Information-communication technologies in the educational process

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DOI: https://doi.org/10.53349/re-source.2025.is1.a1386

Abstract

This paper explores the transformative role of Information and Communication Technologies (ICT) in modern education, emphasising its potential to enhance teaching methods, improve learning outcomes, and foster essential skills such as digital literacy, creativity, and independent learning. ICT, encompassing tools like computers, interactive whiteboards, and digital teaching materials, has redefined traditional pedagogy, making learning more engaging, efficient, and tailored to individual needs. By integrating multimedia elements, animations, and simulations, ICT enriches the learning experience, facilitates understanding complex concepts, and provides dynamic opportunities for personalised and self-paced study. The paper highlights the symbiotic relationship between digital literacy and ICT, where digital literacy equips individuals to navigate and utilise ICT tools effectively. At the same time, ICT is the foundation for fostering critical competencies like collaboration, problem-solving, and research skills. The advantages of ICT include immediate feedback, error correction, and motivation through gamified learning experiences, significantly improving the clarity and accessibility of educational content. As societal expectations for ICT integration in education grow, the paper underscores its indispensable role in preparing students for a technology-driven world. By leveraging ICT, educators can cultivate a generation of innovative, adaptable learners equipped to meet the demands of a rapidly evolving global landscape. ICT is not a supplementary tool but a cornerstone of contemporary education.

Keywords: Information and Communication Technologies (ICT), Digital literacy, Modern education, Personalized learning, Innovative pedagogy.

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1 Introduction

The expansion of information and communication technologies (hereinafter referred to as ICT), which at the turn of the 20th and 21st centuries recorded a sharp upward trend and became a phenomenon of modern society, has significantly influenced the informatisation of education. Teaching in the classical form, lectures, reading from a textbook, or memorising texts is becoming dull for students. Presentation of the curriculum via multimedia and the Internet is also suitable. This will make teaching all subjects more efficient, better and more modern (Mishra & Koehler, 2006).

An essential part of education is also mastering the methods of searching for information and working with it, as well as its presentation and subsequent use and application in practice. Every educated person must adapt to the requirements of contemporary society, which requires communication and computer literacy. A suitable means of achieving this is using information and communication technologies such as the intranet and the Internet, which should be supplementary to basic general information. ICT is an essential means of supporting teaching, studying and other activities in the field of educational development. ICT allows the learning of mathematics to be more efficient, improved and modernised, as well as other taught subjects. The beautiful motivational potential of this teaching method and the possibility of individualising teaching are undoubtedly among the advantages of using ICT in the educational process (Fu, 2013).

We specify the general goals of using ICT in the educational process as follows (Passey & Higgins, 2011):

- to develop cooperation and communication skills (plan work, identify problems, divide the task, combine partial solutions, publicly present the results in a team);
- to develop the student's personality and creativity (to be able to choose an appropriate medium for creating and expressing their thoughts, opinions and feelings);
- to develop metacognitive communication (to learn by discovering, constructing, and thinking about their abilities in the learning process);
- to create formal and logical thinking, to learn methods for solving problems;
- develop the skills necessary for research work (e.g. carry out a simple research project, formulate a problem, obtain information from appropriate sources, look for solutions and causal relationships, discuss the problem, draw conclusions);
- appreciate and respect intellectual properties (understand that information, data, knowledge, and, for example, programs are products of mental work, are objects of property and have value).

ICT means computers, laptops, interactive whiteboards, visualisers, data projectors, scanners, and teaching software (Warschauer, & Matuchniak, 2010).

1.1 Digital literacy: An essential skill in the modern era

Digital literacy is effectively navigating, evaluating, and utilising digital technologies to communicate, access information, and solve problems. In today's interconnected world, this skill has become indispensable for individuals of all ages, enabling them to participate fully in the digital economy and society. Digital literacy goes beyond basic computer usage—it encompasses critical thinking, ethical awareness, and the capacity to adapt to new technologies. For students, digital literacy is crucial for academic success, fostering skills in online research, collaboration, and creative expression. For professionals, it ensures adaptability in dynamic workplaces, where tools such as cloud computing, data analysis software, and virtual communication platforms are increasingly standard (Fu, 2013).

1.2 ICT: The backbone of modern communication and innovation

Information and Communication Technology (ICT) integrates telecommunications, computing, and digital systems to process and share information. ICT has transformed how individuals, organisations, and governments interact, driving innovation across industries. Businesses leverage ICT for automation, data management, and global outreach, while educational institutions use it to enhance learning experiences through digital classrooms and e-learning platforms. ICT also plays a pivotal role in healthcare, enabling telemedicine, electronic health records, and real-time monitoring of patients. As ICT evolves, it facilitates smarter cities, advanced AI systems, and greater inclusivity, bridging the digital divide and connecting communities across the globe (Livingstone, 2012).

1.3 The intersection of digital literacy and ICT

Digital literacy and ICT are interdependent, reinforcing the effectiveness of the other. Digital literacy equips individuals with the skills to use ICT tools efficiently and responsibly, while ICT provides the platforms and systems necessary for digital literacy to thrive. For instance, digital literacy enables users to discern credible sources of information online, a skill that is essential in combating misinformation in the digital age. Simultaneously, ICT provides the technological infrastructure to access and disseminate such information. Together, they empower individuals to engage meaningfully in a rapidly changing digital landscape, fostering innovation, collaboration, and lifelong learning in an increasingly globalised world (Livingstone, 2012).

The paper explores and demonstrates ICT's transformative role in modern education. It seeks to illustrate how ICT can enhance teaching methods, improve learning outcomes, and foster essential skills such as digital literacy, creativity, and independent learning. The paper focuses on:

- Highlighting ICT as a tool to make traditional teaching methods more engaging, efficient, and aligned with the needs of contemporary society.
- Emphasising the importance of developing critical competencies, such as collaboration, research skills, and formal problem-solving, is necessary for students to thrive in a digital era.
- Showcasing the advantages of using ICT, such as individualised learning, immediate feedback, and the ability to simulate complex events while providing specific examples of its application across educational contexts.

The overarching goal is to advocate for integrating ICT into education, ensuring students and educators can harness its full potential to enhance motivation, accessibility, and the overall quality of the learning process.

2 Use of the ICT tools in the educational process

The use of ICT in teaching is currently not only a possibility but also an accurate expectation of society. It is the expectation of parents and students and must also be the expectation of teachers. ICT offers a wide range of applications in our pedagogical practice, which allows us to expand the base of our methodological tools and develop modern competencies in students, increasing their motivation. ICT tools greatly help us in improving the clarity of teaching. Using animations, videos, and precise, illustrative images will enliven every lesson, regardless of the subject. On the one hand, lessons will be more lively, varied, and exemplary. On the other hand, we will significantly help students with learning disabilities, integrated students and those who are simply slower than others. The teaching material becomes easier for them to understand and follow when they see it in a prepared structure. This will help them in creating their notes later. Dynamically processed teaching materials attract students' attention and facilitate the integration of acquired knowledge into wholes. Thus, students can understand the given topic faster and learn the teaching material more efficiently (Higgins, Xiao, & Katsipataki, 2020).

The use of information and communication technologies in the teaching process enriches our methods and impacts the course of the lesson. They significantly speed up the lessons since we do not have to draw pictures and sketches on the board, but in the explanation phase, we only show further steps and new elements. If we work with a projector, we can add a background to the sketches, pictures, and data to the prepared photographs and tables (Tondeur, van Braak, Ertmer & Ottenbreit-Leftwich, 2017).

Information and communication technologies can be used in the teaching process as teaching using digital teaching materials (animations, computer experiments, video recordings), for solving tasks, practising teaching material using ICT tools (interactive whiteboard, computer classroom), for digital written work, in electronic administration, outside the teaching process as teaching materials available to students online, for easier access to supplementary

materials and information, for better understanding and deepening of the curriculum, in tests, and practice tasks (Jenkins, Clinton, Purushotma, Robison & Weigel, 2006).

3 The attitude of students to ICT tools

Students' skills in information and communication technologies primarily develop learning abilities. Secondly, our society also sets certain expectations in this area. The further the emphasis is placed on the so-called computer literacy among young people. Therefore, even elementary schools must provide space for teaching ICT competencies. In school practice, these competencies serve as a means to achieve educational goals and are closely linked to the ability to learn. ICT serves to strengthen the teaching process (Ertmer & Ottenbreit-Leftwich, 2010).

Technical skills consist of the actual use of computers and various information and communication technology devices and different software. This knowledge is not directly included in the teaching process but is an essential means of learning (Voogt, & Roblin, 2012).

Information and communication technologies develop the following abilities and skills of students: student cooperation, presentation skills, independent learning using ICT, and the ability to obtain and process information (Siddiq, Scherer & Tondeur, 2016).

4 Benefits of using ICT in the educational process

There are many advantages of ICT tools in the educational process. The most important benefits of using modern information and communication technologies in teaching include the following.

4.1 Presenting knowledge in an attractive form for students

Modern technology allows you to present information in a completely new way, which can be much more attractively processed visually and, therefore, more interesting and more easily acceptable for students. It is also possible to present knowledge in this form, the presentation of which would otherwise be impossible or would be very difficult to describe in words or individual static images (Henderson, 2020).

4.2 Studying at your own pace

Modern technologies allow students to choose their own pace at which they can study, the time, when and how much they want to research and where they want to study. This allows them to allocate their time much better and, on the other hand, forces them to take on more

responsibility for their study results, developing the student's ability to work independently and effectively divide their time between individual activities (Kozma, 2003).

4.3 Immediate feedback

The use of modern technologies provides students with passive access to new information and knowledge and the opportunity to verify the acquired knowledge and skills. Feedback is usually provided to the student in two ways. In the first of these, the student receives feedback immediately. This method is suitable for acquiring knowledge when it is possible to prevent the student from developing bad habits immediately. In the second method, the student receives feedback only after a specific time, for example, after completing a test, answering all questions, etc. In this case, the provision of feedback is often triggered by a specific action of the student by which he requests input (Henderson, 2020).

4.4 Motivation

The use of computer technology expands the possibility of motivating students. For example, many educational programs are processed as computer games. They have a powerful motivational charge, especially for children. Appropriate graphic and audio processing of the presented material also acts as a motivating factor (Kirkwood & Price, 2014).

4.5 Error warning

Students are much less bothered if a computer program warns them of mistakes they make during their educational process than if a teacher, classmate or parent warns them. Students often do not consider a computer program to be a teacher, even though it teaches them and verifies their acquired knowledge (Selwyn, 2012).

4.6 Possibility of simulating events

Modern technology allows us to simulate events in teaching that would otherwise not be possible to include in teaching because they would be too expensive, too dangerous, or take too long (for example, several centuries). In this area of education, the use of modern information and communication technologies is irreplaceable (Kirkwood & Price, 2014).

5 Conclusion

In the rapidly evolving landscape of education, the integration of ICT has emerged as a transformative force, redefining traditional teaching and learning methods. This paper has explored the critical role of ICT in modern education, emphasising its potential to enhance

engagement, improve learning outcomes, and equip students with the skills necessary to thrive in a technology-driven society. From fostering creativity and collaboration to enabling personalised learning and immediate feedback, ICT tools provide unparalleled opportunities to make education more accessible, dynamic, and inclusive.

The benefits of ICT extend far beyond mere technological adoption. By enabling visually enriched and interactive presentations, students are more engaged, motivated, and able to grasp complex concepts. ICT facilitates individualised learning, allowing students to progress at their own pace and develop a deeper understanding of the curriculum. Furthermore, its ability to simulate real-world scenarios offers learners a hands-on approach to problem-solving and critical thinking, skills that are essential for personal and professional growth.

Moreover, incorporating digital literacy as a foundational competency underscores the necessity of preparing students for the challenges of the modern era. Educators can bridge the gap between academic learning and real-world application by equipping them with the ability to critically evaluate information, communicate effectively, and use digital tools responsibly. Digital literacy, combined with the infrastructure provided by ICT, creates a synergistic relationship that fosters lifelong learning and adaptability.

The societal expectation for ICT integration in education highlights its growing importance. As parents, students, and educators recognise the value of digital tools in enhancing the clarity and efficiency of teaching, the demand for ICT-enabled education continues to rise. Its applications, from classroom instruction to extracurricular learning and administrative processes, demonstrate its versatility and far-reaching impact.

In conclusion, ICT is not merely a supplementary tool but a cornerstone of modern education. By leveraging its capabilities, educators can create an environment that is engaging, efficient, and tailored to the diverse needs of learners. The ability to present knowledge attractively, provide immediate feedback, and simulate otherwise inaccessible scenarios ensures that education remains relevant in an ever-changing world. As we embrace these advancements, the focus must remain on harnessing ICT to cultivate a generation of critical thinkers, problem-solvers, and innovators equipped to navigate the complexities of the digital age.

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