ARTÍCULO PRODUCTO DE INVESTIGACIÓN

Competencias digitales en educación durante la Revolución 4.0

Digital Competencies in Education during the 4.0 Revolution

Jacek Piotr Kwaśniewski[1]
University of Business MBA in Bydgoszcz

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Resumen

En tiempos de la Revolución 4.0, la educación digital está adquiriendo una importancia creciente, ya que las habilidades digitales son cruciales para profesores y estudiantes. Las investigaciones muestran que la mayoría de los docentes poseen competencias adecuadas en tecnologías digitales, pero carecen de la motivación para desarrollarlas. También existen obstáculos para la implementación de la educación digital, como la falta de apoyo pedagógico y técnico. Las formas de apoyo para los docentes en la mejora de competencias digitales se basan principalmente en la formación, aunque también existen herramientas de autoevaluación y redes de profesores. La conclusión de la investigación es la necesidad de preparar adecuadamente a los docentes para implementar la educación digital en el contexto de la Revolución 4.0.

Palabras clave: competencias digitales, educación, Revolución 4.0, nuevas tecnologías

[1] jacek.piotr.kwasniewski@wp.pl
https://orcid.org 0000-0001-6041-4094

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Abstract

In times of the 4.0 Revolution, digital education is becoming increasingly important as digital skills are crucial for teachers and students. Research shows that most teachers possess appropriate competencies in digital technologies, but they lack the motivation to further develop them. There are also obstacles to implementing digital education, such as a lack of teaching and technical support. Forms of support for teachers in improving digital competencies are mainly based on training, although there are also self-assessment tools and teacher networks available. The conclusion of the research is the need to properly prepare teachers to implement digital education effectively in the context of the 4.0 Revolution.

Keywords: digital competencies, education, Revolution 4.0, new technologies

Introduction

As the COVID-19 pandemic has shown, digital competencies at almost every level of administration and in most enterprises have proven to be necessary for proper functioning. The Fourth Industrial Revolution, understood as a process of changes enabling the creation of new types of services and products, concerns the rapid exchange of information and ensuring access to it at any time. Integrating people, processes, and machines requires comprehensive IT knowledge for future employees, which should be provided by the teaching staff. Education focused on challenges and competencies is gaining importance. The value itself results from the practical and individual ability to use knowledge when solving specific life and professional situations. Competence becomes a measure of the ability to take on various social, cultural, economic, and professional roles. The most important justification for this topic is its relevance and the need to show the dynamism of the development of these competencies from a theoretical and practical approach.

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1. Research Methodology

The study aimed to verify competencies, tools, forms of support, and obstacles in digital education during the 4.0 Revolution. The subject was education in the Piła region, focusing on the digital competencies of teachers. The research was conducted using the quantitative method. For detailed research, a survey and graphic method were used.

The main research problems concerned the following issues:

. Do teachers in Polish schools have sufficient competencies and tools to teach in the conditions of the 4.0 Revolution?
. What obstacles occur in education when using modern technologies?
What are the forms of support for teachers in improving digital competencies?
The organization of the research consisted in sending survey questionnaires by e-mail to primary and secondary schools in the Piła district, and then selecting the returned questionnaires and grouping the research results.

1.1 Digital Competencies in Education

The European Commission understands digital competencies as skills that are as important as the ability to write, read, or think mathematically (Recommendation 2006/962/EC of the European Parliament and of the Council). These competencies are essential when using digital technologies and communication technologies freely (Głomb, 2020, p. 7). Other authors define digital competencies as a specific catalogue of knowledge and skills that every person should have, with the only category for their division being criteria such as age or educational level (Buchholtz et al., 2015, pp. 11-12).

Ján refers to information society competencies (knowledge, skills, and attitudes) (Figel, 2007, p. 7). This type of approach was used in the catalogue of digital competencies developed when creating the Digital Poland 2014-2020 program. Figel and this program recommend using a

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relational approach as part of digital competencies in areas such as finances, relationships with others, education, work and professional development, hobbies, health, relaxation, and religion (Jasiewicz, 2018, pp. 123-124).

A noticeable change in the understanding of digital competencies was the increased emphasis on the critical and reflective use of Internet resources (Ledzińska & Czerniawska, 2010, p. 327; Recommendation of the EU Council, 2018/C189/01). Hence, today's expert in digital competencies should also have skills in co-creating or creating a network environment and in selecting and analyzing information sources (Filipiak & Siadak, 2014, pp. 22-25). The Program for the Development of Digital Competencies in Poland outlines the main principles of their implementation, such as a harmonious structure of knowledge, skills, and attitudes enabling living, working, and learning in a society using various digital technologies (Appendix to Resolution No. 24, 2023, p. 6).

Despite great efforts and financial outlays, even after the COVID-19 pandemic, Poland is still one of the countries characterized by a crisis of digital competencies, which are necessary for the country's development in the era of Revolution 4.0 (Głomb, 2020, p. 84; EU Document, 2022, p. 42; Czachorek, 2021, p. 2). This means that digital competencies should be included in teaching plans, and state policy should support digital education more robustly.

1.2 Basic Digital competencies in teaching plans

Across Europe, there is a relatively consistent approach to understanding digital competencies as key (Bourgeois et al., 2020, pp. 9-10). Acquiring these competencies is an essential element that will enable young people to effectively participate in society and the digital economy. Neglecting these skills, especially in teaching plans, will only deepen the digital divide and perpetuate existing inequalities (European Commission, 2019, p. 25).

Digital competencies are part of the curriculum of most EU countries, at all levels of education, in the following forms (European Commission, 2019, p. 28):

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. As a cross-curricular issue (teaching takes place in all subjects, and the obligation to develop these competencies applies to all teachers),
. As an issue integrated with other subjects,
. As a separate item.

The European Digital Competence Framework (DigComp) includes 21 competencies, the most well-known of which are (Vuorikari et al., 2022, pp. 10-11):

. Ability to use information and data: browsing and filtering information, as well as digital content, managing it and its price,
. Cooperation and ability to communicate using digital tools while maintaining security on the Internet and digital identity management
. Integration and creation of digital content and programming basics,
. Network security with the ability to use protection tools (antiviruses, firewalls),
. Solving problems related to digital technology, for example identifying significant gaps in these competencies.

In primary schools in the EU, digital competence education systems dominate in the form of cross-curricular education and as a separate compulsory subject. At the primary level, digital skills are taught as transversal key competencies. Similarly, in secondary schools (European Commission, 2019, p. 28). Within individual education systems, the following skills are included in the teaching plans: using digital information, creating content, communicating and collaborating, maintaining safety, and solving problems (European Commission, 2019, p. 10).

The authors H. Dębowski and W. Stęchły distinguished the following three categories as part of the educational needs related to digital competencies: subject and academic knowledge,

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professional and technical knowledge, and transversal competencies[2] (soft competencies) (Dębowski & Stęchły, 2019, p. 92). This division is not clear-cut, and the curricula often overlap. For example, developing subject knowledge also involves building various cognitive, learning, and problem-solving skills, while professional skills are related to both digital competencies and management or leadership.

1.3 Digital education in state policy

Digital competencies appearing in the directions of implementation of the state's educational policy can be observed in the form of computerization and informatization processes. Recommendations in the field of digital competencies show the evolving policy attitude towards the need to develop specific skills (Table 1). As seen, from 2016 to 2022, state policy in digital education focused on developing IT and digital competencies, fostering creativity and entrepreneurship, and promoting the safe use of digital tools and resources.

Achieving optimal effects of the educational system depends on its components, such as the values and principles dominant in society; the role of stakeholders (students, teachers, parents, state, local government, trade unions, employers); the amount of financial resources allocated to education; institutions in the form of standards, such as educational programs, class and lesson systems, the Teacher's Charter, and the education structure; learning rules for optimizing the educational system; and various types of mechanisms that regulate the interaction between these elements (Cieślik et al., 2021, p. 154).

Table 1. Digital Competencies in the state's educational policy in 2016-2022 (MEN, Basic directions of implementing educational policy).

2016/2017	Developing IT competencies of children and youth in schools and institutions.

[2] The term transversal competencies refers to competencies that are useful when performing work other than the one currently performed. These are competencies acquired in one environment that can be transferred to another environment (Savaneviciene et al., 2014, p. 100).

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2017/2018	Improving the quality of mathematics and computer science education. Maintaining safety on the Internet.
2018/2019	Developing digital competencies of students and teachers. Maintaining safety on the Internet.
2019/2020	Developing students' creativity, entrepreneurship and digital competencies. Maintaining safety when using information and communication technologies.
2020/2021	Using digital tools and resources and distance learning methods. Staying safe online.
2021/2022	Prudent use of digital tools and resources, as well as educational methods using information and communication technologies.

Source: Own elaboration

Raising digital competencies in state policy was primarily dealt with by the Ministry of National Education, which took the following actions in 2016-2022 (Głomb, 2020, pp. 55-56):

. Training to develop teachers' digital competencies.
. School for the innovator.
. Nationwide Educational Network (OSE).
. Active Board

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. Appointing provincial coordinators for innovation in education.

More than 95,000 people were trained as part of training courses developing teachers' digital competencies, and by 2023, teachers should be trained in creating their e-materials ("Lesson: Enter"). Moreover, these training courses include conferences and seminars financed by EU funds ("Innovative solutions for digital activation") (Grewiński, 2018, p. 121).

The main task of the "School for an Innovator" program is to develop model solutions that concern various innovative education methods. The program supports the development of pro-innovation competencies of students and teachers and strives to develop systemic changes, the implementation of which will support the transformation of schools into innovative work environments (Fazlagić, 2018, p. 7).

The National Educational Network involves the introduction of fast, safe, and free internet in all schools. The task of this program is also to support leaders of modern education, i.e., teachers using innovative digital tools (MP, 2023, item 318).

The "Active Blackboard" program aims to provide teachers and primary school students with interactive whiteboards, as well as other digital devices, including media, used to develop digital competencies (Journal of Laws U., 2020, item 1883). The task of provincial coordinators for innovation in education is to disseminate innovative activities and the principles of using digital tools (e-textbooks, e-resources, e-journals, writing programs) (Gajdzica, 2022, p. 114).

In addition to the above-mentioned activities, the state policy plan until 2027 includes a program for financing digital development, which includes the following package of demands related to digital education (Annex to Resolution No. 24 of the Council of Ministers):

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. Transformation of educational institutions towards the development of digital competencies of teachers and students.
. Ensuring digital security and modern infrastructure.
. Introducing one model for implementing digital competencies, instead of many scattered ones, and creating a national certificate of digital competencies.
. Increasing the number of IT classes in secondary school curricula.
. Creation of a national adult education system in the field of digital competencies.
. Opening innovative fields of IT studies (*big data*, artificial intelligence, 5G, Internet of Things, *blockchain*).

There are many other initiatives and activities on the part of the state supporting digital education, the discussion of which is beyond the scope of this article. However, it should be stated that all these initiatives are insufficient or wrongly targeted because Poland is still in one of the last places in the EU in terms of digital knowledge and skills (Gołaszewska-Kaczan & Kuzionko-Ochrymiuk, 2022, p. 138).

2. Revolution 4.0 in the context of education

The fourth industrial revolution encompasses a description of technology as well as the principles of operation of economic organizations, including controlling and monitoring physical processes of systems, cloud computing, the Internet of Things and Services, and the Internet of Everything (Furmanek, 2018, p. 57; Paprocki, 2018, pp. 63-64).

2.1 Educational challenges arising from the 4.0 Revolution

The educational challenges of the 4.0 Revolution are complex. The nature of work is changing, as are the professional skills required. Most work will be performed using robots and computer programs, necessitating digital and technical skills. Teaching methods will evolve, with

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traditional lessons based on memorization being replaced by developing critical thinking, teamwork, and problem-solving skills (Schwab, 2018, p. 7).

Many researchers believe that the 4.0 Revolution will involve more comprehensive changes than ever before. The combination of many technologies, such as artificial intelligence, robotics, and the Internet of Things, can disrupt entire sectors and organizational structures. The "education-employment-career" model will no longer suffice. The concept of specialized skills will shift in favor of multiple transferable skills. The demand for the type of specialization of future graduates will be difficult to predict (Chmielecka, 2019, p. 15; Wieczorek, 2018, pp. 111-112).

In such a changing environment, the educational challenges arising from the 4.0 Revolution involve charting a certain path containing a specific list of determinants, such as new generation electric batteries, three-dimensional printing, optical genetics, metabolic engineering, two-dimensional materials, nanosensors, the Internet of Nanothings, and autonomous vehicles (Chmielecka, 2019, pp. 14-15). One area of education is the appropriate preparation of staff in terms of knowledge and skills, as well as the creation of social competencies and supporting value systems necessary for proper functioning in a specific social environment (Muszyński, 2014, p. 82). The increasing importance of technology necessitates increasingly better-organized education, which is related to increasing the level of knowledge and shaping flexibility towards changes because the 4.0 Revolution is based on constantly updated knowledge (Tomczyńska, 2021, p. 52). Efficiency and innovation increasingly depend on knowledge, its quality, and usefulness.

The most important are analytical skills, integration of knowledge with practice, and the ability to navigate in the virtual process environment. The importance of communication, linguistic, and digital competencies, which concern the area of work but also everyday life, is growing (Rogulski, 2019, p. 4).

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Educational challenges should also be addressed to educational institutions and the equipment of teaching staff. In this area, an active attitude of teachers will be necessary, as they should strive for a flexible approach to changes and updating knowledge. We should also consider the growing role of tools supporting learning and providing educational resources, as well as artificial intelligence, which is becoming more important in continuing distance education. Teachers and students need to understand at least the basics of new technologies, including artificial intelligence (Kayembe, 2019, pp. 85-86).

According to some authors, the constant development of IT competencies allows for full and active participation in areas such as economic, ideological, political, ecological, and social. This provides the ability for individual expression, innovation, and social integration (Brown-Martin, 2017, pp. 6-7). To meet educational challenges, it is necessary to introduce new subjects to schools, such as programming, data analysis, or artificial intelligence, and teachers should continue their education in modern technologies.

As divisions into levels of education begin to lose meaning, because people from different generations can meet in the same group during training or courses (which results from the principle of continuous learning), a difficult question arises regarding education: "who, what, how, where, and why to teach?", which becomes more important if training conducted remotely is considered (Ciechanowska, 2010, pp. 119-120).

Diplomas from some universities will become less important in business, posing a huge challenge to their operating model, especially regarding their ability to obtain funds (public or private), and the labor market will also change. The model of practical preparation of students for their profession will lose its current value (Mazur, Głuc, 2021, p. 10). Educational inequalities may also be a problem, hence the need to identify them and then implement support programs that will use, for example, continuing education (Bandoła, 2020, pp. 177-178; Bartak, 2019, p. 390). State institutions may be helpful in this regard.

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There is no doubt that certain educational processes will have to change towards digitalization and automation. To counteract educational inequalities, it will be necessary to link local solutions with global trends and educational arrangements at the international level, based primarily on dialogue, scientific research, and reliable data (Wieczorek, 2018, p. 55).

The greatest educational challenge resulting from the 4.0 Revolution will be to cause a change in thinking about the function of education in all its aspects (continuous education at every stage of life and creating a knowledge society).

2.2 Changes in the structure of vocational and higher education

The changing labor market necessitates changes in the processes of higher and vocational education. In 2017, recruitment to junior high schools in Poland ended, and vocational education began with the aim of recreating professions that emphasize practical skills. On September 1, 2019, the regulation on the general objectives and tasks of education, in accordance with the principles of vocational education and the classification of vocational education professions, came into force [Regulation of the Ministry of National Education, 2019, Journal of Laws, pos. 991]. As part of this type of education, the following schools were established (amended by the announcement of the Minister of Education on January 5, 2024): First-cycle Vocational School (three years), Second-cycle Vocational School (two years), Five-year Technical Secondary School, and Post-secondary School (two-and-a-half years) (Journal of Laws, 2024, item 110) Figure 2.

Education in vocational schools is to be based on new technologies as part of vocational training. Vocational schools, in consultation with employers, are starting to invest in modern laboratories, specialized equipment, and computer rooms. These schools have begun to offer classes in programming, robotics, and data analysis, enabling students to learn about areas related to modern technologies.

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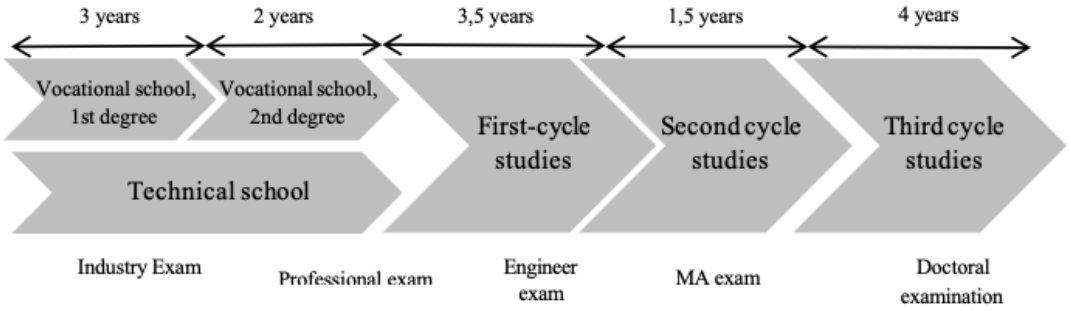
Figure 2. The model of vocational education in Poland from the 2019/2020 school year (Panasiuk, Kaczmarek, 2018, p. 82)



Source: Own elaboration

Changes in vocational education in the field of digitalization require appropriate support from local governments, the state, and enterprises [Głomb, 2020, pp. 27-28]. Similarly, universities, which have been divided into academic (the only ones that provide doctoral education) and vocational (awarding specific professional qualifications) [Rączka & Jędrzejewski, 2022, p. 337], will implement programs related to advanced technologies in the fields of design, production, and primarily in terms of flexible thinking (Journal of Laws, 2022, item 574).

Using EU funds, universities are expanding their laboratories. For example, the Military University of Technology has launched the largest robotics and automation laboratory in Poland, where students can study 2D and 3D vision systems. Vocational schools, technical schools, and universities are awaiting greater funding from local governments, the state, or the EU to provide education that could combine knowledge with skills (Panasiuk & Kaczmarek, 2018, p. 83).

2.3 Digital education in the conditions of the 4.0 Revolution

In the area of digital education, and in the context of the rapid development of digital technologies, this education should become a permanent phenomenon that will be implemented from an early age. It should include not only the ability to use applications but

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also skills related to creating structures and algorithms for their creation. An important element of acquiring these skills should be knowledge of cybersecurity, as well as digital hygiene, critical thinking, and the use of digital media. The development of so-called high-technology competencies, which appear in IT professions and many other professions, such as analytical, innovative, and scientific competencies (Głomb, 2020, p. 39), is of great importance for the development of modern societies.

In the perspective of 2030 - the EU sets the following goals in the field of digital education in the conditions of Revolution 4.0 (European Commission, 2019, pp. 284-186):

. Implementation of local strategies for the development of digital skills and introduction of a systemic mechanism for meeting needs in this area.
. Bridging the high technology competence gap
. Halving the basic digital competence gap.
. Two-thirds of EU citizens have digital skills.

For these goals to be achieved, EU Member States should analyze the possibility of revising the current paradigm of teachers' digital competencies and tools used in teaching - into a new one, consistent with the vision of education in the conditions of the 4.0 Revolution.

2.4 Digital competencies of teachers and tools used in teaching

In many schools, school managers and teachers do not have the appropriate competencies to identify technological needs and order services that meet their needs and the needs of students. There is often a lack of technical staff to support teachers. A serious problem is also the lack of developed standards or good practices, as well as recommendations in this area, which should be designated at the central level by the ministries of education and digitalization and at the regional level (Plebańska & Tarkowski, 2016, p. 4).

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The role of teachers in a contemporary environment in shaping students' digital competencies is ambiguous. When analyzing the space of school infrastructure in terms of teaching these skills, the following relationships should be considered:

. The possibility of teachers and students using computers - does not directly ensure improvement of teaching results in the field of digital competencies, and the school digital infrastructure is only a necessary, but not sufficient condition (McCrindle, Fell, 2020, p. 12; Schleicher, Avvisati, 2015).
. Better teaching results are achieved if digital tools can be integrated with the teaching process and with the entire school ecosystem (Bulman, Fairlie, 2016, pp. 5-6).
. The designated purpose of using computers has a greater impact on the knowledge of digital techniques (Bulman, Fairlie, 2016, p. 7).
. Students who prepare studies, reports and do homework have higher digital skills (Mullis et al., 2017, p. 6).
. Digital skills of teachers and students depend mainly on their nature and online activity (the more activities they take, the better the teaching effects are (Fraillon et al., 2018, p. 38).
. The use of digital resources and tools in the teaching process has a positive impact on the level of digital skills (Fraillon et al., 2018, p. 39).
. The digital transformation of schools causes a change in the attitudes of teaching staff and school managers (Głomb, 2020, p. 21).
. The level of student’s digital competencies largely depends on the level of expenditure on digital infrastructure and teacher training (Fraillon et al., 2018, p. 41; Wagemaker, 2019, pp. 35-37).

Changing knowledge transfer tools to electronic ones - should not significantly affect the essence of teaching (they are only modified). Therefore, it will be important for students to thoroughly familiarize themselves with new technological solutions and new tools (Mischke, Stanisławska, 2003, pp. 69-70).

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A particular challenge faces teachers who deal with early school education. According to A. Płusa, during online learning sessions, students showed serious problems with educational platforms and other digital tools enabling lessons, which negatively affected their well-being, reduced their motivation to learn, and caused stress and frustration (Płusa, 2023, p. 13). With the rapid development of digital tools, the possibilities of using multimedia teaching aids have also changed. These aids are now available online from anywhere at any time and are often dedicated to children and young people with special needs in this area (Molga, 2013, pp. 117-118). Most schools have tablets in stock for use by teachers, including their own, and students. Interactive teaching aids make the process of providing information more attractive.

Digital tools used in teaching are reflected in the regulations on preschool and general education (Education Law, Journal of Laws 2023, item 900; Regulation 2018, item 467), as the ability to solve problems using tools derived from IT, the ability to use information and communication technologies, independently access information and make its selection and evaluation, creating habits of systematic learning (Regulation 2018, item 467, p. 2). It is about the ability to use a family of technologies that process, collect and transmit information electronically (ICT).

The main survey involved asking randomly selected school principals in the Piła region (130 schools) to answer the questions posed in the survey. Almost all teachers demonstrated knowledge of such information technologies as electronic journals and books on electronic media (98% each), as well as 5G networks (75%), 3D printing (62%) and artificial intelligence (56%). Knowledge of the Internet of Things (28%) and cloud computing (39%) was lower - Chart 1.

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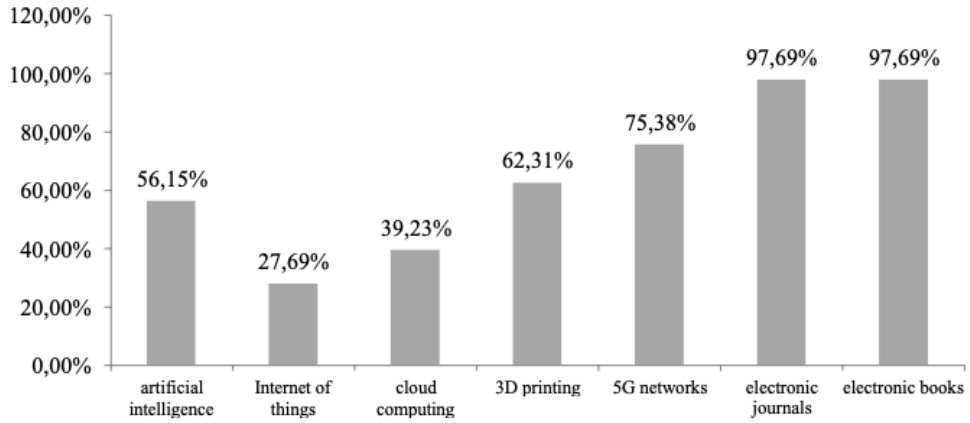
Chart 1. Teachers' knowledge of modern information technologies

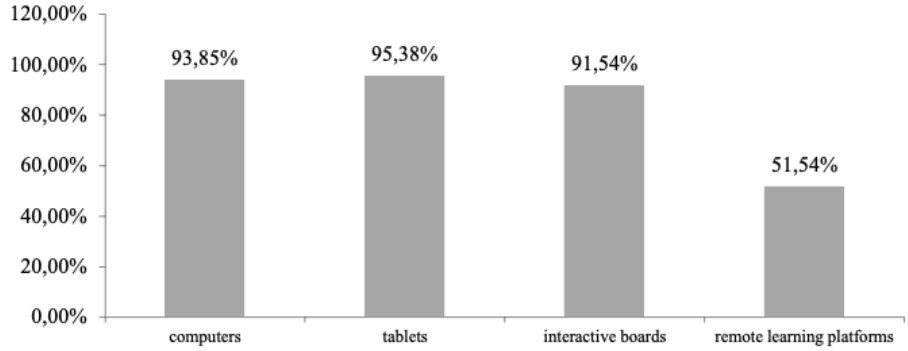


Source: Own study based on surveys conducted in schools in the Piła region

Most teachers undergo appropriate training (95%) and have undertaken the obligation of continuous learning (100.00%), but no one holds them accountable for this obligation. This is probably evidenced by students' achievements in new technologies.

The ability to use modern IT devices among the surveyed teachers involves using computers, tablets interactive whiteboards, and to a minimal extent - remote teaching platforms - Chart 2.

Chart 2. Teachers' ability to use modern computer devices



Source: Own study based on surveys conducted in schools in the Piła region.

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Teachers in Polish schools should therefore have appropriate competencies as well as tools for teaching in the space of the 4.0 Revolution.

The introduction of many modern technologies and continuous improvement of teachers' skills are becoming strategic for effective teaching and preparing students, starting from an early age to function in a digital society. Supporting them in developing their competencies, as well as providing them with the right educational tools, is an investment that will ensure the future of education and the entire nation.

2.5 Forms of Support for teachers in improving digital competencies

The process of professional development of teachers continues throughout their entire careers. Competences, especially digital competencies, should be constantly updated to be able to respond to developing new technologies and social changes. Teacher learning is updated through innovative forms of collaboration as well as through the exchange of experiences (learning networks and communities). In the EU, top-level authorities are involved in all education systems, including in the implementation of teacher development in digital education (European Commission/EACEA/ Eurydice, 2019, p. 53).

2.5.1 Professional development and self-assessment tools

All education systems in Europe lead to the development of teachers' digital competencies and are supported in this area by the highest levels of government. Most systems treat CPD as compulsory (a minimum number of hours that all teachers must devote to CPD) [European Commission/EACEA/ Eurydice, 2019, p. 54]. Supporting teachers' professional development is most often done in the following ways: organizing courses through training institutions (training centres and education centres) or allocating financial resources to training providers.

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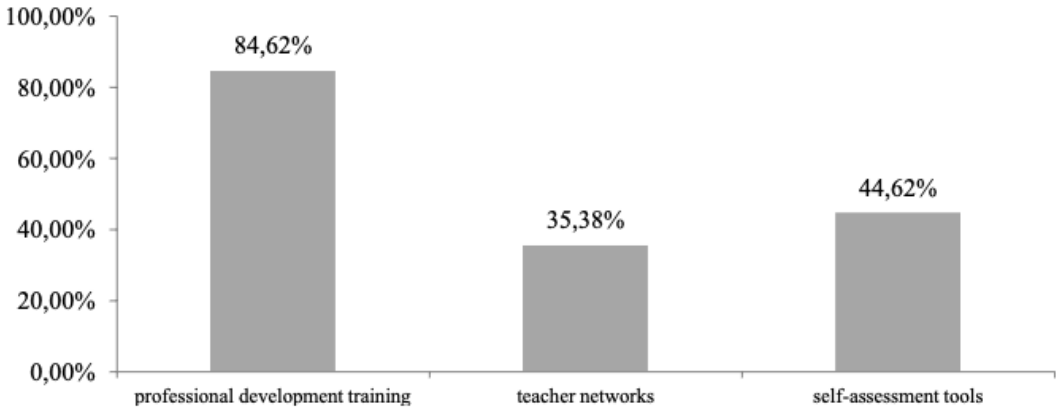
Supporting teachers in improving digital competencies in the surveyed entities includes the following forms: professional development training, teacher networks and self-assessment tools - Chart 3.

Chart 3. Forms of support for teachers in Improving digital Competencies



Source: own study based on surveys conducted in schools in the Piła region.

Professional development training is provided by most surveyed entities (85%), while teacher networks and self-assessment tools are provided by much fewer (35% and 45%, respectively). To assess areas for improvement and the effectiveness of their work, teachers can use self-assessment tools such as online questionnaires, TET-SAT (an experimental project in the field of education policy) or DigCompEdu (a new online self- assessment tool).

2.5.2 Teacher networks

Teachers can also develop professionally in digital technologies by participating in communities and networks. Teacher networks provide the opportunity to cooperate and exchange experiences, as well as share teaching methods, materials and teaching aids. Communities of teachers with IT knowledge most often operate on the Internet, they are part of platforms or portals such as open and digital educational resources and informal online educational and digital contacts. Moreover, the EU offers various e-Twinning platforms

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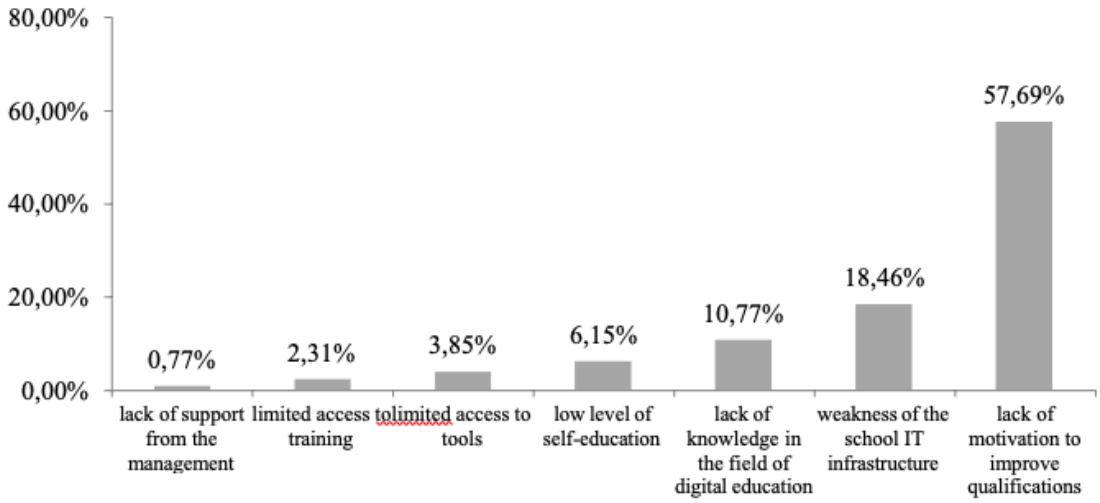
offering many opportunities for communication, cooperation, exchange of experiences regarding digital technologies and the creation of projects (Piekarska, Titlea, 2015).

Education authorities are also supporting the creation of teacher networks by establishing digital platforms. Participation in networks is not obligatory and takes place during free time. This way of learning various digital techniques is popular throughout Europe (European Commission/EACEA/ Eurydice 2019, pp. 76-77).

2.6 Obstacles appearing during the implementation of digital education

Obstacles appearing during the implementation of digital education, expressed by the surveyed schools (teachers), are primarily the lack of motivation to improve their digital competencies (58%) - Chart 4.

Chart 4. Obstacles observed by teachers during the implementation of digital education



Source: own study based on surveys conducted in schools in the Piła region.

This study shows that teachers should be motivated and convinced of the benefits that may flow from the use of new technologies in teaching. The belief in using these technologies in everyday practice is also largely influenced by didactic and technical support, such as

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appropriate school IT infrastructure (18%), access to IT tools and training (6%), as well as knowledge in the field of digital education (11). %) and knowledge related to self-education (6%).

In research on teachers' learning in the digital area, the approach to new technologies, i.e. the motivation to improve digital qualifications, is becoming increasingly important (apart from knowledge and skills). As can be seen from the study, it is not so much the lack of devices, tools or training, but the lack of willingness on the part of teachers that may be the greatest obstacle to the implementation of digital education.

Conclusions

The modern era of the technological revolution (Revolution 4.0) requires a change in the approach to education and acquiring new skills. One of the most important areas of this transformation is digital competencies. Learning and developing skills in using new technologies are increasingly important, especially for future generations. In education, teaching related to digitalization should concern all fields of science, every teacher and student, who should develop their skills in all areas of new technologies, and not only in the context of computer science. The most important thing is that teachers are properly prepared to share knowledge in the use of the latest technologies and develop the digital skills of their students.

For teachers and students in the period of the 4.0 Revolution, the following elements are important in the teaching process: teachers' digital competencies, tools related to digital teaching, forms of support from government and local government authorities, as well as obstacles accompanying this type of education.

The first research problem concerned teachers and their competencies and tools for teaching in the conditions of the 4.0 Revolution. Many respondents stated that they know information technology, which they use in the form of electronic journals and books on electronic media,

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they also use the 5G network and 3D printing, and can also communicate with artificial intelligence. Knowledge of the Internet of Things and cloud computing is poorer. The test subjects are subjected to various training courses on new technologies, and they also know the principles of continuous learning. The ability to use modern IT devices is limited to computers, tablets interactive whiteboards, and to a lesser extent - remote learning platforms.

In the area of obstacles occurring in education when using modern technologies, most respondents emphasize the lack of motivation to improve their digital qualifications. Moreover, the surveyed people noticed gaps in teaching and technical support (IT infrastructure and tools, knowledge related to digital education and self-education).

Forms of support for teachers in improving digital competencies are based mainly on training, and to a lesser extent on self-assessment tools (online questionnaires, TET-SAT, DigCompEdu) and teacher networks (financing the creation of internet portals).

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