introduction

Overall modernization and transformation of education and science by means of digital technology is an important goal in the European and Bulgarian education policy. The integration of information Communication technology (ICT) in education is a public necessity determined by the laws of technological development, the requirements of the information society, the capacity of digital technologies and the educational needs of learners from the network generation. According to Knezek (2011) training in modern conditions should be implemented in a technologically rich environment that enables young people acquire significant experience through active collaboration, interactive interactions, and creative activity in ways that were not answered by previous generations. Dugger (2012) points out that the prospect of the future does not only lie in digital technologies, but in the ability of people to use, manage and understand them. According to Plachkov (2013), the basis of building the competence profile of both teachers and students in the subject "Technology and Entrepreneurship" are the key digital competence, technological competence, and "initiative entrepreneurship" competence.

The modernization of technology and entrepreneurship education is linked to the digitalization of substantive and organizationally functional interactions between learning and teaching. Determining the degree of integration of ICT in secondary technological education allows the development of a clear vision and increases planning for activities. Therefore achieving higher levels of integration is the basis for this type of training to protect its status, expand its presence in educational plans, and transform itself according to the dynamics of information processes.

Development nature of integrating ICT in the education

Apart from the need and the desired result of integrating ICT into learning, innovating pedagogical practice and actively personalizing learning is an extremely complex process. The terms "technological integration", and "digital technological integration" have synonymous use were the term 'integration of digital information and communication technologies in education and training' are used in various sensible aspects, making it difficult to identify and solve educational problems. Different approaches are differentiated to clarify the meaningfulness of the category under consideration, Forexample in the studies of Russell et al.(2005) defining characteristics were separated

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from volume of computer activities performed, methods for use in the teaching process, and opportunities for developing cognitive activity of learners.

The word "integration" in Latin means creating a whole, and to integrate means seamlessly combining existing components, parts or elements in a complex harmonious whole. November (2013) points out that there will be no significant positive impact with the addition of digital devices in classrooms, without changing ways of learning and teaching. Loyd (2005) also noted that the terms "use" and "integration" are not identical, and that integration is achieved not only by placing ICT at the center of the educational content units, but above all by teaching learners.

In the field of education, the digital technological integration integrates all elements related to teaching, learning information, communication technologies and manifests itself in the implementation of digitalized pedagogical practices that place the student at the center of the educational process. A defining characteristic of digital technology integration is the change in teaching and learning. Digital technologies have gradually become a crucial tool for active self and cooperative learning in a complex technological environment. The integration process is complex that it reflects the effects of heterogeneous mediated factors and is characterized by gradual development. Therefore a high degree of integration is a prerequisite for the implementation of constructivism, increasing autonomy, personal responsibility of learners, and the opportunity for personalized learning.

Historically different approaches have been taken to structure the integration process, and the differences are conditioned by the degree of concretization and differentiation, with the number of integration levels varying between four, five, six, and seven. The selected criteria also has an impact on the cases in which the level of "Inactivity" or "Non-use" are distinguished, and in other models the selected criteria is not part of the integration process. A common feature of all structural models is the gradual merger of information, communication, the pedagogical technologies, and the creation of new innovative pedagogical technologies that cannot be realized without modern technological means. The degree of students' autonomy in the learning process, role of ICT, and the functions of teachers are a gradual change. Trainees in the final stage have a comprehensive, and enriched environment with a huge list of technology-based tools.

According to the TFCIM (2013) one of the models used to structure the Technological Information Matrix (TIM) accepts five levels or degrees of integration; entry, acquisition, adaptation, infusion, and transformation. At the entry level, ICTs are used to access additional information and provide educational content on the topic that students have no direct access to. In learning, selected technology tools are used by students in conventional ways, however the teacher decides which digital tools to use, when and how to incorporate the tools into the learning process. At the adaptation level, the use of technological tools is an integral part of the lesson, and ICT infusion is achieved in learning when a variety of technological tools in sufficient quantities for all learners, are used flexibly for teaching and learning purposes. Trainees can make their own choices about how to use ICT under the guidance of the teacher, and when students use flexible technology tools to achieve specific educational outcomes by selecting and combining different tools, learning is transformed. In transformed learning, the electronic technologies are often used to facilitate higher-level learning activities that would be difficult to achieve without the use of modern information and communication technologies. Students are therefore encouraged to select, combine and use flexibly different technological tools. The monitoring of the integration process involves the use of research tools that take into account changes in the process, and organizational functional interactions between learning and teaching in a digitally provided educational environment.

Researching ways to use ICT in technology and entrepreneurship education

The theoretical analysis showed that the degree of development of the integration process is determined by the characteristics of the ICT processes of learning and teaching. To identify the specifics of the applied methods of using ICT in technology and entrepreneurship training, we developed a questionnaire which included questions clarifying;

- Objectives and frequency of use of digital tools in teaching;
- Objectives and frequency of use of digital tools in students' learning activities;
- Making decisions about using digital tools and working with them.

Respondents were required to indicate how often they used the computer activities for technological training, included in the individual questions in the lessons they conduct. A five-point answer likert scale was used (1-not used, 2-one time, 3-sometimes, 4-often, 5-always). With the developed tools in 2014, we surveyed 127 teachers teaching the subject "Technology and Entrepreneurship" in secondary school (grades 5-7).

The surveyed group included teachers from different types of educational establishments from different localities in Bulgaria, with 33.86% of the teachers from the South-West region. The study group was relatively homogeneous in terms of age and teaching experience and reflected some trends in Bulgarian educational reality. The sample included teachers with extensive professional experience were 33.86% of the teachers had been teaching subjects in the subject area of technological training for more than 30 years, 34.65% of the teachers had indicated an internship in the range of 20-30 years, and there were no teachers with professional experience under 5 years.

Comparison of the time of intensive penetration of ICT in Bulgarian education and the fact that a large relative share of the studied pedagogues were over 40 years old, showed that their digital pedagogical competences were formed mainly through the forms of continuing education or self-education. This fact implied that integration outcomes were highly dependent on their attitudes and activities for professional development.

The frequency distribution of ICT-delivered teaching activities can be seen in figure 1

Figure 1 Frequency of ICT use in the teaching process

Source: Authors (2014)

Processing of data from the questionnaire showed great variance in computer-based teaching activities, were the majority of teachers indicated that they frequently or permanently used ICT to provide information and didactic training, to visualize information, motivate learners, and provide teamwork opportunities. The teachers indicated that assigned tasks required the use of ICT at home, and included tasks in lessons where students could use digital tools.

Given the specifics of the content and the practical nature of technology and entrepreneurship training, it is worrying that 42.52% of the teachers do not use digital technology in the instructional process. The reason for the registered result can be found in the lack of resources, ready quality educational

products for this purpose, the need of time, effort and competencies for independent development of such. ICTs offer an extremely rich toolkit for quality, effectiveness, accessible multimedia tutoring with interactive and personalized use capabilities.

The existing resource limitation is evident from the fact that 59.84% of the teachers indicated that they had no conditions to create a learning environment in which students use methods of learning that would have been impossible to complete without computer tools. Methods of learning in computer-assisted technology training were investigated by answering the question "How often in classes, students use described in the questionnaire activities." The coefficients of variation calculated on the basis of the data obtained showed a large variance for all the statistical traits of computer-mediated learning described.

Figure 2 Frequency of ICT usage in the learning process

Source: Authors (2014)

Statistical processing of registered responses indicated low levels of Use of many of the computerized learning activities described in the questionnaires. An exception was the variable "search for additional information on the topic at home", which had a high modal value of "4" and was indicated by 38.58% of the respondents. In class the digital technologies were primarily used to monitor computer visualized explanations and demonstrations, performing some project tasks and presenting of the results of academic activities. In some cases digital technologies were used as a tool to learn computer technology and process data using standard software. According to the survey data 6.3% of teachers indicated that ICTs were constantly used to process data and study computer, and 37% of the teachers indicated that ICT were often used to present learning outcomes in the lessons. The survey further showed that 25.19% of the teachers used ICTs to work on project tasks, 22% used ICTs to process data, and 18.9% used ICTs to self-absorb knowledge.

In the context of the specific objectives of training in the subject of technology and entrepreneurship, creative activity plays an important role. Analysis of the survey data showed that 17% of the teachers surveyed often use ICT for creative activity, and in order to achieve the set results in education standards, the relative share of digitally supported creativity must undoubtedly increase.

One of the leading approaches to acquire included the technology and entrepreneurship curricula key competencies was project work. Mitova (2018) considers the educational technological project as an innovative form of active learning, in which the mechanisms of knowledge transfer are moved from the teacher to the student, by providing free access to educational information resources and the opportunity for self-learning. The survey showed that 30% Of the teachers indicated that ICT was used frequently and consistently for computer-implemented project tasks during. The active implementation of the project method in the technology and entrepreneurship learning process implied an increase in the frequency of computer-implemented project activities. Much of the suggested forms for the use of ICT for learning unfortunately were neither used nor applied. The results of the survey with students were Zoneva (2017) confirmed the findings and at the same time showed that students were more interested in using all forms of computer learning.

In the present study, the researchers found a low level of computer-based student learning activity, were the students' ability to choose and apply digital tools independently was limited. The digital cognitive autonomy of learners was directly guided by the teachers. The overwhelming majority of the teachers (42.52%) answered that they often independently selected and completely controlled the use of digital didactic tools in the process of technological training, implying that collaboration in the process of team digital activity was rare.

Statistical results indicated that digital technologies were more often used to implement the teaching functions of technology education teachers, however the rate of their use for learning was low. The average score for realized digitally supported pedagogical activities was $\bar{X}=3.05$ (confidence interval from 2.81 to 3.29 for $\alpha=0.05$) was higher than the average score of the array for student activities $\bar{X}=2.02$. The central values of the mode for computer teaching activities were $Mo=4$, while the mode for computer learning activities is $Mo=1$.

From the answers to the question "How is the choice and use of digital tools organized?" it was clear that in cases where digital tools were used, teachers more often selected the tools and determined how to work with them. Data processing revealed that of the 4 possible solutions listed that this control variant had the highest value of the arithmetic mean $\bar{X}=2.53$, with the least standard deviation $S=0.9$ and the highest mode $Mo=3$, coinciding with the median. The majority of respondents (42.52%) answered that they often independently chose and fully controlled the use of digital didactic tools in the process of technological training. The degree of independence of students was low, since the opportunities of the learners to independently choose and apply digital tools were limited $\bar{X}=1.89$.

The established features of the use of ICT in the process of pre-secondary technological education corresponded to the characteristics of the first two levels for digital technological integration described in TIM; entry, and adoption. Elements of adaptation were partially manifested in the lessons of 40.16% of the teachers, and the students were sometimes given the opportunity to independently apply digital tools chosen by the teacher.

Conclusion

The analysis of the data from the present study leads to the conclusion that digital technology integration in technology and entrepreneurship education had started, but was in the initial stages of its development. The obtained research characteristics of the ways of using ICT for the purpose of learning, teaching and management organization determines the realization of the first integration levels; entry, acquisition, partial adaptation of ICT in technology and entrepreneurship education. In these cases, learners have access and use digital tools on their own.

For modernization of the secondary technological education and achievement of higher integration levels, continuous focused and well-organized work at all structural management levels is needed to overcome existing barriers and make more effective use of the educational capacity of digital information and communication technologies.

In addition to resource availability with hardware and digital didactic tools, it is imperative to dynamically update the content of forms for professional training of educators and continuing professional development aimed at mastering pedagogical innovations in the use of computer-based methods and forms of technological training.

References

- Dugger, W. E. (2012). *How Standards Interface with Curriculum and Instruction in Technology*. Technology Education for the 21st Century: Bridging Theory and Practice. Palestine. Retrieved 2013, from <http://www.iteea.org/Resources/>
- Knezenk, D. (2011). *Technology Integration: What Experts Say* Educators and researchers share their views on why technology integration is an important strategy for 21st century classrooms. (S. Boss, Interviewer) Edutopia. Retrieved 2014, from Edutopia: <https://www.edutopia.org/article/technology-integration-what-experts-say>
- Loyd, M. (2005). *Towards a definition of the integration of ICT in the classroom*. In AARE, AARE, Eds. Proceedings AARE '05 Education Research - Creative Dissent: Constructive Solutions. Parramatta, New South Wales. Retrieved from <https://eprints.qut.edu.au/3553/1/3553.pdf>
- Mitova, D. (2018). *Project-Based Education on Technology and Entrepreneurship*. LAP Lambert Academic Publishing.
- November, A. (2013). *Why Schools Must Move Beyond One-to-One Computing*. Retrieved 2013, from Novemberlearning.com: <https://novemberlearning.com/article/why-schools-must-move-beyond-one-to-one-computing/>
- Plachkov, S. (2013). Harmonizing the competency profile of the teacher in technology training with the European Qualifications Framework. *Journal for information technology, education development and teaching methods of technical and natural sciences*, 3, 1-5.
- Russell, M., Bebell, D., & O'Dwyer, L. M. (2005). *Tracking the arc of new teachers technology use*. In Preparing Teachers to Teach With Technology: Current Perspectives on Applied Information Technologies. Greenwich: Information Age Publishing, Inc.
- TFCIT. (2013). *The Technology Integration Matrix*. Retrieved 01. 18., 2013, from The Technology Integration Matrix: <https://fcit.usf.edu/matrix/matrix/> The Florida Center for Instructional Technology
- Zoneva, L. (2017). Opinion study for the level of integration of information and communication technologies in the Bulgarian secondary education in technologies. *International Journal Knowledge Scientific Papers*(Vol.16.2), 725-731.