BRAIN. Broad Research in Artificial Intelligence and Neuroscience
ISSN: 2068-0473 | e-ISSN: 2067-3957
Covered in: Web of Science (WOS); PubMed.gov; IndexCopernicus; The Linguist List; Google Academic; Ulrichs; getCITED; Genamics JournalSeek; J-Gate; SHERPA/RoMEO; Dayang Journal System; Public Knowledge Project; BIUM; NewJour; ArticleReach Direct; Link+; CSB; CiteSeerX; Socolar; KVK; WorldCat; CrossRef; Ideas RePeC; Econpapers; Socionet.

2021, Volume 12, Issue 3, pages: 214-235 | https://doi.org/10.18662/brain/12.3/228

Audit of Digital Civic Space in the Modern School: from Teacher to Creative Leader

Olha VLASENKO[1],
Vita PAVLENKO[2],
Olha CHEMERYS[3],
Oksana PIDDUBNA[4],
Anna FEDORCHUK[5],
Inna YASHCHUK[6]

[1] Zhytomyr Ivan Franko State University, Zhytomyr, Ukraine, wlasolia@gmail.com, ORCID https://orcid.org/0000-0001-7258-2108
[2] Zhytomyr Ivan Franko State University, Zhytomyr, Ukraine, pavlenko-vita@meta.ua, ORCID ID https://orcid.org/ 0000-0001-8528-4054
[3] Zhytomyr Ivan Franko State University, Zhytomyr, Ukraine, chemeryswork@gmail.com, ORCID ID https://orcid.org/0000-0002-7099-1095
[4] Zhytomyr Ivan Franko State University, Zhytomyr, Ukraine, oksana-poddubnaja00@ukr.net, ORCID ID https://orcid.org/0000-0002-5937-0677
[5] Zhytomyr Ivan Franko State University, Zhytomyr, Ukraine, anna.l.fedorchuk@gmail.com, ORCID ID https://orcid.org/0000-0001-8227-3210
[6] Khmelnytskyi Humanities and Pedagogical Academy, Khmelnytskyi, Ukraine, yashchuk.ip@gmail.com, ORCID https://orcid.org/0000-0003-4028-3327

Abstract: *The article is dedicated to modern approaches to development of digital civic space of the modern school, in the context of the research results in modern neuroscience, which is a new phenomenon in Ukraine. A brief analysis of results of recent scientific researches that raise the issue of digital citizenship in postmodern times is given. Theoretical principles and practical experience of European countries to create a digital civic space are considered. Definitions of "civic consciousness" and "digital citizenship", "creativity", "postmodernism" are given. The theoretical principles of research in neurosciencees in the system of pedagogical education are considered. Modern approaches to development of digital competence of participants in the educational process are singled out. Vision of the Council of Europe on the components of digital citizenship is considered, which is seen as empowering students and acquiring the necessary digital skills for successful self-realization in the postmodern era. A brief description of the Conceptual Model of Digital Citizenship Education adopted by the Council of Europe is given, emphasizing the importance of systematicity and consistency in its implementation. Prerequisites for achieving results of this Conceptual Model are generalized and highlighted. Tools for auditing the digital civic space of a modern school are proposed, which allows to determine the level of development of basic skills of a digital citizen in all participants in the educational process on the basis of modern neuroscience research results. The main audit methods for this tool are surveys, audit of school records and determination of access to digital technologies. The importance of integrating the content of the Conceptual Model of Education on Digital Citizenship into the content of subjects is emphasized, which should be reflected in the school documentation at different levels: from the Educational Program to the teacher's lesson plan. Criteria and indicators for auditing the school's digital civic space are detailed.*

Keywords: *Civic consciousness, creativity, digitalization of educational space, digital citizenship, leadership, neuropedagogy, postmodernism.*

How to cite: Vlasenko, O., Pavlenko, V., Chemerys, O., Piddubna, O., Fedorchuk, A., & Yashchuk, I. (2021). Audit of Digital Civic Space in the Modern School: from Teacher to Creative Leader. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience, 12*(3), 214-235. https://doi.org/10.18662/brain/12.3/228

Introduction

Globalization, as a unique phenomenon of the modern world, certainly affects all spheres of human life and society as a whole. It is globalization and its consequences that scientists associate all the major trends in education with. Modern information and communication technologies (ICT), new technologies of production and consumption, social technologies – all these are global signs of a new society, a new way of thinking and activity of people. We agree with scientists who argue that today society is at the stage of giving birth to a new form of cultural, better known as globalization culture (Spring, 2008; Mykolaienko, 2012).

Today we record the onset of this new mass culture in a new concept, corresponding to the spirit of globalization – postmodern. Postmodernism as a mixture of concepts, values, attitudes, styles of thinking and activity is vigorously penetrating science, education, politics, economics. It is extremely important to realize the unity of the cultural phenomenon of postmodernism and modern digital, technological society of the Fourth Industrial Revolution. Globalization processes in the days of the Fourth Industrial Revolution led to a change in values, which involves rethinking the nature of pedagogical interaction, which changes both the role of the teacher and the role of the student (Nerubasska et al., 2020; Nerubasska & Maksymchuk, 2020).

Turning to the works of modern Western philosophers shows that there are many unsolved problems in modern education, but the challenge of the philosophy of education does not go unanswered, the process of rethinking modern problems of education is quite intense. Considering the reforms that have taken place in education in Ukraine since 2014, we observe the same processes in Ukraine. In general, the situation in both Western and domestic philosophy of education can be described as criticism and "revision", reconsideration and reconceptualization of ideas. The phenomenon of postmodernism in education is a radical revision and rethinking of the foundations on which all European culture is based. And although postmodernism over-relativizes moral values and norms, rejecting priorities and clear guidelines, on the other hand, the meaning of postmodern thinking is in recognizing cultural polyphony, which opens space for true dialogue, in freeing it from dogmatism, which is so relevant in globalization processes during the Fourth Industrial Revolution (Emovwodo et al., 2019; Ivanova & Ivanov, 2020; Viktorova, 2021).

Today, there are a number of critical gaps in the education system: between how a student perceives the world inside and outside the classroom; between the skills that students acquire in school and the skills that will be needed in real life; between opportunities for students who have access to quality ICT education and those who are denied such access.

At present, during the Fourth Industrial Revolution, we can state contradictions between the processes of digitalization of educational space and insufficient scientific and methodological support for the systemic development of digital civic space and tools for its audit at the level of secondary educational establishment. We believe that there is a significant gap between the current development of digital civic space in the modern school, the available tools for its audit and willingness of teachers to systematically develop the digital civic space in general.

Today, one of the main challenges facing education is the problem of teachers' lack of awareness of the rapid pace of spread and penetration into all spheres of life of the trend of globalization, total informatization. The content and purpose of education today does not correspond to the real life for which this education should prepare. Teachers are insufficiently prepared to use digital tools in their professional activities; they are unaware of the fundamental principles of digital citizenship, which today is the reality of an individual in the digital space. The problem is not so much the reluctance of teachers to use a set of ICT tools, but rather awareness of a systematic approach to building a digital civic space in general, where IC competence is only part of the competence of a digital citizen. We believe that the practical application of digital citizenship by teachers and support of their students in this regard is the foundation for quality modern education that really prepares for the competitive, real, globalized world.

We believe that the priority task of the system of professional training of teachers should be professional training of new generation teachers capable of effective professional activity in the conditions of active use of modern scientific researches, including neurosciences. In this context, there is an actual issue of the absence in the content training of future teachers of orientation on the use of modern research results of neurosciences in their professional activities. We are confident that digitalization processes may be more effective subject to their implementation with the use of results of neurosciences.

The purpose of the article is coverage of conceptual approaches to issues of digital civic space development in the modern school and presentation of tools for conducting its audit in the context of modern neurosciences.

Literature review

Today, the concepts of digital citizenship and digital civic space in the modern school is not new and is used among the European and the world scientific community, as well as the domestic one. In Ukraine, the works of Bykov (2008) are devoted to the issues of standardization and assessment of IR competence, which considers standardization of IR competence of teachers as a prerequisite for successful digitalization of education Kocharian & Hushchyna (2011), who emphasizes the need to include in the structure of the IR competence of the teacher the competence to form in teenagers safe forms of behavior in the Internet. Conditions for development of IR competence in a teacher are studied by Lytvynova (2012) and Morze (2010). Lytvynova (2012) focuses on improving the skills of teachers in application of cloud technologies. Morze (2010), in turn, draws attention to the need to develop national policies, standards for the use of technology in the educational process, and in case of their absence in the need to develop and implement corporate policies and standards for the use of ICT in the educational process.

The phenomenon of an educational institution in the world order of postmodern globalization is studied by domestic scientists (Korotkova et al., 2020), where globalization is seen as a driver of change in the values of society and a prerequisite for rethinking the purpose and objectives of educational work in the educational institution.

Among foreign scholars, the works of Ribble (2017), Jones and Mitchell (2016) are devoted to general issues of the digital civic space. Gastil and Richards (2016) and Roberts (2021) study the issues of law enforcement in the digital civic space. Schwanholz et al. (2017) explore the issues of Internet regulation, the use of social networks and public participation in the Internet. The role and place of NGOs in building a digital civic space is explored by Gordon (2019). The works of Gleason and von Gillern (2018) and Greenhow et al. (2009) are devoted to the issue of integration of digital civic space into the content of school education. Goodwin's research (2020) focuses on young people's understanding and perception of globalization processes and their impact on teenage behavior.

However, despite significant number of researches on the problems of digital civic space in the modern school, the issues of systemic and practical implementation of digital civic space concepts at the level of the secondary educational establishment and methods of substantiation and selection of tools for its audit have not been sufficiently studied in domestic

pedagogical research and are insufficiently included in modern teacher training and development programs.

Furthermore, for the last ten years, studies of the neural mechanisms of adult learning in modern educational systems have become increasingly popular. On the basis of the conducted researches a new integrative direction of pedagogical education evolved – the neuropedagogy. The beginning of neuropedagogy is based on researches of Hart (1992), who argued that creation of educational experience without understanding the brain functioning is ineffective and urged scientists to conduct researches on cognitive processes of the brain (Hart, 1992).

However, despite a significant number of studies devoted to the problems of digital civil space in modern school and research on neuropedagogy, these studies are separate, not combined together and do not have systemic and simultaneous use. Problems of development of digital civil space in the context of neurosciences at the time of choosing tools for conducting its audit have not received a sufficient comprehensive study in domestic pedagogical researches and are not adequately included in modern teacher training and enhancement training programs.

Building a digital civic space at school

The globalization processes that have taken place in recent years in the world are actively promoting emergence of new professions and, accordingly, require new competencies from labor market participants. In order to be competitive, labor market participants should quickly acquire new competitive knowledge and skills, be flexible and able to abandon previously formed competencies and react to global changes in a new way. Transformation of the education system is a key condition for economic development of the country, one of the main indicators of its competitiveness. Over the last decade, research has been actively conducted to determine the didactic potential of ICT for transformation of national educational systems, forming the framework of IC competence of teachers and National policies and standards (Bykov, 2008). As a result, all participants in the educational process acquire increasingly complex skills that are necessary not only for professional, but also for socio-cultural and economic development (Komogorova et al., 2021; Melnyk et al., 2021; Onishchuk, 2020).

That is why at the moment the problem of system digitalization of education is becoming more and more urgent: globalization processes and inevitability of active use of modern ICT have led to reforms in the content

of general secondary education, the COVID19 pandemic has updated the readiness of teachers to use distance learning technologies.

According to Article 12 of the Law of Ukraine on Education, "information and communication competence" is defined as one of the key competencies (Law of Ukraine on Education, 2017). However, despite a sufficient number of scientific studies of domestic scientists on formation, development of IC competence of teachers, their motivation to use ICT tools in professional activities, at the same time there are no nationally approved indicators of IC competence. In Order №2736 of 23.12.2020 of the Ministry of Economy, Trade and Agriculture of Ukraine (Ministry of Economy (2020) "On approval of the professional standard for the professions "Primary school teacher", "General secondary school teacher", "Primary school teacher (with a junior specialist diploma)" separated information and digital competence as a component of professional competence of a teacher. This document lists the requirements for teachers regarding the information and digital competence of teachers, namely "the ability to navigate in the information space, search and critically evaluate information, operate it in professional activities", "the ability to effectively use existing and create (if necessary) new electronic (digital) educational resources", "Ability to use digital technologies in the educational space" (Ministry of Economy of Ukraine, 2020). At the same time, there are no indicators that can be used to monitor and / or assess the level of mastery and application of digital technologies by teachers.

In addition, it should be noted that in the age of digitalization it is necessary not only to have a sufficient level of IR competence, but also to develop soft skills, EQ, think creatively, be able to manage large amounts of information, work and study remotely. In the age of digitalization, it is not enough for a teacher to develop the third level of IR competence according to UNESCO standards. It will soon become the norm. Today, in the era of the Fourth Industrial Revolution, when technology is actively (and sometimes quite aggressively) entering the daily life of an individual, the problem of forming a digital citizen remains extremely relevant. The citizen and the citizenship are not identical concepts. Formation of civic identity is determined not only by the fact of citizenship. This is especially important today, when in the context of digitalization of the world, physical borders of countries are dissolved in free virtual access, and cultural and educational contexts are seen as boundless, unlimited by physical borders and are an affordable asset for everyone.

In our study the main concepts are civic consciousness, creativity, digitalization of educational space, digital citizenship, leadership, postmodernism.

By creativity we mean the ability to create and find new original ideas that differ from usual patterns of thinking, to successfully solve problems in a non-standard way, as well as the ability to solve problems that arise within static systems (Cachia et al., 2010).

By civic consciousness we mean the state of consciousness of individuals, their informal attitude to their state, emphasizing that citizenship is granted, whereas civic consciousness is nurtured.

Application of the concept of "digital citizenship" is characterized by its multifaceted nature. One of the most common interpretations of this term is the interpretation related to implemented or planned practice of a number of countries aimed at acquiring the status of a citizen online. Based on this interpretation, digital citizenship is understood as a digital procedure for obtaining a legal status.

In addition, digital citizenship is treated as a cultural phenomenon that reflects socialization of new generations under the influence of digital communications in postmodern times. In this sense, the digital citizenship is filled with a value understanding and, therefore, capable of performing a number of regulatory functions.

To realize themselves as a digital citizen, according to Maksimova, L., Grigorovich, L., Kurenkova, M., it is necessary to possess digital skills that involve proper and responsible use of ICT by users (Maksimova, 2019). Digital citizenship researcher Mike Ribble (2015) formulated three principles for such use: respect, education and protection. Among foreign scientists in the EU, and we agree with them, there is a more widespread understanding of digital citizenship as an awareness of the impact of ICT on society, community and each of its representatives; a digital citizen is not only able to use modern ICT, but also aware of their systemic effects, advantages, disadvantages, opportunities and threats (Ribble & Park, 2019). Digital citizenship includes a wide range of activities, from creation, consumption, exchange, gaming, communication, learning and professional activities. Digital citizens are able to respond to new and everyday challenges related to education, work, employment, leisure, inclusion and participation in the life of a society, respect for human rights and intercultural differences. It is a process that should begin from the earliest childhood at home and at school, in formal, non-formal and informal education (Ribble & Park, 2019).

The Council of Europe on Democratic Culture (CDC) offers a simplified overview of the competences that citizens should acquire if they

want to participate effectively in their country's democratic processes using ICT (Council of Europe, 2016). These competencies are not acquired automatically, on the contrary, they need to be mastered and practiced. And in this, the school education plays the key role. The following 20 competencies of democratic culture cover four key areas:

- Sphere 1. Values (appreciation of human dignity and their rights and freedoms; appreciation of cultural diversity; appreciation of democracy, justice, equality and the rule of law);
- Sphere 2. Attitudes (openness to cultures and religions of other citizens; respect; responsibility; tolerance for ambiguity);
- Sphere 3. Skills (analytical and critical thinking skills; listening and observation skills; empathy; flexibility and adaptability; collaboration skills; conflict resolution skills);
- Sphere 4. Critical thinking (critical understanding of the world: politics, law, culture, religion, history, media, economy).

In order to form and develop these competencies of digital citizen (digital citizenship) in 2016, the Steering Committee for Educational Policy of the Council of Europe created an expert group on digital civic education and since 2019 the Council of Europe members have introduced "Digital Civic Education" in the EU schools (Council of Europe, 2019). The conceptual model of education on digital citizenship is presented in Fig. 1.

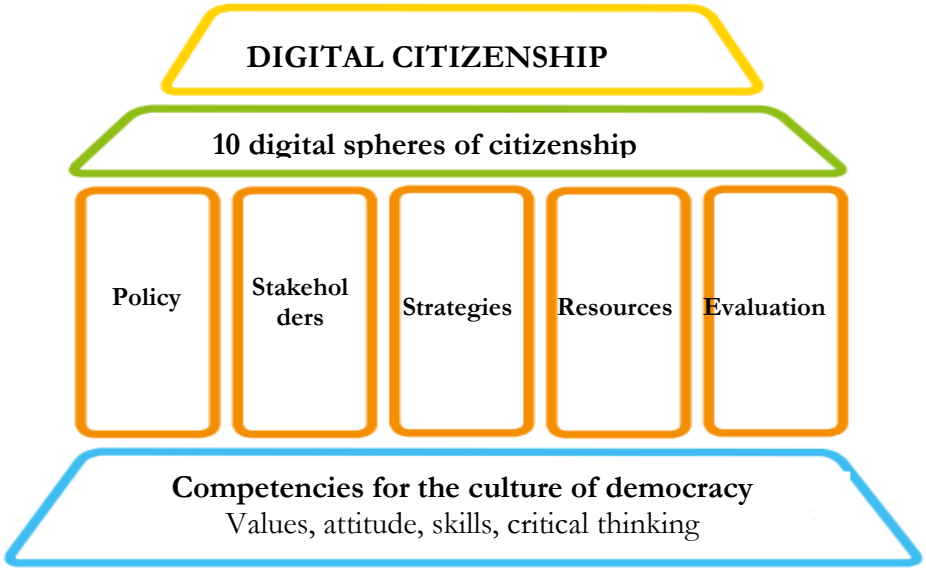

Fig. 1. *Conceptual model of education on digital citizenship (Council of Europe, 2019)*

Thus, agreeing with foreign researchers, we clarify the concept of "digital citizen" and understand them (digital citizens) as people who are able to actively, responsibly and constantly participate in community life using ICT. Such participation depends on the organizational criteria underlying educational progress towards digital citizenship. This progress will be facilitated or hindered by the level of consequences of a number of stakeholders, from parents to teachers at school, to decision-makers (access to the Internet, restrictions on access to certain resources, etc.).

According to Ribble & Park (2019), Ovcharuk (2020) etc., in order to achieve results of implementation of the Conceptual Model of Education on Digital Citizenship, the following prerequisites are required:

1. Access to digital technology, which is an integral part of everyday life of modern society. Despite the inequality of the Internet access at home, the school, as a center for formation and development of digital citizenship, should be a place of permanent and free access to the Internet.

2. Digital competence. Today it is impossible to get free, systematic and unhindered access to the tools of e-democracy, to participate in various sociological and other surveys, to obtain information from various sources without the use of ICT. That is why the school at the level of educational policy goals forms and develops digital competence, which is not possible without the appropriate level of IR competence of teachers. This also includes the use of ICT tools used in the educational process.

3. Secure digital space, which is the responsibility of ISPs and the administration of the educational institution. This can also include development and compliance with one's own corporate policies and corporate standards for implementation of a secure digital space.

4. Knowledge of rights and responsibilities. It is a key factor for the active development of digital citizen competencies. This is not only knowledge that is formed by values and attitudes, and, of course, taught at home and at school, but also responsible behavior to respect the rights of others and protect one's own. This includes netiquette – safe behavior on the Internet (Kocharian & Hushchyna 2011).

5. Flexible thinking and the ability to solve problems. These are higher cognitive skills that require a broader combination of all four areas of 20 competencies of democratic culture (Council of Europe, 2016). Of course, the ability to solve problems requires understanding of current issues, their analysis, synthesis, but above all it depends on the educational activities at school, which promotes cognitive development through activities. Therefore, the use of various ICT tools at school is playing an increasing role in developing flexibility of thinking and problem-solving

skills. Scenarios for using ICT as ready-made answers, solutions and attitudes will not contribute to the development of this skill. However, learning scenarios, when ICT is used as a tool to achieve a pedagogical goal of the lesson, will facilitate the search activity of the student – such scenarios will develop the skill to solve problems, rather than finding ready-made template solutions.

6. The skill of effective and safe communication. Schools play an important role in supporting and enabling students to develop their communication skills to help them understand and apply their rights and responsibilities when using digital tools. It is not only the ability to find a common language, to adhere to netiquette and respect for the interlocutor. These are the rules of safe behavior on the Internet when communicating with other students, friends, teachers, etc. This also includes respect for confidentiality of the interlocutor, respect and non-dissemination of unreliable, unverified or untrue information.

7. Civic empowerment is a key principle without which digital citizens cannot improve their citizenship skills or exercise their rights and responsibilities. It is assumed that everyone has access to an open, neutral and safe system where algorithms are open, freely chosen and configured by users, where citizens can act without warrying for the consequences of their vote. Ukrainian researchers of digital citizenship combine this premise with the problem of ensuring confidentiality and security, which mainly concerns personal protection of one's own information from others (Ovcharuk, 2020, p. 9). We agree with Ovcharuk (2020), who proposes to combine security issues with IR competence in terms of setting up anti-virus programs, firewalls, using strong and reliable passwords, etc. However, we are more focused on ensuring the civic opportunity for free expression of the student's will, rather than providing a technical component of preserving their personal and / or confidential data, or data that the student is afraid to disclose. Ensuring technical safety, of course, must be implemented by all means, but the technical protection itself does not ensure the active civic position of a student. It is not enough to provide security; it is necessary to form the desire to be a "digital citizen".

We understand that the process of developing digital citizenship in educational establishments takes place due to efforts of teachers, who in their time were not prepared in educational establishments for this activity. Moreover, the rapid pace of informatization leads to the fact that teachers almost constantly have to take enhancement courses to keep "in trend" and be able to implement modern technologies, methods and techniques of teaching. It is clear that at the present stage the basis for the development of

the system of adult teacher education is their continuing professional education of adults, which contributes to rapid adaptation of people to fast pacing working conditions. However, having analyzed the educational programs of training and retraining of teachers in Ukraine, we did not find a systematic implementation of the results of modern neurosciences (and neuropedagogy in particular) in this process.

We are also aware that modern advances in neurosciences require training of specialists in the framework of new areas of neuropedagogy. We also realize that the brain activity research program needs to be built based on interdisciplinary approach using brain research methods adapted to pedagogy, psychology and andrology.

At the same time, we are convinced that the use of following theoretical concepts and provisions of neurosciences will significantly influence effectiveness of teacher preparation for development of digital civil space:

- the concept of neuroplasticity - the ability of the human brain to rebuild its neural connections in order to adapt to environmental factors (Brault-Foisy et al., 2020);
- provisions on the functions of limbic formations of the brain that provide motivational activity in acquisition of information (Vovkanych, 2020);
- the concept of psychophysiological mechanisms of the dominant, which regulates intellectual activity and purposeful work of the higher mental functions (Kushch, 2014);
- theory of self-organization of brain activity, which provides functions of active thinking, memory, attention, behaviour (Kushch, 2014);
- provisions on formation of an individual profile of the hemispheric functional asymmetry, which includes a certain functional antagonism;
- identification of potential opportunities for child development through the interaction of genetically embedded development programs and social determinants (Druzhilovskaya, 2020).

Audit of digital civic space of a modern school

Analyzing scientific literature of domestic and foreign researchers on the development of digital civic space, we can summarize the following:

- The problem is urgent and its significance in coming years will only grow;
- Among the foreign studies mentioned in our publication, we observe a systematic approach to the development of digital competence

and digital citizenship, namely creation and active use of strategic documents (frameworks) related to digital and civic competence.

- In Ukraine, teachers rely on the standard of IC competence of a student, which is laid down in the State Standard of Primary Education (Cabinet of Ministers of Ukraine, 2019), the State Standard of Complete General Secondary Education (Cabinet of Ministers of Ukraine, 2020) and the IC standard of teacher competence based on the professional competence of the teacher.
- In Ukraine, the use of methods for development of civic education using ICT tools has not yet become widespread. There are no programs and frameworks at the national level that would regulate development of the digital civic space of educational institutions; forms and methods of their implementation, implementation tools, systems for monitoring and auditing the effectiveness of their implementation.

That is why, on the basis of our scientific research, the results of which are given above, we have developed a checklist that would allow the head of a general education institution to conduct an audit of the digital civic space at the level of the educational institution. A checklist is a two-part document. The first part of the checklist provides an audit of the activities carried out in the institution for development of digital civic space. The second part identifies criteria and indicators for determining (diagnosing) the state of development of digital civic space in schools.

We took as a basis the conceptual positions, approaches and methodology that were laid down during development of SELFIE and ITL Research. SELFIE is a free online tool that helps analyze state of digitalization, effectiveness of using digital technologies in educational institutions (European Commission, 2021). These monitoring tools have been developed by experts from the European Commission and are used in 74 countries around the world. ITL Research is an international study conducted in 2011 at the initiative and support of Microsoft in 7 countries (European Agency, 2011).

Thus, we propose the main methods of auditing the digital civic space of a school to determine the following: surveys of teachers and school administration, analysis of school documents and analysis of the results of students' learning activities.

Regarding the content of the audit, we took as a basis the components of digital citizenship identified at the World Economic Forum (Park, 2016), namely 8 basic skills that students should have in the era of the Fourth Industrial Revolution (see Table 1).

Table 1.*Basic skills of a digital citizen (Park, 2016)*

Skill	Skill description
Digital identity of citizens	the ability to holistically create a sound identity both online and in everyday life (offline)
Screen time management	ability to manage screen time, multitasking and participation in online games and social networks with one's own self-control
Cyberbullying management	ability to detect cyberbullying situations and get out safely in a cyberbullying situation
Managing own cybersecurity	the ability to protect one's own data using a variety of methods
Privacy management	the ability to securely use personal information about oneself and others
Critical thinking	the ability to distinguish between true and false information
Digital tracs	the ability to understand the nature of digital tracs and their real consequences and to manage them responsibly
Digital empathy	the ability to show empathy for one's own and others' needs and feelings on the Internet

Table 2 presents the criteria and four target groups (administration, teachers, students and parents) for audit of digital civic space in schools.

Table 2.*The structure of the checklist of the school head for the audit of the level of development of digital civic space at the school level (developed by the author)*

	Audit participants			
Audit criteria	School administration	School teachers	Students	Parents
1. Understanding digital citizenship	Implemented by conducting a survey			
2. Development of a digital citizen during educational activities	Implemented by auditing the following documents: minutes of meetings of pedagogical councils, educational program	Implemented by auditing the following documents: curriculum and lesson plan	Implemented by conducting a survey	
3.	Implemented by	Implemented	Implemented	

Development of a digital citizen during educational work	auditing the following documents: minutes of meetings of pedagogical councils, educational program	by auditing the following documents: curriculum and lesson plan	by conducting a survey	
4. Advanced training in the development of digital civic space	Implemented by auditing the following documents: minutes of meetings of pedagogical councils, educational program	Implemented by auditing existing documents confirming the completion of advanced training	Not applicable	
5. Access to digital technologies	Audit of access to digital technologies and the Internet			Not applicable

For example, we detail the Indicators that we propose to use during the audit of Criterion 1 "Understanding Digital Citizenship" among school administration and teachers (Table 3).

Table 3.*Audit indicators of the school's digital civic space. Understanding digital citizenship (developed by the author)*

Audit criterion	Indicator
Understanding digital citizenship	1.1. Knowledge of the digital civic space, its essence and benefits. Ability to describe the overall purpose of the ideal digital civic space; 1.2. Familiarity with international and national documents on digital civic space policy; 1.3. Familiarity with school documents on the digital civic space (internal regulations, standards, corporate policies and procedures, etc.); 1.4. Awareness of trends in the process of informatization of society and changes in lifestyles; 1.5. Ability to analyze barriers that arise when using ICT in one's own actions, professional activities, daily life; 1.6. Awareness and application of e-democracy and e-government tools; 1.7. Ability to be aware of various risks that may arise when using ICT; 1.8. Awareness of legal norms regarding activities in the digital civic space.

Here are some examples of indicators that we propose to use for the audit of criterion 2 "Development of a digital citizen during learning activities" among teachers and school administration (Table 4).

Table 4.*Audit indicators of the school's digital civic space. Learning process (developed by the author)*

Audit criterion	Indicator
2. Development of a digital citizen during educational activities	2.1. Indication in the school curriculum of general provisions and principles of documents at the national level and the school level on development of digital civic space; 2.2. Indication in the curricula of school teachers of the general provisions and principles of national and school documents on development of digital civic space; 2.3. Application of ICT tools during educational activities; 2.4. Encouraging students to use ICT tools to solve everyday tasks related not only to learning activities; 2.5. Presence in the curricula of teachers of integration of disciplines with the use of various forms and methods, ICT tools; 2.6. Presence in the curricula of a definition of the content and essence of media literacy and information literacy. Teaching students their practical application; 2.7. Presence in the curricula of a definition of the content and essence of critical thinking. Teaching students its practical application. 2.8. Presence in the curriculum of a definition of the content and essence of safe online behavior. 2.9. Use of ICT tools for organizing educational projects and setting tasks. 2.10. Ability to select appropriate ICT tools to monitor and disseminate students' performance; 2.11. Use of ICT tools for educational activities; 2.12. Ability to assess reliability of data obtained from the Internet; 2.13. Ability to use search engines with ranking of search results, making use of keywords.

Indicators of criterion 3 – "Development of a digital citizen during educational activities" may be identical to indicators of criterion 2.

Here are some examples of indicators that we propose to use for the audit of criterion 4 "Advanced training in the development of digital civic space" (Table 5).

Table 5.*Audit indicators of the school's digital civic space. Certification training (developed by the author)*

Audit criterion	Indicator
4. Advanced training in the development of digital civic space	4.1. Understanding the benefits of using ICT to improve quality and efficiency of one's own professional activities; 4.2. Understanding the opportunities, advantages and disadvantages of ICT as a means of improving quality and efficiency of work during advanced training; 4.3. Using ICT to access, create and disseminate various resources needed for professional activities; 4.4. Using ICT to communicate with colleagues from other institutions; 4.5. Ability to use ICT to search, organize, analyze, integrate and evaluate information needed for professional development during advanced training; 4.6. Ability to receive advanced training online.

We are confident that achievement of these indicators of effective development of the digital civic space of a modern educational establishment is possible under the preconditions of effective and efficient training of teachers who will implement this space. Training, in our opinion, will be effective provided an active use of the results of modern neurosciences.

For example, within our study of selection of audit tools for the digital civic space of an educational establishment, we faced the problem of motivating teachers not to the audit process itself, but even to the process of their own professional training to build such space in the establishment. It is not enough to measure indicators of digital civic space - it is necessary to build it; and "builders" are the teachers who must be prepared for such activities. That is why, based on the above analysis, taking into account theoretical positions and statements, taking into account the andrological approach in the context of modern neurosciences, we propose to use a separate course "Modern neurosciences in education system" in the content component of professional teacher training programs. The aim of the course is specialized training of teachers for systematic and continuous application

of the results of scientific researches in modern neurosciences in their professional activities, including during their own enhancement training.

Thus, audit of the digital civic space of school should provide high-quality teacher training (which is possible provided that the results of scientific researches in modern neurosciences are applied) and include not only an audit of the development of digital citizenship of its participants, but also technological opportunities that would provide all participants with equal access to digital technologies (criterion 5 of the audit checklist listed in Table 2). The toolkit should be comprehensive and adaptive, allowing to assess not only "hard" but also "soft" skills. In our opinion, the main purpose of conducting such audits should be to provide feedback that will help students better understand their strengths and weaknesses so that they can find their own ways of success and competitiveness in the postmodern era. A prerequisite for effective development is the position that each individual has a unique brain, which can be characterized by a large number of parameters (performance, dominant type of memory, level of flexibility, speed of information processing, etc.). Conducting such audit will allow a modern creative teacher, in turn, to plan their teaching and educational work in line with development of digital citizens.

Conclusion

According to the results of our research and results of other scientists, we can state a steady increase in attention to development of digital civic space. Summarizing the experience of digital citizenship education, we came to the conclusion that it is necessary to conduct an audit, which we consider as an opportunity to provide dialogue and a feedback between participants in the educational process.

In our opinion, the main issues of the audit of the digital civic space of a modern school should be issues of determining understanding of the digital civic space of all participants in the educational process, the state of development of the digital citizen during teaching and educational work. A separate issue is training of teachers in the development of digital civic space. The issue of auditing access to digital technologies by both students and teachers remains mandatory. The proposed tool allows us to systematically conduct audits and identify so-called "development zones" that need to be improved and developed. Despite results of the audit, we believe that the prerequisite for a successful development of a digital citizen-student is training of a modern digital citizen-teacher.

At the same time, we realize that education on digital citizenship at school depends on modern teachers, because they implement the concept

developed by administrative structures and form the skills of digital citizenship in everyday practice. And if at the national level in Ukraine there are no normative documents and standards that would regulate the content of digital citizenship and tools for its monitoring, then schools can develop them independently on the basis of normative documents of European countries. Finally, the pedagogical community in postmodern times has to understand the importance of digital citizenship as a foundation of digital intelligence. And the beginning can be in school. There is no more time to think. Students are already immersed in the digital world and it affects them. It is up to educators to support children so that they can use not only ICT to meet their needs and satisfaction, but also be a full-fledged digital citizen who can change the world for the better.

Only such systematic approach to education of digital citizens, which involves solving tasks to be set in the educational programs of the institution, will help to achieve efficiency. It is crucial that teachers respond quickly to ever-changing digital content to ensure its comfort and accessibility for use by students.

Researches of modern neurosciences confirm effectiveness of their use in pedagogy. We believe that the effective development of digital civic space is possible provided there is high-quality training of teachers who will be implementing it. And application of the above provisions of neuropedagogy will allow us to quickly obtain the desired result and, as a result, successfully achieve these indicators and indicators of the audit of the school digital civic space.

References

Brault Foisy, L.-M., Matejko, A. A., Ansari, D., & Masson, S. (2020). Teachers as orchestrators of neuronal plasticity: effects of teaching practices on the brain. *Mind, Brain, and Education*, *14*(4), 415-428. https://doi.org/10.1111/mbe.12257

Bykov V. (2008). Modeli orhanizatsiinykh system vidkrytoi osvity: monohrafiia [Models of organizational systems of open education: monograph]. Atika. https://lib.iitta.gov.ua/9649/1/Art105Text-2.pdf

Cabinet of Ministers of Ukraine. (2019). Pro vnesennia zmin do Derzhavnoho standartu pochatkovoi osvity [On Amendments to the State standard of primary education]. https://zakon.rada.gov.ua/laws/show/688-2019-%D0%BF#Text

Cabinet of Ministers of Ukraine. (2020). Pro deiaki pytannia derzhavnykh standartiv povnoi zahalnoi serednoi osvity [On some issues of state standards of complete general secondary education].

https://www.kmu.gov.ua/npas/pro-deyaki-pitannya-derzhavnih-standartiv-povnoyi-zagalnoyi-serednoyi-osviti-i300920-898

Cachia, R., Ferrari, A., Ala-Mutka, K., & Punie, Y. (2010). *Innovation and creativity in education and training in the EU member states: Fostering creative learning and supporting innovative teaching. Literature review*. Office for Official Publications of the EC. https://edu.lu.lv/pluginfile.php/74635/mod_resource/content/1/%21%21_Creative%20Learning%20and%20Innovative%20Teaching.pdf

Council of Europe. (2016). Competences for democratic culture – Living together as equals in culturally diverse democratic societies. Strasbourg. https://www.academia.edu/24945692/Competences_for_Democratic_Culture_Living_Together_as_Equals_in_Culturally_Diverse_Democratic_Societies

Council of Europe. (2019). *Digital Education. A Conceptual Model.* https://www.coe.int/en/web/digital-citizenship-education/a-conceptual-model

Druzhilovskaya, O.V. (2020). Neurosciences as a source of formation of a new direction of modern pedagogical education. *Citise, 3*(25), 314-321. http://doi.org/10.15350/2409-7616.2020.3.27

Emovwodo, S., Andriamalala, L., Rizki, B.A., Suwito, K., & Laurent, A.(2019). Defining lifestyle, consumer culture, and postmodernism in industry 4.0. In G. Anggadwita & E. Martini (Eds.), *Digital Economy for Customer Benefit and Business Fairness: Proceedings of the International Conference on Sustainable Collaboration in Business, Information and Innovation (SCBTII 2019), Bandung, Indonesia, October 9-10* (pp. 91-94). Taylor & Francis Group. http://doi.org/10.1201/9781003036173-15

European Agency (2011). *Innovative Teaching and Learning Research (ITL Research).*https://www.european-agency.org/sites/default/files/itlresearh2011findings.pdf

European Commission. (2021). SELFIE Education and Training. https://ec.europa.eu/education/schools-go-digital_en

Gastil, J., & Richards, R. C. (2017). Embracing Digital Democracy: A Call for Building an Online Civic Commons. *PS: Political Science & Politics*, *50*(3), 758-763. http://doi.org/10.1017/S1049096517000555

Gleason, B., & von Gillern, S. (2018). Digital Citizenship with Social Media: Participatory Practices of Teaching and Learning in Secondary Education. *Educational Technology & Society*, *21*(1), 200–212.https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1099&context=edu_pubs

Goodwin, A. L. (2020). Globalization, global mindsets and teacher education. *Action in Teacher Education*, *42*(1), 6-18. https://doi.org/10.1080/01626620.2019.1700848

Gordon, E. (2019). Civic Organizations and Digital Technologies in an Age of Distrust. *Media and Communication*, *7*(3), 54-56. http://doi.org/10.17645/mac.v7i3.2385

Greenhow, C., Robelia, B., & Hughes, J. (2009). Learning, teaching, and scholarship in a digital age Web 2.0 and classroom research: What path should we take now? *Educational Researcher*, *38*(4), 246-259. https://doi.org/10.3102/0013189X09336671

Hart, L. A. (1992). *Human brain and human learning*. Books for Educators.

Ivanova, S., Ivanov, O. (2020). Education in the Era of the Fourth Industrial Revolution: Development Vector, Prospects and Challenges for Russia. *Space and Culture, India*, *7*(5), 70-79. https://doi.org/10.20896/saci.v7i5.703

Jones, L, & Mitchell, K. (2016). Defining and measuring youth digital citizenship. *New Media & Society*, *18*(9), 2063-2079. https://doi.org/10.1177/1461444815577797

Kocharian A., & Hushchyna, N. (2011). Vykhovannia kultury korystuvacha Internetu. Bezpeka u vsesvitnii merezhi: navchalno-metodychnyi posibnyk [Education of Internet user culture. Security in the World Wide Web: a textbook].Onlandia. https://elibrary.kubg.edu.ua/id/eprint/1547/1/Internet.pdf

Komogorova, M., Maksymchuk, B., Bernatska, O., Lukianchuk, S., Gerasymova, I., Popova, O., Matviichuk, T., Solovyov, V., Kalashnik, N., Davydenko, H., Stoliarenko, O., Stoliarenko, O., & Maksymchuk, I. (2021). Pedagogical Consolidation of Pupil-Athletes Knowledge of Humanities. *Revista Romaneasca Pentru Educatie Multidimensionala*, *13*(1), 168-187. https://doi.org/10.18662/rrem/13.1/367

Korotkova, Y., Romanyuk, S., Vysochan, L., Shkleda, L., & Kozlova, L. (2020). The Phenomenon of the Institution of Education in the World Order of Postmodern Globalization. *Postmodern Openings*, *11*(3), 244-256. https://doi.org/10.18662/po/11.3/211

Kushch, O. S. (2014). Vzaiemodiia mekhanizmiv praksysu z tvorchym myslenniam v produktyvnii diialnosti osobystost [Interaction of mechanisms of praxis with creative thinking in productive activity of the person]. *Pedahohichnyi protses: teoriia i praktyka* [Pedagogical process: theory and practice], *1*, 159-163. http://nbuv.gov.ua/UJRN/pptp_2014_1_26

Lytvynova, S. G. (2012). *Khmarni tekhnologhiji jak zasib rozbudovy innovacijnoji shkoly* [Cloud technologies as a means of building an innovative school]. https://virtkafedra.ucoz.ua/el_gurnal/pages/vyp14/Litvinova.pdf

Maksimova, L. (2019). Specifity of social identity of all-girls boarding school adolescents. *The European Proceedings of Social and Behavioral Sciences EPSBS, Moscow, April 22-23, 2019,* 325–333. https://doi.org/10.15405/epsbs.2019.07.42

Melnyk, N., Maksymchuk, B., Gurevych, R., Kalenskyi, A., Dovbnya, S., Groshovenko, O., & Filonenko, L. (2021). The Establishment and Development of Professional Training for Preschool Teachers in Western European Countries. *Revista Romaneasca Pentru Educatie Multidimensionala*, *13*(1). https://doi.org/10.18662/rrem/13.1/369

Ministerstvo rozvytku ekonomiky, torhivli ta silskoho hospodarstva Ukrayiny [The Ministry of Economy, Trade and Agriculture of Ukraine]. (2020). *Pro zatverdzhennya profesiynoho standartu za profesiyamy "Vchytel pochatkovykh klasiv zakladu zahalnoyi serednoyi osvity", "Vchytel zakladu zahalnoyi serednoyi osvity", "Vchytel z pochatkovoyi osvity (z dyplomom molodshoho spetsialista)"* [On approval of the professional standard for the professions "Primary school teacher", "General secondary school teacher", "Primary school teacher (with a junior specialist diploma)"] (№ 2736). https://zakon.rada.gov.ua/rada/show/v2736915-20#Text

Ministry of Economy of Ukraine. (2020). Reiestr profesiinyi standartiv [Professional standards register]. https://www.me.gov.ua/Documents/Detail?lang=uk-UA&id=22469103-4e36-4d41-b1bf-288338b3c7fa&title=RestrProfesiinikhStandartiv

Morze, N. V. (2010). Yak navchaty vchyteliv, shchob kompiuterni tekhnolohii perestaly buty dyvom u navchanni? [How to train teachers to computer technology ceased to be a miracle in education??] *Kompiuter u shkoli ta sim'i* [Computer at school and family], *6*(86), 10-14. http://nbuv.gov.ua/UJRN/komp_2010_6_4

Mykolaienko, I. (2012). Hlobalizatsiina kultura yak alternatyva kulturnii identychnosti. Geneza i perspektyvy rozvytku [Globalization culture as an alternative to cultural identity. Genesis and prospects of development]. *Naukovi zapysky Natsionalnoho universytetu Ostrozka akademiia. Seria Kulturolohiia* [Scientific notes of National University of Ostroh Academy. Series Culturology], *9*, 59-69. http://nbuv.gov.ua/UJRN/Nznuoakl_2012_9_8

Nerubasska, A., Maksymchuk, B. (2020). The Demarkation of Creativity, Talent and Genius in Humans: a Systemic Aspect. *Postmodern Openings,* 11 (2), 240-255. https://doi.org/10.18662/po/11.2/172

Nerubasska, A., Palshkov, K., & Maksymchuk, B. (2020). A Systemic Philosophical Analysis of the Contemporary Society and the Human: New Potential. *Postmodern Openings*, *11*(4), 275-292. https://doi.org/10.18662/po/11.4/235

Onishchuk, I., Ikonnikova, M., Antonenko, T., Kharchenko, I., Shestakova, S., Kuzmenko, N., & Maksymchuk, B. (2020). Characteristics of Foreign Language Education in Foreign Countries and Ways of Applying Foreign Experience in Pedagogical Universities of Ukraine. *Revista Romaneasca Pentru Educatie Multidimensionala*, *12*(3), 44-65. https://doi.org/10.18662/rrem/12.3/308

Ovcharuk, O. V. (2020). Current approaches to the development of digital competence of human and digital citizenship in European countries. *Information Technologies and Learning Tools, 76*(2), 1-13. https://doi.org/10.33407/itlt.v76i2.3526

Park, Y. (2016, September 6). *8 digital life skills all children need – and a plan for teaching them.* World Economic Forum. https://www.weforum.org/agenda/2016/09/8-digital-life-skills-all-children-need-and-a-plan-for-teaching-them/

Ribble, M. (2015). *Digital Citizenship in Schools: Nine Elements All Students Should Know* (3rd ed.). International Society for Technology in Education.

Ribble, M. (2017). Digital citizenship. http://www.digitalcitizenship.net

Ribble, M., & Park, M. (2019). Digital Citizenship Handbook for School Leaders: Fostering Positive Interactions Online. International Society for Technology in Education

Roberts, T. (Ed.) (2021). *Digital Rights in Closing Civic Space: Lessons from Ten African Countries*. Institute of Development Studies.

Schwanholz, J., Graham, T., & Stoll, P.-T. (Eds.). (2017). Managing Democracy in the Digital Age: Internet Regulation, Social Media Use, and Online Civic Engagement. Springer. http://doi.org/10.1007/978-3-319-61708-4

Spring, J. (2008) Research on globalization and education. *Review of Educational Research*, *78*(2), 330-363. https://doi.org/10.3102%2F0034654308317846

Viktorova, L. (2021). Zastosuvannia shtuchnoho intelektu ta chat-botiv pid chas vyvchennia inozemnoi movy [Use of artificial intelligence and chatbots when learning a foreign language]. *Innovatsiina pedahohika* [Innovative pedagogy], *32*(2), 166-173. I https://doi.org/10.32843/2663-6085/2021/32-2.33

Vovkanych, L. (2020). Fiziolohiia kintsevoho mozku: lektsiia №6 z navchalnoi dystsypliny "Normalna fiziolohiia liudyny" [Physiology of the final brain: lecture No. 6 on the subject "Normal human physiology"]. Vovkanys LS. http://repository.ldufk.edu.ua/handle/34606048/24432?mode=full

Zakon Ukrainy 'Pro osvitu'. Vidomosti Verkhovnoi Rady. No. 38–39 stattia 380 [Law of Ukraine. About education no. 38-39, p.380] (2017). https://zakon.rada.gov.ua/laws/show/2145-19