https://doi.org/10.53656/ped2023-7.1

Research Insights
Изследователски проникновения

DEVELOPMENT OF THE DIGITAL COMPETENCES OF PERSPECTIVE PRIMARY-SCHOOL TEACHERS

Prof. Dr. Vladimira Angelova,
Dr. Hilda Terlemezyan, Assoc. Prof.
Plovdiv University „Paisii Hilendarski" (Bulgaria)

Abstract. This paper examines the digital competences of current and perspective primary-school teachers the content that the ICT courses at the Educational faculty of Plovdiv university provide and their potential to develop the digital competences of the students during their studies at the university. In order to analyse the content areas of the ICT courses at the Educational faculty a content analysis was conducted of their thematic content which outlined their main focus and deficiencies. Focus group interviews with 91 primary-school teachers was also conducted which aimed to investigate to what extent digital competences are required in their professional life; which software products and applications are most often used in their work and third, how university courses can adapt in order to enhance students' digital competences. The findings from this research will provide valuable insights into how universities can better prepare student teachers for the ever-evolving world of education technology.

Keywords: digital competence; ICT courses; primary school teachers

1. Introduction

The global technological revolution and the expected trends associated with the potential of: Artificial intelligence and Machine learning; Cloud Computing and Big Data, Internet of Things; Virtual Reality and Augmented Reality; 3D printing; nanoelectronics and nanomaterials; quantum computing; Cyber Security and Safety; Blockchain technologies and Space technologies, Social Networks, Social Activation and Crowdsourcing and a number of other technological solutions make the future of education and personal development even more unpredictable and challenging.

These technological trends impose a new and complex structure of the digital competences that teachers need to possess and new requirements both to the ongoing professional development of pedagogical specialists and to the university training of perspective teachers.

The present study aims to investigate the potential of university ICT courses for developing undergraduates' digital competences and to explore further possibilities in the opinion of experienced primary-school teachers.

The results of these analysis will highlight the ways to improve students' digital competences both for teaching and learning through more effective use of ICT-based innovative educational technologies and educational models in the teaching practice of Bulgarian undergraduate students – perspective primary-school teachers.

2. Literature Review

2.1. The concept of 'competence' in education

The terms "competence" and "competency" are often used interchangeably in the Bulgarian educational context.

The comparative analysis of the definitions of the concepts "competence" and "competency", makes it possible to conclude that competence is the broader concept and refers to the motivation and attitudes of the person to put into action the acquired knowledge, skills and experience to achieve goals in a given area. The main difference between competence and traditional knowledge and experience is that competence is integrative; it has a practical orientation and is directly related to one's qualities and value system (Dimitrova 2016).

Competencies are also defined not as innate abilities, but as such that can only be developed through serious practice and high-quality learning (Zwell 2000).

In other words, the concept of human competence represents the integrative property of one's personality, which is expressed in the specifics of organizing and using various knowledge and skills and allows effective decisions and behaviour in different situations (Radev 2005). This rather didactic interpretation of competence is enriched with psychological accents and defined as a set of behaviour patterns that help people to act selectively, actively and successfully so as to influence the material and social environment or to change it, in accordance with their own needs, goals and intentions (Dessev 1999).

For the purposes of this study the following definitions, derived from the 2.2 update to the Digital Competence Framework for Citizens (Vuorikari, Kluzer & Punie 2022, p. 3) are adopted:

"The competences are a combination of knowledge, skills and attitudes, in other words, they are composed of concepts and facts (i.e., knowledge), descriptions of skills (e.g., the ability to carry out processes) and attitudes (e.g., a disposition, a mindset to act)".

The report defines knowledge as "…the body of facts, principles, theories and practices that is related to a field of work or study" (Vuorikari, Kluzer & Punie 2022, p. 3). The same document defines skills as "the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualifications Framework, skills are described as cognitive (involving

the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments)" (Vuorikari, Kluzer & Punie 2022, p. 3).

Attitudes "are conceived as the motivators of performance, the basis for continued competent performance. They include values, aspirations and priorities" (Vuorikari, Kluzer & Punie 2022, p. 3).

The need to classify competencies is justified by the widening of the application of the concept of "competency" in a great number of various fields. On the one hand, competencies can be classified as individual (e.g., social, emotional, cognitive, civic and professional competency) and organizational competencies. On the other hand, they can be behavioural, or "soft" (e.g., emotional intelligence, communication, resistance to change, proactivity, teamwork, decision-making skills, achievement orientation, motivation skills, leadership, etc.) and technical, or "hard", i.e., competencies that define specific professional skills and abilities.

The Ministry of Education in Bulgaria very clearly specifies the differences between the traditional educational approach and the competence-based approach in education and describes competence-based approach in education as:

– ***Practically oriented***, striving to develop students' personality and their ability to make direct connections with the educational activities.

– ***The educational content*** to be studied is entirely subject to the acquisition of skills by the student and their application in practice. That requires teachers to plan the activities independently or in a team using cross-curricular connections and interdisciplinary approaches.

– ***Educational activities*** lead to independent solving of educational issues based on the acquired knowledge, as well as research, projects, essays, etc. The teachers need to adopt the roles of consultants and facilitators rather than informers.

– ***The assessment*** is complex as it includes the process, the degree of participation and the achieved expected outcomes. Therefore, teachers are supposed to report the achievements, promote comprehensive assessment and plan supporting measures.

– ***The expected outcomes*** are not oriented towards particular test or examinations but towards the development of ability to solve problems of varying complexity that will build the required confidence in students to use the acquired knowledge.

In Bulgaria, the concept of the formation of key competences is founded in the Preschool and School Education Act (2016) as it defines the state educational standards, curricula and programs, with the application of which aims to introduce the competence-based approach in education.

Bulgarian Ministry of education and science (2021a) defines key competences as those that:

– are applicable to all ages and all forms of education;

– make life-long learning real;

– provide a connection with the labour market;
– are a tool for measuring quality, but also for measuring educational systems;
– create opportunities for mobility, credit transfer and certification;
– ensure successful performance and social well-being of people by increasing the quality of life;
– reduce the risk of social exclusion (2021a).

The Council of the European Union (2018) recommends 8 key competences to be developed in the educational process:
– Literacy competence
– Multilingual competence
– Mathematical competence and competence in science, technology, engineering
– Digital competence
– Personal, social and learning to learn competence
– Citizenship competence
– Entrepreneurship competence
– Cultural awareness and expression competence

2.2. The concept of 'digital competence' in education

Despite the abundance of research focused on digital literacy, digital skills, information literacy, computer literacy, ICT literacy, media literacy, E-literacy, ICT competence and digital competence, carried out before 2020, a systematic review of the scientific literature on this topic (in the Scopus, Web of Science and ERIC databases) shows that there is no unambiguous interpretation of the concepts and there is still a long way to go to reach a consensus on their content and structure. The review of researches (Sánchez-Caballé, Gisbert-Cervera & Esteve-Mon 2020), leads to the conclusion that most of the papers focus on research related to the evaluation of digital competence (the level achieved by university students and pupils), not so much with the possibilities for its development and its design in an educational context.

The continuous refocusing of the studies upgraded the definition proposed by K. Ala-Mutka (Ala-Mutka 2011) with a wider and more complex set of knowledge, skills, attitudes and finally included specific ways of critical thinking about encoding, decoding and recoding information, related to the continuous adaptation to the growing technological possibilities and their projections and reaching, to the level of expert digital competence, or at least to the vision of it.

In the report presented by K. Ala-Mutka (Ala-Mutka 2011, p. 47) digital competence is defined as comprising the following main areas:

"1) Instrumental knowledge and skills for digital tool and media usage;

2) Advanced skills and knowledge for communication and collaboration, information management, learning and problem-solving, and meaningful participation;

3) Attitudes to strategic skills usage in intercultural, critical, creative, responsible and autonomous ways. Instrumental knowledge and skills are a precondition for developing or using more advanced skills".

Digital Competence is comprehensively defined (Ferrari 2012, p. 30) as "the set of knowledge, skills, attitudes (thus including abilities, strategies, values and awareness) that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socialising, consuming, and empowerment."

In the DigComp 1.0 version of the Framework for Developing and Understanding Digital Competence in Europe five main areas of digital competences are identified: Information; Communication; Content creation; Safety and Problem solving (Ferrari 2013).

The 2016 updated version of the Digital Competence Framework (DigComp 2.0) (Vuorikari, Punie, Carretero & Van Den Brande 2016) did not actually significantly change the naming of the levels of competence but focused on the conceptual reference model, provided updated vocabulary and concepts and streamlined descriptors and gave examples of how DigComp was used at the European, national and regional levels.

The next version of DigComp 2.1 (Carretero, Vuorikari & Punie 2017) was a further development of the Digital Competence Framework for Citizens and focused on expanding the initial three proficiency levels to eight level description with the corresponding examples. These eight levels were defined through learning outcomes following Bloom's taxonomy. The lay-out and the graphical representation of DigComp. 2.1 was improved which increased readability for all stakeholders interested in implementing the framework.

The latest version: DigComp 2.2: The Digital Competence Framework for Citizens - With new examples of knowledge, skills and attitudes (VuorikarI, Kluzer, & Punie 2022) provides more than 250 new examples of knowledge, skills and attitudes that help citizens engage confidently, critically and safely with digital technologies, and new and emerging ones such as systems driven by artificial intelligence (AI).

The 2.2 update to the Digital Competence Framework for Citizens adopts the updated definition of "digital competence" presented in the Council Recommendation in 2018 that is as follows: "Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It 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" (2018).

The DigComp 2.2 conceptual reference model identifies 21 digital competencies in almost the same 5 main areas as in the DigComp 1.0 version but still updated and specified as follows (VuorikarI, Kluzer & Punie 2022, p. 4):

1. Information and data literacy (1.1 Browsing, searching and filtering data and digital content; 1.2 Evaluating data, information and digital content; 1.3 Managing data, information and digital content)

2. Communication and collaboration (2.1. Interacting through digital technologies; 2.2. Sharing information and content through digital technologies; 2.3 Engaging in citizenship through digital technologies; 2.4 Collaborating through digital technologies; 2.5 Netiquette; 2.6 Managing digital identity)

3. Digital content creation (3.1 Developing digital content; 3.2 Integrating and re-elaborating digital content; 3.3 Copyright and licenses; 3.4 Programming)

4. Safety (4.1 Protecting devices; 4.2 Protecting personal data and privacy; 4.3 Protecting health and well-being; 4.4 Protecting the environment)

5. Problem solving (5.1 Solving technical problems; 5.2 Identifying needs and technological resources; 5.3 Creatively using digital technology; 5.4 Identifying digital competence gaps)

3. Purpose of the study

The Bulgarian education standard for the status and professional development of teachers, school heads and other pedagogical specialists within the pre-school and school system is defined in Ordinance No. 15 of 22.07.2019 (2019). The Ordinance focuses on the importance of the development of: (1) knowledge of the potential of the information and communication technologies and the mechanisms for the integration and their application in the educational process; (2) knowledge of techniques and ways of formation in children and students of communication skills, critical and constructive thinking, for effectively searching, retrieving, selecting and evaluating the usefulness of information from various sources; (3) knowledge and planning the use of innovative methods for teaching and assessing student performance; (4) skills to apply the information and communication technologies in work, support and motivation of the children/students to form digital skills; (5) knowledge and application of the requirements for safe conditions of training, education and work, as well as the provision of the children/students with a secure and safe environment, including for work in the Internet environment; (6) acquisition of techniques for presenting and providing support for the construction of presentation skills in students.

The state requirements for acquiring a professional qualification "teacher" in Bulgaria determine compulsory academic courses and define the minimum number of academic hours for them. One of the pre-determined mandatory courses is the one called "Information and communication technologies in education and work in a digital environment" with a minimum of 30 academic hours.

Since the requirements for the preparation of the students of the pedagogical programmes are continuously growing in number as well as the need for finding and applying more effective educational technologies and practices the aim of this study is first to make a content-analysis of the university course "Information and communication technologies in education and work in a digital environment" and to investigate the primary-school teachers' opinion on the use of modern information technologies and technical means in the educational process. The teachers that were involved in this study had graduated from the educational faculty of Plovdiv University 'Paisii Hilendarski' in the previous 7 years (2015 – 2022) through a focus-group semi-structured interview.

The digital competence framework of the teachers and the determination of levels of assessment and evaluation, make the management of its formation and development in an educational context possible.

4. Methodology

The whole research was organized in the Educational Faculty of Plovdiv University 'Paisii Hilendarski' in the period January-February 2023.

First the thematic content of the "Information and communication technologies in education and work in a digital environment" course was analysed and next the semi-structured interview with the teachers was conducted. The teachers were 91 altogether and they were organized in 10 focus-groups of nine to ten people. All of them had graduated from the Educational Faculty of Plovdiv University 'Paisii Hilendarski" and had at least 3 years teaching experience.

The interview was organized online since many of the teachers were from different towns in Bulgaria.

5. Results and analysis

5.1. The results from the content-analysis

Following the logic of most curricula in which the learning content is distributed and presented in separate thematic modules, the content analysis was implemented by classifying the separate thematic categories and through their frequency accumulations. The results of the research outlined the following thematic areas

1. ***Computer word processing*** – study of the main stages and operations in word processing, content processing, formatting and reproduction. Font pairings. Formatting and editing a text document. Insert, place and position graphics. Create, apply, and modify style formats. Designing and grouping graphic schemes. Table creation and layout. Structuring a document and generating content. Circular letters and documents.

2. ***Tabular and graphic representation of data***. Spreadsheet structure, formatting and editing, calculations and charts. Data validity. Sort and filter data in a spreadsheet.

3. ***Computer presentations***. Interactive presentations. Presentation design (applying and modifying a selected design template). Embedding and linking of audio and video objects. Implement navigation within a presentation. Creating and using user submissions. Application of animation effects to a slide and to parts of a slide. Starting animation effects on elements of a slide by using triggers. Graphics in MS PowerPoint. Saving objects from a presentation in different graphic formats.

4. ***Integration of activities and documents.*** Object integration technologies. Embedding and linking objects.

5. ***Multimedia***. Digitization of audio-visual information. Digital sound processing. Creation of video documents. Formats for audio and video files. Popular software products.

6. ***Web design***. Basic principles of web design. Planning, designing, developing, publishing and maintaining a website. Web design standards and basic web technologies. Specialized software tools for creating websites. Content management systems (CMS systems). Using web-based CMS systems to systematize and manage educational content and optimize access to educational resources.

6. ***Use of modern information technologies and technical means in the educational process.*** Mobile communications, GRID and CLOUD technologies. Google Apps for Education (G Suite for Education). Interactivity in the educational process. Interactive learning methods and tools. Working with an interactive whiteboard. Modern software tools for creating interactive educational resources.

8. ***Optimizing the organization*** and conduct of the educational process at school by using innovative means and modern technologies to organize the content of the education, manage access to educational resources and control the performance of educational assignments by students. Managing and using Google Classroom. Popular eLearning environments.

5.1.1. Analysis of the results from the content analysis

The conducted content-analysis allows the formulation of the following conclusions:

1. Priority is given to the following core content areas: (1) computer-based technologies, (2) computer word processing, (3) spreadsheets, (4) computer presentations and computer multimedia, (5) internet technology and e-learning and (6) audio-visual and informational means in the educational process. The focus on computer games and/or interactive whiteboard and its potential is minimal.

2. The focus in this course is on the formation of knowledge and the development of skills related to the application of technical means and information technology in a general context.

3. The educational content of the course lacks pedagogical and methodological orientation which deprives students from the opportunity to develop the required skills in the perspective of their future professional career.

4. The ICT courses are usually conducted by professors with a technological or mathematical education and background and that fact together with the academic freedom enables university professors to determine the content of the curricula leads to huge diversity in the scope and depth of the topics of this course.

5.2. Results from the focus groups interviews

The semi-structured interviews with the 10 focus-groups were designed to address the following questions:

1. The areas where the ICT could be applied in the professional life of the primary-school teacher.

2. The most frequently used software products, programmes and applications;

3. The areas in which the university education can adapt the courses in order to improve the digital competence of the students.

The results from the discussions in the focus groups outlined the following opinions, problems and expectations:

1. In primary school Information and communication technologies are most often used for administrative needs such as creation of documents with MS Word, very rarely MS Excel and writing e-mails. Sometimes teachers are required to prepare short MS PowerPoint presentations and search for specific information in Google. They admitted that most often in their everyday professional life they teach by the book and are not required to develop their own resources. Sometimes they use resources developed by other colleagues that are available on specific sites or shared by them. Very few of them mentioned that they sometimes adapt the resources they found in sites or received by other colleagues.

2. The teachers admitted that most of the applications and programmes that are designed for creating online interactive worksheets are in English and naturally most of them are not that confident in their foreign language competence to try such platforms. If they need to prepare an additional resource, they prefer to prepare it with MS Word and print it out on paper.

3. The teachers admitted their disappointment with the level and content of the ICT course at the university which according to them is better to be developed in the context of the separate methodological courses. They couldn't mention more than three topics from the ICT course they had done at the university ("creating word documents, PowerPoint presentations and sending e-mails"). Their dissatisfaction was mainly related to the fact that the ICT course was not aligned with their specific needs as future teachers.

4. The teachers expressed the expectation the ICT course to provide more knowledge and develop skills for using the interactive whiteboards and specific educational technologies that can help them create game-based resources and multimedia simulations ("*help struggling readers for example*"). Most of the participants expressed the opinion that they need more practical assignments at the university that will help

them simultaneously develop their content-based methodological knowledge and digital competence as well ("*they can make us develop specific educational resources using a specific technological tool that later we will know how to use*").

5. In the course of the interview, they confessed that they are afraid of letting their students use technological devices too often in class because they think that in this way students' attention will be easily distracted and they feel they cannot compete with the attractiveness of technologies and everything that is on screen.

6. In terms of motivation the teachers said that the lack of knowledge and skills related to specific software or applications that are applicable in primary-school education deprives them of confidence and desire to develop their digital competence on their own or even in specialized qualification courses. They said that this lack of motivation is even more tangible with their older colleagues who are even less digitally literate and therefore more unwilling to develop.

5.2.1. Analysis of the results from the focus groups interviews

The conclusions from the focus-group discussions:

1. More emphasis has to be put on the educational potential of the Information and communication technologies course and not so much time has to be devoted to the traditional topics of Word Processing, Presentation Software and Email.

2. The digital competences of the students need to be developed not only in the ICT course which appears once in the four-year Bachelor degree programme but in all the methodological courses that are part of their syllabus as well.

3. The methodological courses have to set assignments that require meaningful use of specific software, applications and tools and have to be continuously diversified.

4. A specific course has to be introduced focused on online interactive tools for education.

All these results imply that new approaches have to be sought that will develop the digital competence of the university students – perspective primary-school teachers. These approaches have to be applied not only in the ICT course but in many of the other pedagogical and methodological courses as well.

6. Conclusions

This research paper was focused on the content of the ICT course the educational faculty of Plovdiv University 'Paisii Hilendarski' offers to its undergraduate students and on the opinion of primary-school teachers who used to be undergraduate students at the same university.

The results and the analysis of this research prove that despite the modern policy for continuous development of the digital competences of teachers the interviewed teachers lack inner motivation and prescribe it to the poor preparation they received at the university. Schools also do not require teachers to prepare additional resources

because they can rely on the many that are available in the books they teach by. On the other hand, the teachers' resistance to developing and applying digital resources in their classes is due to both the lack of confidence and motivation to use them as well as to insufficient preparation for that.

The creation of an interactive, skill-based and creative ICT environment at universities will develop the digital competence of undergraduate students and they will become more competitive; will enhance the quality of education and will make the implementation of the personalized learning approach completely realistic and in tune with trends in modern education.

Acknowledgements

This study is financed by the European Union-NextGenerationEU, through the National Recovery and Resilience Plan of the Republic of Bulgaria, project № BG-RRP-2.004-0001-C01.

NOTES

1. EU COUNCIL RECOMMENDATION OF 22 MAY 2018 on key competences for lifelong learning. [viewed 03 October 2022] Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604(01)&rid=7.
2. MINISTRY OF EDUCATION AND SCIENCE (2016). [viewed 21 November 2022]. Available from: https://www.navet.government.bg/bg/media/ZAKON-ZA-PREDUCHILISHTNOTO-I-UCHILISHTNOTO-OBRAZOVANIE.pdf.
3. MINISTRY OF EDUCATION AND SCIENCE, 2019. Ordinance No. 15 of 22.07.2019 on the status and professional development of teachers, principals and other pedagogical specialists. [viewed 08 February 2023]. Available from: https://lex.bg/bg/laws/ldoc/2137195301
4. MINISTRY OF EDUCATION AND SCIENCE, 2021a. Kompetentnosti i obrazovanie. [viewed 11 March 2023]. Available from: file:///C:/Users/user/Downloads/I-book%20(1).pdf
5. MINISTRY OF EDUCATION AND SCIENCE, 2021b. Za prehoda ot znania kam umenia. [viewed 09 November 2022]. Available from: file:///C:/Users/user/Downloads/II-book%20(1).pdf

REFERENCES

ALA-MUTKA, K., 2011. *Mapping Digital Competence: Towards a Conceptual Understanding*. Luxembourg: European Commission. Available from: 10.13140/RG.2.2.18046.00322.

CARRETERO, S.; VUORIKARI, R. & PUNIE, Y., 2017. *DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency*

levels and examples of use. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-68006-9 (pdf).
DESSEV, L., 1999. *Rechnik po psyhologia*. Sofia: Bulgarika [In Bulgarian]. ISBN 954-8378-87-6.
DIMITROVA, R., 2016. Razbirane i prilagane na kompetentnostniya podkhod v obuchenieto po finansov kontrol. *Izvestia*, vol. 60, no. 2, pp. 208 – 225 [In Bulgarian]. ISSN 1310-0343.
FERRARI, A., 2012. *Digital Competence in practice: An analysis of frameworks*. Sevilla: Institute for Prospective Technological Studies.
FERRARI, A., 2013. *DIGCOMP: A Framework for Developing and Understanding Digital Competence in Europe*. Luxembourg: Publications Office of the European Union. ISBN 978-92-79-31465-0.
RADEV, P., 2005. *Obshta uchilishtna didaktika.* Plovdiv: Paisii Hilendarski [In Bulgarian]. ISBN 954-423-336-9.
SÁNCHEZ-CABALLÉ, A.; GISBERT-CERVERA, M.; ESTEVE-MON, F., 2020. The digital competence of university students: a systematic literature review. *Revista de Psicologia*, vol. 36, no. 1, pp. 63 – 74. [viewed 07 January 2023]. Available from: https://doi.org/10.51698/aloma.2020.38.1.63-74.
VUORIKARI, R.; PUNIE, Y.; CARRETERO, S. & VAN DEN BRANDE, G., 2016. *DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1: the Conceptual Reference Model.* Luxembourg: Publications Office of the European Union.
VUORIKARI, R.; KLUZER, S. & PUNIE, Y., 2022. *DigComp 2.2, The Digital Competence framework for citizens: with new examples of knowledge, skills and attitudes.* Luxembourg: Publications Office of the European Union. ISBN 978-92-76-48882-8.
ZWELL, M., 2000. *Creating a culture of competence.* New York: John Wiley & Sons, inc. ISBN: 0471350745.

✉ **Prof. Dr. Vladimira Angelova**
ORCID iD: 0000-0002-5559-5369
Plovdiv University „Paisii Hilendarski“
Plovdiv, Bulgaria
E-mail: vangelova@uni-plovdiv.bg

✉ **Dr. Hilda Terlemezyan, Assoc. Prof.**
ORCID iD: 0000-0003-3706-6460
Plovdiv University ‘Paisii Hilendarski’
Plovdiv, Bulgaria
E-mail: terlemezian@uni-plovdiv.bg