

Developing and improving the digital competences of students – future teachers

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Abstract: *In the modern digital world, people have to possess new competencies that allow them to be active and successful members of the society. This imposes new requirements on the education and training of adolescents. Innovative information and communication technologies, a connected network of smart devices are implemented to create a smart learning environment. Teachers need knowledge, skills and competences to carry out, manage and integrate effectively different digital tools in the learning process. The strict restrictions imposed during the Covid-19 pandemic and the shift to online learning proved to be a powerful catalyst for using the full potential of digital technologies in education. During the pandemic, digital competencies were critical to the success of both learners and educators.*

The existing frameworks and models of digital competences and the corresponding toolkits are aimed at establishing the level of existence of teachers' digital competences. The relevant questions that arise are related to how to ensure the formation, development and improvement of teachers' professional digital competences. How to achieve the desired level of a given type of competence, what targeted educational activities should be carried out in the training of students - future teachers to develop all important digital competences? The aim of the current article is to make a short review of the existing frameworks of teachers' digital competencies and outline a framework and system of educational activities for their development and enhancement during students' university education. The system of training activities should be embedded in the curriculum of pedagogical specialties in order to prepare specialists who are capable of teaching the digital generation of learners.

Keywords: Development of digital competences, System of educational activities, Future teachers.

1. Introduction

Modern society is building a digital world that is based on the use of innovative Information and communication technologies (ICT) and the connected network of smart devices and strives to become a smart society. To be active and successful members of such a society, people need suitable digital competences. Some of the digital skills are formed through the daily use of digital technologies in various activities. For shaping the required digital competences, specific training

activities are necessary. This imposes new requirements on the education and the training of adolescents. In order to adapt the educational system to the needs of the digital generation learners, ICT are applied to create the necessary learning environments. To be able to manage such environments teachers need knowledge and appropriate digital skills and competences.

Digitization of education is a goal for a long time, but it was approached with slow steps in certain aspects. The strict restrictions and isolation imposed during the Covid-19 pandemic and the shift to online learning proved to be a powerful catalyst for harnessing the full potential of digital technologies in education. The pandemic has tested teachers' digital competence as well as that of students. A number of studies have highlighted the stress of teachers during the transition to distance learning (Guillén-Gámez et al., 2022). Digital competencies have proven to be extremely important to the success of both learners and educators. It turned out that in pandemic situation, without the necessary digital competence of teachers and students, the learning process would be extremely difficult, even impossible.

Today's learners and teachers use different devices and software in their daily lives, including in the learning activities. The question is, are they being used effectively to achieve educational goals? In our digital society, digital literacy is not enough for teachers. They have to possess specific digital competence in order to be good educators of the digital generation of learners. The digital competence refers to a wide range of competences related to the use of digital technologies, not just technical skills and ability to use specific tools (Instefjord, 2015). Teachers need competencies for using digital technologies for organizing and implementing all stages of the learning process, working together with their colleagues in both educational and administrative activities. They have to be able to use digital channels and media for communication and interaction with other subjects in the educational process. At the same time, they are responsible and have to be able to support the development of learners' digital competencies.

The rapid development of digital technologies gives rise to a new problem related to the better digital preparation of students – future teachers. Usually, the curriculum provides separate courses for working with ICT and their integration into the educational process. Their purpose is to help students to acquire basic skills they need to work with digital tools. These skills will help them in developing and using digital learning content and learning activities. In ICT courses, the focus is on building students' confidence and positive attitudes towards using digital resources in teaching and learning and developing the necessary skills to work with them (Falloon, 2020). The question is, is such training sufficient to form the necessary digital competencies in students – future teachers and prepare them for the pedagogical practice? There is no unambiguous answer to this question. Future teachers need not only skills how to use digital technologies and devices, but also they must be taught how to implement them in teaching and learning to achieve the learning objectives as well as how to support the

development of digital skills in their students. The formation of the necessary competencies for working in a digital learning environment can be achieved through targeted training activities.

The aim of the current article is to outline a system of educational activities for development and enhancement of students' digital competencies during their university education. The system of learning activities should be embedded in the curriculum of pedagogical specialties in order to prepare educators who are capable to train the digital generation of learners.

2. Reference frameworks of digital competences

The concepts of digital competence are evolving and changing, since there is a rapid development and penetration of new digital technologies, as well as changes in attitudes and the ways people are using them. According to Janssen (Janssen et al., 2013), digital competence is beyond the skills to use digital devices and applications and includes comprehension of the role of ICT and knowledge about legal and ethical aspects, privacy and security. Ferrari (Ferrari, 2012) views digital competence as a collection of knowledge, skills and attitudes that people need to be able to work in a digital environment. In a context of education, Instefjord (Instefjord, 2015) defines digital competence as a set of knowledge, skills and attitudes that allow people to use digital technologies critically and reflectively for building new knowledge.

At the global and European level, models and frameworks of digital competences are being developed. They describe the key knowledge, skills and competences that each member of the information society needs to be fully and actively integrated. The current priority in this area is to train teachers how to use the full potential of digital technologies to improve teaching and learning and to ensure that students are adequately prepared to live and work in a digital society. Many countries are developing or revising frameworks, self-assessment tools, and training programs to guide teachers' education and the acquisition of the digital competencies they need (Redecker, 2017).

The European Commission has developed a **Reference framework for key competences for lifelong learning** known as Recommendation on key competences for lifelong learning. The framework includes 8 key competences and each of them combines 3 elements – knowledge, skills and attitudes. One of the key competences is *Digital competence*. The basic idea of Digital competence was that people had to know how to use Information technologies (IT) for learning, working and social activities. They have to possess basic skill to find and manage information using computers and communicate and collaborate via services of global network Internet (Sahin, Akbasli & Yelken, 2010). Nowadays, digital competence “includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity),

intellectual property related questions, problem solving and critical thinking“ (European Commission, 2019).

A **European Framework for Citizens' Digital Competence (DigComp)** is another framework developed by the the European Commission. The framework upgrades the ideas of the digital competence set out in the Reference framework for key competences for lifelong learning. DigComp presents the vision of the competencies that people need to answer to the challenges posed by the digitalization of society (Vuorikari, Kluzer & Punie, 2022). DigComp includes five areas of competence *Information literacy, Communication and collaboration, Digital content creation, Safety and Problem Solving*. The framework has 21 competences with respective levels of mastery. The citizens can test and determine their level of digital competence using an online tool.

The **European Framework for Educators' Digital Competence (DigCompEdu)** is a science-based framework that sets out the specific digital competences for educators in order to respond to rapidly changing demands and the need of innovations in education. DigCompEdu describes specific digital competencies for educators organized into 6 areas: *Professional engagement, Digital resources, Teaching and learning, Assessment, Empowering learners and Supporting learners' digital competences* (Redecker, 2017; Caena & Redecker, 2019; Cabero-Almenara, et al., 2020). There are 6 mastery levels of the competencies – from Newcomer (A1) to Pioneer (C2) and they are cumulative – each subsequent level includes the competencies from the previous ones (Redecker, 2017). The European Framework for Teachers' Digital Competence has been used as a basis for the development of a self-assessment tool (online questionnaire) – DigCompEdu CheckIn.

The **UNESCO ICT Competency Framework for Teachers (ICT CFT)** was developed by UNESCO and is used as a tool to guide the pre- and in-service training of teachers on the use of ICT in education. It also includes sample activities through which these competencies can be developed. The framework includes 18 competences, which are organized according to the 6 aspects of teachers' professional practice and 3 levels of teachers' pedagogical use of ICT (UNESCO, 2018). The aspects of a teacher's professional practice are: *Understanding the role of ICT in education policy, Curriculum and assessment, Pedagogy, Application of digital skills, Organization and administration and Teacher professional learning*. The levels of teachers' pedagogical use of ICT are: *acquiring knowledge* about the use of technology and basic ICT competences, *knowledge deepening* where teachers acquire ICT competences that enable them to provide learning environments and *knowledge creation* where teachers acquire competences to create a learning environment that encourages students to create new knowledge.

In Bulgaria, a **Regulation on the state requirements for acquiring the professional qualification "teacher"** states that the subject "Information and

communication technologies in education and work in a digital environment" is a mandatory subject in the curriculum. In the same regulation, it is indicated that among the elective disciplines, which support the development of the competencies necessary for teaching profession, it is desirable to include subjects such as "Digital competence and digital creativity" and "Development of lessons for learning in an electronic environment" (MON, 2021). The regulation describes in detail the groups of competences that teachers in the various professional qualifications must possess. The groups that are relevant to digital competences are *Educational environment*, *Pedagogical interaction with children*, *Working with parents and family community*, *Educational work*, *Work in a multicultural and inclusive environment and Teaching* (MON, 2021).

3. Developing and improving the digital competences of students – future teachers

There are many frameworks that define what digital competences citizens and educators should possess as well as various instruments to measure them. But providing future teachers with the necessary competences to integrate digital technologies into their future classrooms remains a challenge for teachers' education programs worldwide (Instefjord, 2015). The specific training activities that support formation and development of digital competences during the training of students are not sufficiently described.

It is necessary to design a system of specific educational activities for the development of students' digital competences, so they can be successful in their pedagogical practice. The digital competences are shaped as a result of integrating various learning activities in different courses. Acquiring theoretical knowledge in the field of ICT and digital skills and applying them in various context in different academic disciplines will ensure the formation of digital competencies in future educators and development of abilities to improve them. At the same time, future teachers will build confidence to support the formation of digital competences in the students they teach.

Educational activities through which the digital competences of students – future teachers can be developed are systematized and summarized in 3 groups.

3.1 Professional interaction with subjects in the educational process

During their training, students can use digital technologies to interact with their colleagues, teachers and administrative staff (Table 1). They have to:

- acquire the necessary skills for working in a digital environment;
- know how to chose the most appropriate channels and means for providing information and making contacts;
- be able to work collaboratively with other people in professional context.

Table 1. Educational activities for developing competences in the field Professional interaction with subjects in the educational process

Educational activities
Work in a cloud environment and use of cloud services that support collaboration and interaction: <ul style="list-style-type: none"> • organizing and managing groups or teams; • communicating via group emails or discussion forums; • organizing and managing events in shared calendars; • coordinating meetings and inviting users to them.
Work with systems for video and web conferences: <ul style="list-style-type: none"> • organizing meetings and inviting users; • giving presentations; • sharing screens; • organizing work in small teams; • recording meetings.
Creation of groups in various social and professional networks and conducting communication and collaboration in them.
Collaboration on various project activities by using cloud office packages: <ul style="list-style-type: none"> • creating and using shared documents, folders and drives; • tracking history of document changes; • using chats and comments during collaboration.

3.2 Creating and working with digital learning resources

The use of existing digital resources and the creation of new ones is among the main activities that future educators will carry out (Table 2). They have to:

- know how to use digital resources for learning purposes;
- know to adapt existing digital resources to specific learners' needs;
- be able to create digital learning resources using different tools.

Table 2. Educational activities for developing competences in the field Creation and work with digital learning resources

Educational activities
Use of existing digital resources (with an emphasis on free access materials) in the preparation of assignment or essay on a given topic: <ul style="list-style-type: none"> • searching for digital resources; • developing criteria for comparison and evaluation of the resources; • checking the authenticity of the resources; • using resources in consideration of the copyrights and licenses under which they are distributed.
Use of existing digital resources (with an emphasis on open access materials) in

Educational activities
preparation and development of a curriculum lesson: <ul style="list-style-type: none"> • searching for digital resources; • adapting digital resources to particular educational goals; • adapting digital resources to the educational needs and characteristics of the learners, including for those with special educational needs.
Use of appropriate software tools for the development of own learning resources: <ul style="list-style-type: none"> • identifying appropriate software tools; • training for working with software tools; • creating learning content.
Creation of text documents, presentations, images, audio and video materials, animations, 3D models, augmented and virtual reality projects on given curriculum topics to be used as learning resources.
Creation of interactive learning content using h5p technology.
Creation of digital learning resources in collaboration with other students using cloud services, blogs, wiki systems, discussion forums, social networks and media.
Work with websites: <ul style="list-style-type: none"> • publishing educational content; • developing own websites via different tools.
Create question banks on given topics from the learning content, quizzes and exam tasks with various software tools.

3.3 Teaching activities

The main teachers' professional duties involve teaching and assessing (Table 3). They have to:

- know when and how to use digital resources and tools in learning;
- be able to organize teaching, learning and assessing in a digital environment.

Table 3. Educational activities for developing competences in the field
Teaching activities

Educational activities
Development of learning activities based on the use of digital technologies, which include both individual and collaborative activities in groups (teams): <ul style="list-style-type: none"> • creating a teacher's blog and students' blogs; • creating an educational content in wiki systems; • organizing collaborative work with workshops.
Use of interactive learning activities with active participation of learners: <ul style="list-style-type: none"> • using mobile educational apps; • using activities with gamification elements.

Educational activities
Use of interactive whiteboards, 3D pens, educational robots, Augmented and Virtual reality glasses and head-mounted devices.
Create directional and positive feedback to assessment learning activities in different forms – text comments, audio and video comments or resources, hyperlinks.
Use of digital technologies (spreadsheet software or statistical software) for: <ul style="list-style-type: none"> • analyzing accumulated data on learners' performance and outcomes; • detecting trends and patterns; • visual representating accumulated data.
Create branches in learning content in order to provide an individual and personalized path of knowledge acquisition.

At the present moment, the specified learning activities are applied independently in the training of students from Faculty of Education at Trakia University – Stara Zagora, in different IT courses of curriculum, without being coordinated and linked to each other. To support the development of the digital competences in future teachers, it is needful to organize all activities in a complete system. They have to be coordinated with other educational and creative activities, arranged in a logical sequence and purposefully implemented.

The proposed educational and learning activities can be implemented and automated in a digital environment by using Learning Management Systems (LMS). In addition, LMS Moodle allows teachers to apply frameworks for evaluating students' competencies (Moodle Documentation, 2021). The competency framework in Moodle is an organized collection of competencies (Moodle Documentation, 2021; Titus Learning). The process of applying the competency framework includes: 1) creating the framework and adding competencies; 2) connecting the competency framework to specific electronic courses; 3) connecting the competencies to specific learning activities in the electronic course (it is possible to map more than one competency to a given activity).

4. Future tasks

The designing and structuring of a complete system of specific learning activities and analysing the expected results are the purpose of a scientific project "Development and improvement of the digital competences of students – future teachers" at the Faculty of Education in Trakia University – Stara Zagora. The main goal of the project is to develop and improve the digital competencies of students – future teachers through a system of educational activities. The research hypothesis is that the construction of an accurate profile of necessary digital competences of students – future teachers and the design of a system of specific educational activities will support effectively the development of students' digital competences. The construction of an accurate profile of the necessary digital

competences of future teachers is possible by studying the existing competence frameworks and surveying the opinion of principals and teachers. Based on the results, the necessary educational activities, their logical sequence and interconnection in a single system will be determined and can be used purposefully in the training of future teachers.

5. Conclusion

In the modern world, people need new competencies that will allow them to be active and successful members of the digital society. The development of society invariably leads to the emergence of new jobs. It is not easy to predict what kind of knowledge and skills they will require, but it is certain that digital competences will play a key role in any profession. The COVID-19 pandemic has given an impetus to the digitization in the field of education. The new situation has reinforced the opinion that new generation of learners need to be educated in a completely different way, not by applying traditional teaching and learning methods transferred to a digital environment. The transformation of education in accordance to the new reality requires all participants in the learning process to have the necessary digital competencies. Teachers need specific digital competencies that will allow them to organize and implement an effective training method, professional interaction with their colleagues and professional development. Their education has to include purposefully use of specific educational activities, based on the digital technologies in order to develop and improve their digital competences.

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