Chapter

Advanced Digital Competence of the Teacher

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Abstract

This chapter is devoted to the issues of changing the structure of the competence of teachers in the transformation of the school of the twenty-first century—the school of digital civilization. With this in mind, this chapter takes a fresh look at the advanced competencies of teachers of the near future in the context of these real school changes, the structure of which can be represented as the "triangle of digital competencies": life, social, and professional. As shown by analytical studies and experimental experience of teacher training, the results of which are presented in this chapter, this triangle of competences will allow children to be included in the digital school environment and form their further activity in the smart education system in the profession throughout their lives. It is also important to note that new competencies have become the basis of a new profession in the school—a digital curator, which is also discussed in this chapter.

Keywords: digital economy, digital pedagogy, digital competence of teachers, smart education, digital school, digital curator

1. Introduction

Each new stage in the development of society changes first of all the forms of learning. The school of the eighteenth to nineteenth centuries, the school of humanism of the Enlightenment, changed the attitude toward the child in accordance with the nature of their growing up, aimed learning on the study of nature. It was an era of great scientific research and geographical discoveries, travel, and knowledge of the evolution of life on earth.

The school of the twentieth century, the school of the era of industrial society, became widespread and introduced into formal education scientific achievements, educational equipment, mathematics, as the language of science, and rationalism in cognition and design. It was a period of searching for new pedagogical methods, and as a result, the twentieth century became the century of universal literacy.

The school of the twenty-first century, a digital school, made it possible to use the individualization of education in a global knowledge network that transformed the concept of school as a building where children study in classes. Network class, virtual network school, has become a reality.

Digital forms of formal education in the open knowledge network have become part of a new educational environment, a smart education environment in which each student can build their own individual educational route outside formal education in accordance with their educational developmental interests. This new form of education is part of the social benefits of the digital age for everyone throughout

their lives. The school of the twenty-first century is an open information resource of education for everyone; it is a school of universal education.

The history of the development of the digital competences of the citizens lasts from the 1960s of the twentieth century. In the second half of the twentieth century—the century of Cybernetics—massive development received television. It entered every home, which led to the instantaneous dissemination of information and the influence of the information flow on the public consciousness. This can be called the first information wave that was emerging at that time. In schools, there was a TV, and television in school time broadcasts TV courses of leading scientists in different subject areas directly to the classes. Now it has grown into a digital television, which has become available on the Internet to anyone in any country, not only as a public global media but also as part of a global network of knowledge.

Modern TV technologies have allowed to generate a new form of digital pedagogical education—MOOC, which gave rise to "tsunami" of higher education and became a possible alternative form of formal training. e-Learning, as a new pedagogical environment, requires new competencies from all teachers—e-learning competencies. Awareness about various courses, the ability to use the tools of online courses, and the ability to use video communications assist students in such courses—these are the key competencies of e-learning digital pedagogy of modernity and the future.

Since the 1980s, there has been a period of massive introduction of personal computers in human life, family, and school. It was a computer wave of social development. This wave swept the children in the education system, and the computerization of schools has begun. Computer classes, training programs and tests, e-books appeared in each school. Now this wave has grown into the infrastructure of digital schools, distance, and e-learning, accessible to the child with the use of collections of electronic learning materials and mass online courses.

In the first decade of the twenty-first century came the third digital wave—the development of mobile networks and the Internet and their coverage of all the inhabitants of the planet. This ensured the academic mobility of students and the accessibility of education to all children with any special needs via video link. Video consultations and trainings, webinars, teleconferences swept the educational environment. Social networks have formed a new subculture—a cyber society without borders between states and people. Scientists are already talking about the new humanism in the global social network, global media. The key issue for the development of our digital civilization is the preservation of the principles of humanism in the global digital world for future generations.

The school as a social institution has taken these digital waves upon itself, and this has influenced the extremely dynamic renewal and expansion of teachers' competencies—from traditional to digital. This demanded from governments to pay close attention to the digital competencies of citizens, and especially teachers, who form these competencies in children not spontaneously, but systematically for the socialization of the younger generation in the information society.

A modern digital society educator must continuously enrich and complement their digital competence by working with the growing digital generation of aboriginal children in the digital society.

Any adult, not only a teacher, will always face a new digital wave during his life, which is generated by more and more technically advanced information and communication technologies. In this sense, an adult, and a teacher also, in the community of children, always remains an emigrant of the digital society in the new digital wave.

Now we are experiencing a digital wave of artificial intelligence—the fourth industrial revolution and the electronic economy [1]. It is connected with the penetration of

numbers in the artificial world of things, which became possible to manage thanks to artificial intelligence already in the global information space through the Internet and mobile devices not only in the workplace but also in everyday life. In this new digital world, a teacher forms a willingness to live in a new civilization.

At the turn of the fourth digital wave, the international community of teachers under the auspices of UNESCO in 2010 developed a structure of ICT competence of teachers, which can serve as a framework for the development of new digital competencies of teachers [2]. What should be the structure of digital competence of teachers of the new digital wave, what prospects for the development of digital competence should lay society in the training of teachers? This issue will accompany the digital wave of our era for a long time; this is the focus of UNESCO's research in a globalizing world in the digital age [3].

Existing experience shows that user competencies (digital literacy) in the new conditions of the digital economy are transforming and include not only common for all user (life) digital competencies, but also professional digital competencies (profession digitalization) and new social digital competencies in the global information world. Consider this triangle of new advanced digital competencies for a teacher in the conditions of the fourth digital wave.

The concept of advanced digital competencies, presented in this chapter, is based on an analysis of the development of advanced training courses for teachers in ICT competences that have been held on large scale in Russia since 2000 within the framework of national targeted educational informatization programs. In particular, such programs were as follows:

- The program for the development of a unified educational information environment of the Russian Federation for 2000–2005 (at least five teachers were trained in each school of the country in open educational resources in school subjects—a single collection of digital educational resources).

- The program of developing the publicly accessible information environment "Russian E-School (NES)," raising the qualifications of teachers in e-learning methods, involving teachers in developing scenario lessons in the NES environment, including basic ICT competencies of teachers in the professional standard of teachers in Russia (2011–2015).

- The program of developing a new system of teacher certification, taking into account the key competencies of active work in the digital learning environment based on the use of information training systems in Russia (NES and the electronic textbook system in all school subjects), remote communication tools with students and parents (digital communication medium of electronic diaries), as well as systems of educational analytics (electronic system of accounting of control materials and the final certification of students) and electronic cloud-based document management (since 2015) [6].

2. The transformation of school in the digital environment

The new concept of "smart education" is debated, but there is an important material for International Studies, which is summarized in publications on the official website of UNESCO Institute for Information Technologies in Education (IITE) [11]. The problem of the deployment of smart education in different countries, including Russia, has already approaches and solutions, which can be solved by methods of digital pedagogy—pedagogy of the information society.

Digital school is an integral part of smart education. Digital school as a concept appeared at the beginning of the twenty-first century. This concept reflected the objective processes of development of the information society and its social institutions. The transformation of the educational system was the result of the formation of a global digital civilization. Society is on the verge of great change, and teachers are directly involved in the formation of a new education system in the world—digital education. One can only observe this process as a challenge of time, and one can be an active designer of digital education as an order of the information society for changes in social institutions, one of which is the school. Smart meaning "intelligent", spaces mart education—is automated, controlled, and accessed from anywhere in the educational process—the most complex system for integration in school.

Smart education integrates the new concepts of digital pedagogy [1]:

- Open educational resources (OER)
- Massive open online courses (MOOC)
- Educational platforms (learning management system/LMS)
- Electronic textbooks (smart book/e-book)
- Electronic libraries (e-library)
- Open licenses (e.g., Creative Commons)
- Mobile training and mobile educational services
- Cloud educational systems and Internet services Web 3.0
- Digital video communications
- Global media
- Automated management systems of educational organizations (e.g., the ACS of schools, "smart systems")
- Electronic portfolios and personal electronic offices of participants in the educational process

Undoubtedly, digital pedagogy engaged in system integration of various digital educational resources and organic insertion in the training along with traditional learning materials, their coordination and management throughout the country, ensuring access to them for every student and teacher. In addition, she is engaged in shaping new educational standards and resources, taking into account these new realities of the modern world, developing and testing methods for their use in educational activities, and updating teachers' competences. It should be noted that, in addition to schools, it covers all levels of education.

You can see that the process of updating education in terms of embedding innovations in digital pedagogy comes from the top down. The higher school responded first to the changes: smart university, electronic campus, open university—this is the current state of universities, and it all began with the introduction of distance learning and digital libraries. But if a university is a systemic mechanism of compact management within the corporate network of organizations, then the digital school

of the region is a global territorial system that includes hundreds of educational organizations in a single management from the region through a network of municipal clusters. At the same time, the globalization of the digital school is already underway in the Russian education: a federal cloud accounting system is being created for all students in the country, the state educational portal EDU.RU is being developed, and the new portal "Russian e-school" is being created.

For now, we are talking about digital schools as the pioneers of smart education. These are separate pilot schools that have begun to introduce digital services and education resources with coverage of all students and teachers of this school. However, digital pedagogy implies a systemic solution, that is, the design of smart education as a system of digital schools in the territory, and this is the task of the next decades. In many countries, digital school systems are already being created as global cities of smart education. Different models are selected, from the coverage of each school by a single territorial educational platform (digital model of formal education) to the global cloud environment open to everyone through mobile devices (digital model of nonformal education) [3].

There is no doubt that the introduction of intelligent educational models depends largely on the management decisions of the governing bodies of the country's education management. This factor can both enhance the pace of this construction, and slow them down what is observed in different countries in the twenty first century as a result of the development of digital society. New ICTs offer solutions for smart education and provide a lot of educational innovation. It is important that the pedagogical community in this process perceives new ICT in education not as a spectator, but as a creative community of like-minded creators. But there is a risk factor here—this is the staff readiness of teachers to build smart education. There are already pioneers of smart education, and with respect to them, one can trace the speed of updating schools in different countries.

Teachers in partnership with the family are people who directly integrate smart education innovations into the learning process. The role of the family in the design of smart education is very significant, since the special feature of the digital school of the territory is its penetration into the family, the inclusiveness of digital resources, and access to them in all areas of the child's activities at home and in any place where the child is.

It should be noted that in Russia for 30 years of informatization of education, teachers have been prepared to work with smart education objects, and there is already a family order for smart education. In every school, today there are more than half of teachers who are already using elements of the digital educational environment and are puzzled by the slowdown in the pace of introducing smart objects into the educational process. Such readiness of schools is a guarantee of a systemic good result. It is also a matter of the willingness of the smart education facilities themselves and the management level of specialists in the territories to constructively treat innovations. But various countries themselves choose digital school strategies, models, and learning platforms for their integration into smart education. At the same time, the following approaches can be distinguished in the design of smart education:

1. Development, globalization, and smart management of digital school resources through cloud services, including personalized in the region: an electronic diary for all schools in the territory, a unified management environment for diagnosing student achievement, electronic textbooks as a content system, a single access point to them in territories, and in integration with the electronic diary, open educational content and its development by students, ACS of the schools of the territory as a single mechanism of material and

financial accounting, including the global digital video network of education, mass open online courses in the cloud of the region in integration with universities for children and teachers, and above all the various extracurricular courses available for the development of creativity, research activities in areas of children's interests.

2. The introduction of different models of access to the resources of the digital school of the territory:
   - "one to one" (requires equipping each student with a mobile computer device);
   - "one to many" (a group of children needs access to a single digital resource containing courses and video services);
   - "many to one" (individual access of any child to computers and resources of several teachers is required, it is especially important to provide such access for children with disabilities, gifted schoolchildren who are trained according to an individual plan);
   - "many to many" (collective access is required for educational creative communities with groups of remote users, children, and adults, to use digital resources of libraries, clubs, museums, exhibitions, etc.). So far, such a model of interaction in a digital school is developing spontaneously, but we need to allocate Web space, for example, to create a "single window" so that groups of children and communities of teachers can use them at any time.

3. The system integration and strategic management of digital schools and digital education resources is the core of smart education in the region. Systems integration, considered as a digital school platform, can have its own development model (projection) in different countries of the world and in different territories in a particular country. It is already in its infancy and its growth rate is colossal, while it is formed spontaneously in the part of the procedures for embedding in the territories. The digital school platform includes a set of system solutions in a digital environment: banks of students and teachers, collections of educational materials, educational communication mediums, means of managing the educational process, financial and logistical accounting subsystems, and environment of creative portfolio of educational process participants. Here, we need a strategy for its design with the possibility of combining subsystems according to general technological requirements. In the meantime, it is necessary to analyze what to choose from a set of system solutions, how to put the selected constructs into a single smart education platform, and how to ensure its functioning as a global accessible educational environment in the territory. Digital school in the smart education system will allow to conduct educational analytics and identify the demand for digital resources, services, and educational statistics, that is, get a picture of the educational activity of children and teachers in various educational services and build on the basis of this analysis, promising trajectories of development and modernization of digital school, to determine the actual order for teachers' professional development in the most demanded directions of development of the school education system.

4. As part of the promotion of smart education ideas, the notion of resource availability plays a special role, that is, their openness and free access for all comers. At the same time, the most important focus is on the problem of the quality of

open digital educational resources in the modern Web space based on cloud and mobile technologies. This idea is reflected in the concept of a global "knowledge network" [3], which unites various educational resources on the Internet and is open to creativity of students and teachers in a digital school.

As shown by analytical studies and experimental experience of teacher training, an important perspective task of the development of a digital school is to ensure the readiness of teachers for work and creativity in the global knowledge network. This is one of the most important tasks of digital pedagogy. Therefore, there is a high demand for massive open online courses on advanced digital competencies of teachers. This is a new step toward the development of digital pedagogy, since this requires updating the structure of digital competences of teachers in the near future, taking into account the existing experience of informatization of education.

Such advanced competencies of a digital school teacher are represented by a triangle of digital competencies: vital digital competences (common user), social competencies (communicative competencies of the digital society), and profile competencies (on the subject of the teacher's activities). Consider their conceptual content.

3. Digital life competencies

Digital space is based on the mass exchange of information between people, computer programs, things, and machines. In the process of this global exchange of information in the world, there are common to all rules—the need for digital literacy, which relates mainly to the technological aspects of the use of cyberspace resources, which combine computers, mobile communications, and Internet of things (smart things that can be controlled remotely). Cyberspace accumulates huge amounts of information (big data). Cyberspace has become an integral part of our civilization, creating a cyberspace without borders. This society is not only capable of the highest progress but also carries dangerous threats as people create cyberspace and cyber worlds in it.

In the modern real computerized world, new technologies of artificial intelligence (smart technologies) are developing. These technologies allow machines, computer systems, to learn on the basis of the information that they process, to create new information objects themselves, and to interact with other machines and people, that is, to generate new cyber worlds or to contribute new features into existing hyperworlds. Smart technologies change society greatly, as in real life there are new relationships between people and smart machines, and this becomes part of the general digital competencies of citizens.

UNESCO's Information for All Programme [7] recognizes the considerable effort being invested by many international organizations in "measuring the information society," defining digital literacy as a life skill. Basic digital competence actually complements all major life competencies of citizens and expands opportunities in education, creative development, and professional growth and success in the work [8].

Cyber worlds, in which children of our digital wave already live, are a natural environment of normal human activity, filled with virtual analogs: cyber art, cyber education, cyber offices, cyber banks, cyber police, cyber libraries, cyber enterprises, cyber medicine, etc. All this should be included in the basic digital competence of the teacher to teach children to live in a digital world and to have an idea of the penetration of all new digital devices into it. Life digital competence of a competent user becomes a natural component of the general culture of the digital world.

4. Social digital competencies

All Internet users are cyber citizens, or Internet citizens, who have no geographical boundaries for interaction. How to be a cyber citizen in a global cyber society?

Our civilization as a cyber society works in everyday life continuously and at a high pace with large amounts of electronic information in the form of websites, e-mails, and visual and audio fragments (clips), which in turn leads to a decrease in attention, critical meaningful perception of information which is characteristic of the precomputer "book" civilization. Thus, fragmentation in the perception of information increases in a modern child, and "clip thinking" develops.

Cyber society bears the psychological threat to the man himself in it. Computer or Internet addiction is an irresistible addiction of a person to spend time at the computer or on the Internet. Internet addiction, which is now supplemented by and cyber mania, due to the increase in different new devices, allows not only to work with information in the Internet but also to immerse themselves in virtual worlds. All these are new aspects of pedagogy-digital pedagogy.

How to use the enormous possibilities of cyber-books, electronic textbooks, educational platforms, virtual reality and global communications to preserve value human communication and emotions, moral values of humanism, where insults, deception, fraud, rudeness, invasion of privacy is unacceptable? Studies in this direction show the importance of educating children in the spirit of humanism in the context of global media and the formation of new media information literacy [9].

Social digital competence of the teacher is not only psycho-oriented but is also aimed to form in children the value of education and general media literacy in working with information on the Internet and global media, prevention of cyber-crime and cyber mania, fostering a culture of cyber security and Internet etiquette in global knowledge networks as opposed to entertainment. Here, the teacher should act like a digital curator for the socialization of children in the digital world.

5. Professional and specialized digital competence

The profile aspect in digital competencies is a personal choice and the sphere of adaptation of each person to new challenges in the profession with the development of digital technologies throughout life, so as not to lose professionalism and keep up with the digital wave. Each high school student learns in the profile chosen by them, defining the future professional sphere of activity. Each teacher already has a professional environment, which is determined by the school curriculum and school subjects. Knowledge of all aspects of the subject is already insufficient for the teacher of the digital age.

Teachers' professional competences are based on general digital literacy but include general competencies of digital pedagogy, such as e-learning, use of learning platforms for mobile learning, e-books, and open educational resources. This also includes educational analytics systems based on big data, as well as digital competencies for the development and use of digital learning materials on job profile (pedagogical design) and digital learning equipment on school subjects (teacher's computer workplace) [6].

A wide range of digital materials of the knowledge network has become an important, if not predominant, part of the professional environment of the teacher. The ability to work with modern digital materials and learning platform, to be a tutor of e-learning, to actively use online courses for self-education in their subject—these are already existing key professional competencies of the teacher.

The digital wave has brought new resources to digital pedagogy—interactive worlds of cognitive activity, virtual reality, smart equipment for learning and practice, new approaches for educational analytics based on big data. Individual study route for each child is the nearest prospect in a mass traditional school, supplemented by e-learning in all subjects.

The advanced new professional digital competencies of the teacher are based on their inclusion in work with educational information systems, e-learning systems, and distance learning technologies, including video calls for the remote presence of children in the classroom. Each school should become a digital bridge for accessible education of children with their class and teachers, even if the child is out of school, studying at home, in a hospital or working in field practice, creative competition, temporarily being trained in another educational organization [10].

The new mission of a digital pedagogy teacher is to teach children to learn in a digital environment throughout their lives. It is also important that each teacher brings to the children's community information about new professions in their subject area. Children are focused on the future. Their professional choice is formed in school, and professions are formed by the digital economy and the new digital wave also defines the digitalization of the professions.

In addition to the professions of a programmer, web designer, and system administrator, which are traditionally digital for the beginning of the twenty-first century, the digital economy is rapidly enriching all professions with numbers and creating new professions. New professions of the near future show the dynamic addition of the surrounding world with the cyber world. Knowing about these professions, helping children to get basic professional skills with the involvement of business partners in school is the most important task for the professional choice of the child, their readiness for the challenges of the digital world.

6. New profession in school-digital curator

In the new digital wave, social digital competencies require special attention for teachers to work with children. It is necessary to strengthen the environment of development of social digital competences of teachers. In many countries, teachers have already appeared-digital curators in libraries and social adaptation centers, but it is important that they are in every school.

Professional standard "consultant in the field of digital literacy (digital curator)" is approved in Russia from October 31, 2018, by the Ministry of Labor and Social Protection [4]. The responsible organization developer of the professional standard was the all-Russian public and state educational organization "knowledge" [5].

The purpose of the new type of professional activity is to advise on the use of information and communication technologies in various spheres of life, to promote the development of digital literacy of different groups of the population.

The competencies of the digital curator are the following:

- conducting direct reception of citizens' appeals;
- electronic communication on citizens' appeals;
- search and processing of information required for consultations in accordance with the work assignment;
- visual and remote placement of information and consultations;

- maintaining a database of citizens who have applied for advice;
- explanation and demonstration of the ICT application algorithm;
- informing about the most common threats when working in the network, using the means of communication;
- informing about the main methods of combating cyber threats;
- conducting surveys and questionnaires on the results of activities aimed at the development of digital literacy;
- development of programs of information and educational activities for the development of digital literacy of various groups of citizens and the promotion of consulting services;
- diagnostics of the level of digital literacy of the citizen who applied for consultation;
- analysis of the market of digital products and services, digital literacy of the citizens, and resources for their development (information resources, educational and enlightening programs);
- organization of the introduction of modern methods, techniques and forms of counseling on digital literacy development, dissemination of positive experience of counseling, etc.

Digital curator should know the rules of business correspondence and written etiquette; rules of business communication and speech etiquette; requirements for documentation; norms of the native language; principles and mechanisms of search engines; and functionality of popular search services. They need to know the legislation of the country law in the field of intellectual property, personal data, types and basic user characteristics of mobile devices; basic principles of organization; and functioning of computer networks. They should be familiar with the main online services for the provision of electronic services, state portals, and municipal services, including services provided with the use of electronic social cards, electronic payments, electronic queues, and electronic reception. They are required to get acquainted with the trends in the development of information and communication technologies and digital literacy; the market of modern educational programs aimed at the development of digital literacy; directions and prospects for the development of ICT for the citizens; modern approaches, forms, methods, and techniques of additional education and enlightenment; features of additional education and education on the development of digital literacy; etc.

7. Conclusion

The triangle of digital competencies creates a stable structure for their development. Vital (custom) digital competencies will keep up with the world of digital devices and services. Profile and professional competencies will determine the adaptability and success in the conditions of digitalization of professions. Social digital competence of citizens will help to preserve our fragile world on the

principles of humanism and creative development of our children, to avoid atomization of digital society.

The child acquires vital user digital competencies not only at school, but also in everyday life, communication, profile competencies—in school and in the system of additional education, professional digital competence—in the system of professional education.

Traditionally, the development of general user and professional digital competencies of teachers is engaged in the system of professional development of teachers, for which every year new courses are formed taking into account the development of digital pedagogy. As for the formation of social digital competencies in children at school, this is connected with the socialization and upbringing of children in a digital society, which has new features reflected in the interaction with the cyber world, cyber security, and legal information literacy of active citizens of any country. Here, the school needs help, and the digital curator of the school will become a new profession generated by the digital wave of our time. Digital curator will unite the efforts of the school as a social platform for working with children and family in the socialization of children in the face of complex challenges of the new digital world.

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