THE IMPACT OF DIGITALIZATION AND DIGITAL TOOLS ON TEACHING EFFICIENCY IN PRIMARY EDUCATION

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ABSTRACT

Digitalization is one of the most significant processes transforming modern education. From a teacher's perspective, the impact of digital tools on teaching efficiency is multifaceted and profound. The introduction of various digital technologies – such as interactive learning platforms (Google Classroom, Moodle), communication and collaboration tools (Zoom, Microsoft Teams), multimedia content and assessment applications (Kahoot, Quizizz) – enables a more dynamic, visually appealing and flexible teaching process. These tools enable teachers to better plan, organize and monitor teaching, as well as more effectively individualize teaching activities according to the needs and abilities of each student. At the same time, digitalization contributes to increased engagement and motivation among students, who are active participants in the learning process through research, discussion and creation. Through the use of digital resources, teaching becomes more interactive, with the opportunity to integrate different subject areas and develop digital competencies among students. However, this process also brings a number of challenges. Teachers face the need for continuous digital education, adaptation of teaching methods and provision of technical conditions for quality teaching. There is also a risk of unequal access to technology, which can create a digital divide between students. Overall, digitalization, when applied in a pedagogically designed and targeted manner, is a powerful instrument for increasing the effectiveness and quality of teaching. It enables the creation of a modern, inclusive and motivating educational environment, in which the teacher retains his central role as a mentor and moderator of learning.

Keywords: digitalization, digital tools, teaching efficiency, teacher, education, technology

1. Introduction

Digitalization, as a global process, is also changing education, encouraging the development of new models of teaching and learning. In primary education, where the foundations of knowledge and skills are laid, digital tools have a special role in improving the teaching process and increasing its efficiency. The inclusion of digital didactic materials in the teaching and learning process of students in primary education inevitably implies changes. Some of them relate to the training of teachers, others to the interactions and roles of members of the educational community, and others to the innovation of the educational process itself.

We are in an era in which printed books and other cultural media are giving way to the expansion and ubiquity of next-generation media. These technologies are leading to a profound transformation in our conception and format of culture. Digitalization has facilitated the creation and distribution of audiovisual content, democratizing the production of multimedia materials. Modern society demands a new role for educational professionals, a role that will not be limited by conventions or frameworks imposed by publishers. Educators must take on a new role when it comes to incorporating digital didactic materials, which includes creating digital resources with clear educational objectives, collaborating with other professionals to share experiences, and developing proposals that promote students' digital competences. The digital transformation of educational environments is an undeniable aspect of contemporary teaching and learning landscapes, highlighted by the integration of digital tools across various learning platforms.

Digitalization in education:

- **Digitalization** is the process of integrating digital technologies into all aspects of the education system. In the context of primary education, it includes the use of digital platforms, electronic textbooks, assessment applications, online collaboration and communication, as well as the creation of digital content. The theoretical foundations are related to constructivism and modern learning theories that emphasize the active role of the learner, self-regulation and learning through inquiry
- **Digital tools** – mean digital technology used for a specific purpose or function, for example, for information processing, communication, content creation, security or problem solving (personal computer, laptop, mobile phone, tablet, interactive whiteboards, TV, projectors, cameras, etc.);

Digital tools can be classified into several categories, as follows:

- Interactive learning platforms: Google Classroom, Moodle
- Communication tools: Zoom, Microsoft Teams
- Assessment tools: Kahoot, Quizizz, Socrative
- Multimedia: videos, simulations, interactive presentations

These tools enable individualized teaching, greater involvement and faster feedback.

- Digital content – means any type of content that exists in digital form, data encoded in a computer-readable format and that can be created, viewed, distributed, modified and stored using digital technology (online information, websites, online platforms, images, audio, video, online games, educational programs and applications, teaching materials, virtual classrooms, social networks, etc.)

The inclusion of technology and the development of digital competences at this level appear as a necessity because they contribute not only to increasing the efficiency of teaching but also to preparing children to live and learn in a society that is increasingly based on information and technology. This section aims to offer a clear framework for how technological development and its inclusion in education affect the quality of teaching and learning. For teachers, these competences are related to the ability to include technology in the teaching process, prepare digital content, manage online environments and support the development of digital skills among students. Together, these dimensions form the basis of a modern and inclusive education, adapted to the demands of the 21st century. Teachers, as bearers of the educational process, are at the center of this transformation. The use of interactive platforms, multimedia materials, communication tools and online resources enables more flexible, dynamic and student-centered teaching. But at the same time, numerous challenges arise related to digital competencies, technical support, and equal access to technology.

Students need to master a range of skills that include: the ability to search, analyze and critically use online information; basic technical skills for using computers, tablets, platforms and educational applications; as well as the ability to communicate and collaborate in digital environments. They also need to learn to prepare digital content (presentations, interactive activities, videos or creative materials), to respect authorship and sources, and to develop competences in the protection of personal data and online safety. By using technology to solve practical problems, students acquire reflective, critical and creative skills that help them become active and responsible users of technology.

The development of digital competences of teachers and students is an interconnected and inseparable process. As leaders of the teaching process, teachers have a key role in modeling and encouraging the use of technology, and through the acquired skills, students become active and aware users of digital tools. This interaction ensures that digital competences directly contribute to the quality of learning and to the preparation of generations for the information-based society.

Technology creates dynamic and attractive learning environments, engages students in the teaching process and at the same time plays an important role in the development of critical thinking and problem solving. Through interaction with digital content, students face challenges that require analysis, reflection and creativity, which makes them more active in the learning process.

One important dimension of the inclusion of technology in education is its use in the process of assessing students. In primary education, assessment is no longer limited to traditional forms (written tests or oral questions), but is enriched with digital platforms that offer opportunities for faster, more interactive and personalized feedback.

Platforms such as Google Forms, Microsoft Forms, Kahoot, Quizizz and other similar applications have become part of teaching practice and make the assessment process more engaging and inclusive. Through them, primary school teachers can prepare interactive quizzes, collect immediate data on students' progress and provide real-time feedback. Students, on the other hand, are more engaged because they expe-

rience assessment as a playful and motivating activity, rather than as a formal process that causes anxiety. In addition to the motivation aspect, technology has also contributed to the personalization of assessment. Digital platforms allow for the adaptation of questions and tasks according to the rhythm and individual needs of students and support differentiated learning and the development of skills in a more appropriate way. This personalization is particularly important in primary education, where individual differences between children are more pronounced. Another advantage is the opportunity that technology offers for the development of self-assessment and peer assessment. Through digital tools, students can reflect on their work, compare results with their classmates, and learn from each other. This helps them develop reflective, collaborative, and critical skills.

2. Literature Review

Contemporary literature consistently describes digitalization as a key driver of educational reform. According to many researchers, digital tools have the potential to significantly improve the quality of teaching by increasing interaction, motivation and individualization. Never before in human history has there been such a developed technology available for information as today. Globally, the rapid development of technology is considered the "fourth industrial revolution". Within this revolution, most existing professions require digital skills (Williamson et al., 2019).

Research shows that digital platforms such as Google Classroom and Moodle enable more efficient management of learning materials, better communication and rapid provision of feedback (Black & Wiliam, 2018). Multimedia content promotes visual and active learning, which is especially beneficial for students in primary education.

From a European perspective, digital competence encompasses the skills needed by an individual to function in a digitalised society (Hatlevik & Christophersen, 2013). To support this, many education systems use the European Framework for the Development of Digital Competence (DigComp) as a basic reference for planning and implementing different intervention strategies, on the basis of which DigCompEdu and DigCompOrg have been developed. These frameworks aim to assist Member States in promoting digital competence among citizens and in fostering innovation in education. Digital competence is defined as the ability to use digital devices, applications and communication networks to: access and manage information, communicate, collaborate, solve problems, produce and share digital content for learning and working in social and collaborative activities (UNESCO, 2018). In recent years, there have been different descriptions of an individual's skills related to the use of technology. Also, different terms are used, such as: ICT skills, technological skills, 21st century skills, digital skills, media skills, digital competence, etc. In more recent publications, the term competence is more frequently used than the term skills. The differences between the terms competence and skills are defined in more detail in an OECD project, which states: "Competence is more than just knowledge and skills. It includes the ability to meet complex demands and psycho-social resources (skills and behaviour) in a given context" (OECD, 2005, p. 4).

According to UNESCO (2021), the most common challenges are unequal access to technology, insufficient ICT support, technical barriers and limited digital literacy among teachers. These factors affect the success of digital reforms in education.

In the study by the University of Helsinki (2021), What is digital competence?, the term digital competence is described as a broader and constantly evolving concept, linked to developments in the field of technology, as well as to the goals of citizenship in a

knowledge-based society. In 2018, the Council of the European Union adopted recommendations on key competences for lifelong learning. Digital competence is one of the eight competences and is presented as: "The ability of an individual to confidently, critically and responsibly use and interact with digital technology for learning, performing tasks and participating in society. It includes understanding information and data, communication and collaboration, media literacy, digital content production (including programming), security (including digital well-being and online safety), intellectual property issues, as well as problem solving and critical and creative thinking. Therefore, fostering digital competence in all citizens is of great importance, and the main burden is borne by the education system and educational institutions at all levels" (EU, 2018). The use of information and communication technology (ICT) in education is one of the main pillars of global policies for quality and inclusive education. One of the most important documents in this direction is the UNESCO Framework for ICT Competences for Teachers (ICT - CFT), which was updated in 2018. This Framework aims to assist governments, educational institutions and teacher training providers in integrating ICT into the educational process. It is not just a technical tool but a catalyst for pedagogical change (UNESCO, 2018).

The use of technology in primary education represents one of the most significant changes in recent decades and directly affects the cognitive, social and emotional development of children. In international and domestic literature, technology is seen as an element that not only supports the teaching process but also reshapes it and creates more interactive and flexible environments. Research shows that the use of digital devices, online platforms and educational applications has a positive impact on the acquisition of basic knowledge and on increasing motivation for learning. Lin and Lin (Lin & Lin, 2018) found that the use of ICT in primary schools significantly improves reading and mathematics results and at the same time increases engagement in teaching.

According to Prof. Dr. Daniela Koceva, Vice-Dean of the Faculty of Educational Sciences at the University „Goce Delchev" in Shtip, „Thanks to technology, today we have tools that enable adaptive learning according to the individual needs of students. For example, AI systems can recognize weaknesses in a student and offer them targeted exercises for improvement. However, the future of education will not be in the hands of technology alone, but what will be important is how to maintain quality interaction between teacher and student, the socialization process, and at the same time, emphasize the development of critical thinking." According to Prof. Dr. Koceva, among the most used educational digital tools in education are Google Classroom, which is used to organize materials and monitor student progress.

While platforms such as Kahoot, Mentimeter, Quizizz, Class Craft enable interactive quizzes that increase engagement. The Zoom and Microsoft Teams platforms enable hybrid and online teaching, which has become particularly important, and at the same time have proven their role during the pandemic. Other visualization tools are Prezi, Canva, Padlet, Microsoft Whiteboard. Artificial intelligence in teaching: ChatGPT, Grammarly, Turnitin, Socratic. These tools not only facilitate learning but also make it more dynamic and interactive. Pupils and students access them more easily and participate more creatively in creating and solving problems, questions, discussions. However, modernization does not mean abandoning tradition, but a balance between classical methods and innovative approaches, adapted to the developmental profile of today's children. Innovative practice in primary education includes the use of educational digital games, work on simple projects, group collaboration, mind maps, role-playing games and the use of multimedia tools to develop 21st century skills.

3. Research methodology

The aim of this research is to determine how the use of digital tools affects the efficiency of teaching in primary education from the perspective of teachers. The survey was conducted with teachers working in rural and urban areas, 90 teachers of different ages and with different work experience were surveyed. The research questions were aimed at the following: Which digital tools are most often used by teachers in primary education?, What is the impact of digital tools on the efficiency of teaching? What are the most common challenges in the digitalization process? What kind of help do teachers need to successfully implement digitalization in teaching and realize efficient teaching, etc. Some of the questions were open-ended in order to examine the attitude and opinion of teachers on this topic. After processing all the data obtained, and in order to obtain relevant conclusions from this scientific paper, a statistical analysis of the data and a graphical presentation of the responses received from the survey questionnaire were made. The results and conclusions from this research can serve to create a policy to support teachers in successfully using digital tools in the teaching process, implementing modern teaching that will respond to the needs of students, encourage them to think critically and make decisions.

4. Findings/Results

According to the demographic structure of the respondents, it can be concluded that the majority of respondents belong to the age group 41–50 years (48.3%), followed by teachers over 50 years (31%). The share of teachers aged 31–40 years is smaller (17.2%), and the least are those under 30 years (3.4%). This indicates that the sample is predominantly composed of teachers with longer work experience.

In terms of place of work, 62.1% work in an urban environment, while 37.9% in a rural area, which allows for a comparison of the conditions for digitalization in different environments. Work experience is relatively evenly distributed, with the highest share among teachers with under 5 years and over 20 years of experience (27.6% each), indicating the presence of both beginners and highly experienced teachers.

Regarding the availability of digital equipment, the majority of teachers rate it as satisfactory (33.3%) or basic (33.3%), while a small percentage consider it good or excellent (13.3%). A significant proportion (16.7%) indicate insufficient equipment, which is a serious barrier to quality digital teaching.

To the question: How often do they use digital tools in teaching?

Most teachers (56.7%) report that they use digital tools often or daily, which indicates a high level of integration of technology in the teaching process. Only a small proportion use them rarely, and there are no teachers who do not use digital tools at all.

The most commonly used tools are:

- Educational videos (82.8%)
- PowerPoint presentations (79.3%)

Learning management platforms (Google Classroom, Moodle) and interactive tools (Kahoot, Quizizz) are used much less, indicating that digitalization is more focused on content presentation and less on interactive and student-centered learning.

Digital tools are most commonly used for:

- Explaining new content (96.6%)
- Project work (34.5%)

They are almost not used at all for homework and formative assessment, which represents an untapped potential of digital technologies.

The results of the Likert scale show a very positive attitude of teachers towards digitalization:

- Teachers believe that digital tools:
  - improve student motivation (M = 4.14),
  - make teaching more efficient (M = 4.28),
  - significantly facilitate the teaching process (M = 4.38),
  - create more dynamic and interesting teaching (M = 4.34).

At the same time, teachers have moderate confidence in their own digital competencies (M = 4.00), which indicates a need for additional training.

Interestingly, the claim that digital tools take too much time to prepare is rated with a low average value (M = 2.55), which means that most teachers do not consider this a serious problem.

Almost all respondents agree that digitalization should be systematically developed and supported in primary education (M = 4.28).

In the section where teachers should freely express their challenges and needs in teaching, they gave the following answer:

The most common challenges stand out:

- Insufficient or outdated technology (69%)
- Weak internet (41.4%)
- Insufficient ICT support and digital literacy among students (24.1%)

In terms of support, teachers most need:

- Fewer administrative obligations (62.1%)
- Technical support (41.4%)
- Training on specific digital tools (37.9%)

This shows that the problems are not only pedagogical, but also systemic and organizational.

Qualitative analysis – critical review – Open-ended responses indicate that teachers experience digitalization as a process that:

- changes their role from a knowledge transmitter to a mentor and guide,
- encourages innovation, creativity and individualization of teaching,
- facilitates preparation and increases motivation among students.

However, some teachers also point to negative aspects, such as:

- reduced concentration,
- screen addiction,
- reduced physical activity,
- weaker social interaction and creativity,
- risk of misuse of internet content

The results show that teachers have a predominantly positive attitude towards digitalization and recognize its value in improving the teaching process. However, there are clear challenges related to infrastructure, support and balanced use of technology by students. Therefore, digitalization should be developed in a planned manner, with continuous training, appropriate technical support and clear pedagogical guidelines.

5. Discussion and conclusions

Based on the conducted research and the analysis of the data obtained, the following conclusions can be drawn:

- Teachers in primary education show a high level of acceptance of digital technologies and recognize them as a significant factor in improving the quality of teaching. Digital tools are perceived as a means that increases student motivation and makes teaching more efficient and dynamic.
- The use of digital tools is most pronounced in the phase of presentation and explanation of teaching content, while their application in the processes of formative assessment, monitoring of progress and assigning homework is limited. This indicates a need to expand the pedagogical application of digital technologies.
- Although teachers mostly believe that they have adequate digital competencies, the results indicate that there is a need for continuous professional development, especially in the use of advanced and interactive digital tools.
- Insufficient and outdated digital equipment, unstable internet connection and limited ICT support represent key structural barriers to more effective integration of digital technologies in the teaching process.
- Qualitative analysis shows that digitalization transforms the role of the teacher from a traditional transmitter of knowledge to a mentor, guide and facilitator of learning, which requires the development of new professional and pedagogical competencies.
- At the same time, teachers point to potential negative consequences of increased digitalization among students, such as reduced concentration, superficial learning, dependence on digital devices and reduced social interaction, which emphasizes the need for careful and balanced use of technology in education.
- The general agreement among teachers that digitalization should be systematically developed and institutionally supported indicates the need for a clear educational policy and a long-term strategy for digital transformation in primary education.

Based on the conclusions obtained, the following recommendations are proposed:

- Systematic improvement of the digital infrastructure
  The competent institutions should ensure continuous investments in modern digital equipment and stable internet infrastructure, in order to enable equal access to digital teaching in all schools.
- Continuous professional development of teachers
  It is necessary to establish a sustainable system of professional development that will include training for pedagogically justified and effective use of digital tools, with a special emphasis on interactive teaching and digital assessment.

- Integration of digital tools in the assessment process
  To encourage the use of digital tools for formative and summative assessment, as well as for monitoring individual student progress, which will improve the quality of teaching evaluation.
- Reduction of the administrative burden on teachers
  Educational policies should provide for the simplification of administrative procedures and digitalization of documentation, in order for teachers to have more time for pedagogical and creative work.
- Development of digital literacy and critical thinking among students
  Include content in curricula that will contribute to the responsible, ethical and safe use of digital technologies, as well as to the development of critical thinking and media literacy.
- Ensuring a balanced approach to digital teaching
  Digital technologies should be used to support traditional teaching, taking into account the age of students, teaching objectives and psychophysical development.
- Strengthening institutional and technical support
  Establish functional ICT support in schools that will provide technical assistance and an advisory role for teachers in the implementation of digital teaching.

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7. Annexes

SURVEY SHEET

Survey for primary school teachers: The impact of digital tools on teaching

The survey is intended for primary school teachers in order to examine attitudes, opinions, experiences and critical perspectives on the use of digital tools and digitalization.

The survey contains closed questions, multiple choice (Likert scale), open questions and a critical section. The survey is anonymous and is used for research purposes.

I. General information (demographic data)

1. **Your age:**
- Up to 30 years
- 31–40 years
- 41–50 years
- Over 50 years

2. **Place where you work?**
- City
- Village

3. **Work experience as a teacher:**
- Under 5 years
- 5–10 years
- 11–20 years
- More than 20 years

4. **In which classroom do you work?**
- Class teaching (grades I–V)
- Subject teaching (grades VI–IX)

5. **Availability of digital equipment in your school:**
- Insufficient
- Basic
- Satisfactory
- Good
- Excellent

II. Use of digital tools in your practice

6. How often do you use digital tools in teaching?
- Never
- Rarely
- Sometimes
- Often
- Every day

7. Which digital tools do you use most often? (multiple choices possible)
- PowerPoint / Presentations
- Google Classroom
- Moodle
- Microsoft Teams
- Zoom
- Kahoot, Quizizz or similar
- Educational videos (YouTube, Learn360, etc.)
- Other: _____

8. For which activities do you most often use digital tools?
- Explaining new content
- Formative assessment
- Homework
- Project work
- Communication with students/parents
- Monitoring progress

III. Attitudes and opinions (Likert scale - 1 “strongly disagree” to 5 “strongly agree”)

9. Digital tools improve student motivation

1 2 3 4 5

10. The delivery of teaching content is more efficient with the use of digital technologies

1 2 3 4 5

11. The use of digital tools facilitates my teaching process

1 2 3 4 5

12. I have sufficient digital competences to use technology effectively

1 2 3 4 5

13. Digitalization creates more dynamic and interesting teaching

1 2 3 4 5

14. The use of digital tools takes too much time for me to prepare

1 2 3 4 5

15. Digitalization should be systematically developed and supported in primary education

1 2 3 4 5

IV. Challenges and barriers

16. What challenges do you most often face? (multiple choices possible)

- Insufficient technology / old equipment
- Weak internet
- Insufficient ICT support from the school
- Insufficient own digital literacy
- Insufficient digital literacy among students
- Insufficient preparation time
- Too much digital time for students
- Other: _____

17. What kind of support do you need the most?

- Training on certain digital tools
- Technical support
- Improvement of infrastructure
- Fewer administrative obligations
- Access to more digital resources
- Other: _____

V. Critical review of teachers

18. How is digitalization changing the character of the teacher‘s role?

19. In your opinion, what are the biggest negative consequences of increased digitalization among students?

ABOUT THE AUTHOR

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