Ways to design a digital educational environment for K-12 education

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Abstract

Most educational institutions strive to create favourable conditions for students which meet educational needs of each student. It leads to high demand in the digital educational environment of K-12 education institutions. The article is devoted to the description of the concept, components and ways of designing the digital educational environment of a K-12 education institution through the transformation of educational activities. The importance of developing an educational policy of an educational institution in the field of digital technology is described. Authors present the model and the ways of designing the digital educational environment of the K-12 education institution. The necessity of self-assessment of digital technologies usage in the educational process by all its participants is substantiated; the ways of application of the European tool SELFIE for carrying out such self-analysis are described. Based on the adaptation of all components of the tool SELFIE for Ukrainian education, the results of its usage at one of the secondary schools in Kyiv are presented.

Keywords

digital digital educational environment, educational strategies, digitalization of education, SELFIE tool, self-assessment, K-12 Educational Policy

1. Introduction

Socio-economic changes around the world, the comprehensive processes of globalization and the rapid spread of innovation lead to constant transformations of educational systems at various levels. As a result, the entrenched models, methods, forms of learning and educational content are undergoing radical changes. The key task of general K-12 education in these conditions is to ensure quality training of students, focusing on the requirements of the modern labour market. A modern graduate of a secondary school must be competitive, mobile and ready for continuous learning. Such requirements include a rethinking of the structure and content of the provision of educational services by K-12 education institutions (SEC). Mastering and using the latest forms of educational activities, modernization of educational approaches will promote the development of competent professionals who will have thorough knowledge and will be highly trained; they will be able to think rationally and will have an integrated approach to stated problems.

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However, today the essence of education remains constant, the conditions of teaching and learning are being transformed very slowly and too carefully. Digital tools are gradually being introduced at the state level, but not all educational institutions are ready for this, as most teachers, educational politicians and heads of educational institutions do not have basic digital competencies. At the same time, there are still no approved standards for the use of digital technologies in educational activities in Ukraine. Digital competences for the population and educators have already been adopted in Europe, the United States and some post-Soviet countries, particularly in education: the European Digital Competence Framework 3.0 [1], the UNESCO Teacher ICT Competence Framework [2] and the ISTE Standards for Educators from the International Society for Educational Technology [3].

At the same time, in Ukraine there are still no state requirements to assess the digitalization level of the educational process for educational institutions and the level of digital competence development of all stakeholders in education. As a result, there is a low level of digital literacy among the entire population. The Ministry of Digital Transformation of Ukraine in 2019 conducted research that shows the importance of determining ways to implement the digital transformation of education. Thus, 37.9% of Ukrainians aged 18-70 have low digital skills, another 15.1% do not have them at all. 53% of the population of Ukraine is below the mark "average level" according to the methodology for assessing the level of digital skills, which is developed and proposed by the European Commission for implementation. Another number obtained from the survey relates to the actualization of digital skills training in the country – 47% of Ukrainians aged 18–70 believe that digital skills training is relevant for them. And it should be noted that most of them are young people [4]. Interest in mastering digital skills is probably worse due to low digital readiness. This leads to the irrelevance for the population to learn the latest digital systems and tools. As for interest, the need for research of new directions and tools, deepening of already acquired knowledge and expansion of relevant competencies is actualized.

Based on the experience we can say that creation of a digital educational environment is a necessary and sufficient condition for the development of digital competencies of all stakeholders in the educational process especially at the level of secondary education. Furthermore, its effective usage will ensure the quality of learning outcomes.

The purpose of the article is to determine the principles of educational policy for designing a digital educational environment of K-12 education, a description of tools for identifying the level of digital readiness of all participants in the educational process based on reflection and self-assessment systems using the examples of secondary schools.

2. Literature review

Today, studies of theoretical and methodological aspects of digital transformation of K-12 education and the creation and effective use of educational institutions digital policy are quite relevant. These issues are not fully studied, researched and generalized in the implementation of the New Ukrainian School Concept [5] and the updated Law of Ukraine "On complete general secondary education" [6].

The problems of digitalization of education are in the center of attention of the pedagogical

community, as evidenced by numerous conceptual and thorough studies of Ala-Mutka and Punie [7], Barna [8], Burov et al. [9], Bykov et al. [10], Lázaro-Cantabrana et al. [11], Carretero Gomez et al. [12], Clark [13], Fedorenko et al. [14], Ghomi and Redecker [15], Haddad and Demsky [16], Ivaniuk [17], Kozma [18], Morze et al. [19], Pokulyta and Kolotylo [20], Semerikov et al. [21], Smyrnova-Trybulska et al. [22], Strutynska et al. [23], Vuorikari and Scimeca [24], Xu and Warschauer [25].

Digitalization of education is an important component of the transformation of K-12 education, one of the main tasks of information society development in Ukraine. The concept of development of the digital economy and society of Ukraine for 2018–2020 provides that the digitalization of education is a modern stage of its informatization [26].

The main obstacle to the digital transformation of the educational process is the lack of understanding of starting points, the lack of integrated vision and understanding of the necessary and sufficient conditions for the success of such transformation. As the outlook of radical change can be misleading, it is important to understand which strategy to choose and how effectively develop an educational policy in the field of digitization and create a digital educational environment of high quality.

Unfortunately, at the state level Ukraine has not yet formed a strategic document that would regulate the process of formation and use of digital education policy. The Decree of the President of Ukraine "On the National Strategy for the Development of Education in Ukraine until 2021" provided for some provisions that indirectly relate to educational policy, in particular: the section on the informatization of education [27]. Some strategic provisions for the education development are presented in the Digital Agenda of Ukraine–2020 [28]. Educational policy can accelerate the progress of updating approaches to the use of digital educational technologies. A clear action plan at all levels of interaction will contribute to empowering educators in using digital technologies that promote their professional activities.

To create a digital educational strategy one needs to analyze the state of the institution. Intel has developed guidelines to create digital education policies for all stakeholders. It [29] consists of six interrelated components: a shared vision and division of responsibilities in the team; combination of leadership, methodology and evaluation; professional development of teachers; resource provision; educational repository; openness and transparency.

Experts of the Ukrainian Institute of the Future [30] suggest for analysis the following indicators that characterize the state of implementation of digital educational policy in the educational institution:

1. providing access to technology;
2. high-quality network coverage;
3. development of multimedia educational content;
4. increasing digital literacy;
5. data protection.

3. Research methods

To research the peculiarities of the education environment a complex of theoretical (analysis and synthesis of Ukrainian and foreign scientific, pedagogical and methodological sources on the

article's topic) and empirical methods and analysis of the received data. Students and teachers took part in the survey within SELFIE.

4. Research result

To develop an educational policy, it is necessary to determine what are the external and internal components of the educational environment, what tools should be used, how participants in the educational process can interact to achieve their goals and how coordination, management and evaluation of results is going to happen. It is important to note that such activities are not limited to work in the field of the educational institution; it continues to exist outside, through digital tools as well.

Based on the study of Kulesz [31] we built a model that reflects the ways of designing a digital educational environment (figure 1).

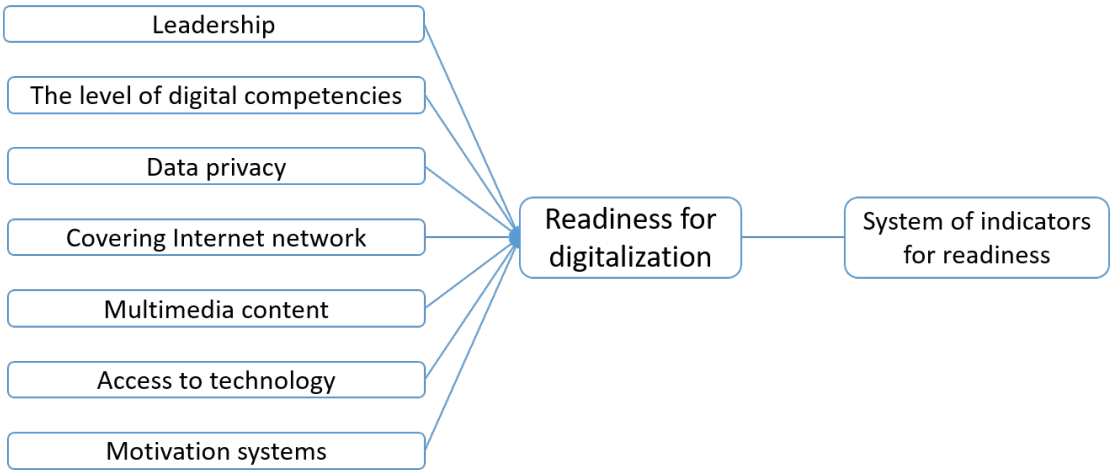

Figure 1: Model of designing a digital educational environment.

Based on the model and in accordance with the Digital Agenda of Ukraine–2020 [28] and the program "Ukraine – learning nation" [32], we can identify the following ways to build a digital educational environment of K-12 education (figure 2):

- `independent` qualitative and quantitative research of digital competencies of participants in the educational process, identification of factors influencing their development, outlining the main obstacles to building a holistic digital educational policy;
- `creation` of a universal set of digital services for all participants in the educational process;
- `assigning` each participant of the educational process a unique digital signature to certify learning outcomes;
- `introduction` of the BYOD model (bring your own device);
- `creation` of high-quality educational multimedia digital content;

- measuring and certifying the level of digital skills in accordance with modern needs on the basis of the adopted European Digital Competence Framework (DigComp) [12].

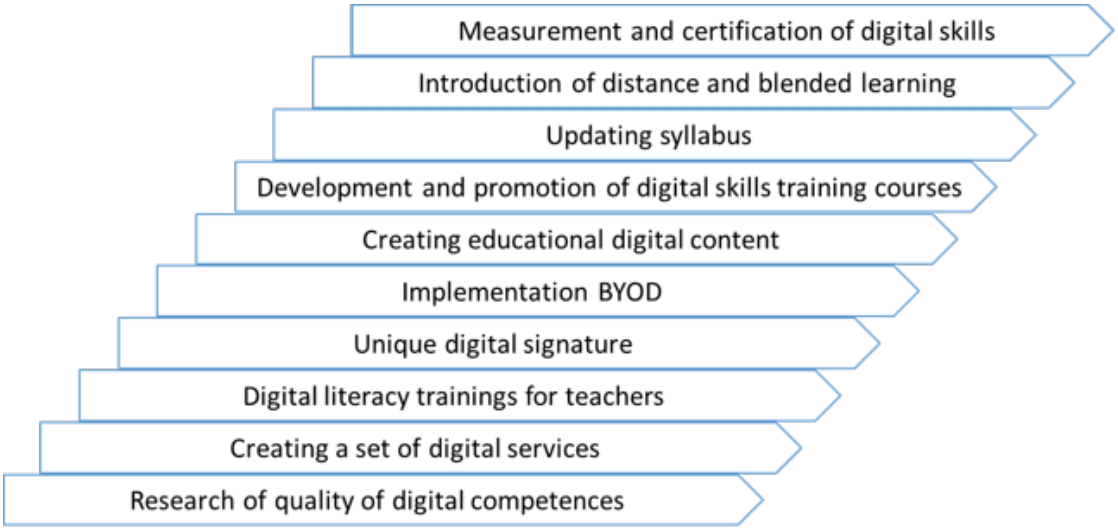

Figure 2: Ways of designing the educational environment of secondary education [28, 32].

To help with selection of digital resources for educational policy design in secondary education Intel has developed certain strategies to find resources for learning in the implementation of educational policy [29]:

- selection of appropriate digital resources, taking into account specific goals and objectives;
- assessment of reliability and security of digital sources and resources;
- review of restrictions on the use of digital resources.

Innovations have significant potential to ensure the quality of educational programs, but participants in the educational process may not be ready to integrate technologies and do not have the appropriate knowledge and skills to use them. The successful application of digital technologies in the curriculum relies heavily on the teachers' and managers' willingness to accept change [29].

There are already various resources and tools in the world to assess the level of digital competences. For example, Microsoft Customer assessment tool [33], COMDID [11], ETS iCritical Thinking, NAEP, Australian National ICT Literacy [16], SELFIE [34].

Analysis of the activity of secondary education institutions proves that the use of SELFIE tool is quite relevant. Moreover, in our opinion its usage is a necessary condition for creation of educational policy by educational institutions in terms of digitalization of educational process.

SELFIE is a free online tool that helps schools in assessment of digital technology usage for innovative and effective learning [34]. This self-assessment process can help to start a conversation at school about potential areas for improvement. SELFIE enables schools to make

a brief description of where they stand in the use of digital technology. SELFIE also allows school to track its progress over time.

Through a series of questions to teachers, school leaders and students, SELFIE measures how digital technologies are used for teaching at school. The questions for school leaders focus primarily on school-level strategies and practices related to the use of digital technologies. The questions for teachers mostly focus on their teaching practices, and as for students they have questions regarding their experience and learning practices related to the use of digital technologies. Schools can customize the tool by adding questions that fit their context. With SELFIE, you can anonymously gather the views of students, teachers and school leaders on how technology is used in their school today. The survey process takes about 30 minutes. The questions are adapted to each group [34].

SELFIE is seen as a tool for self-reflection of the educational institution by promoting the use of innovative educational technologies. It is designed to help educational institutions implement digital technologies in the educational process effectively. This tool helps to analyze comprehensively the results of the whole team and draw sound conclusions about it, identify problems and outline further development. One of the main features of SELFIE is that it can be used to prioritize the quality of the internal educational environment. Due to this resource, you can get information from students, teachers and school administration about the way a particular educational institution uses digital technology [34].

SELFIE covers the following stages of self-assessment: reflection, discussion, planning, and improvement. Any educational institution needs self-reflection on a regular basis. Moreover, building a shared vision and involving the entire school community will help create lasting change.

The survey is conducted anonymously, without specifying the name, class, field of activity. The questions used provide answers in the form of short statements, which are evaluated in the range from 1 to 5. The questions of the comprehensive questionnaire are divided into the following groups: leadership, infrastructure, teacher training process and its evaluation, continuous professional development and digital competence of students (figure 3) [34].

After conducting a survey using the SELFIE tool, an individual interactive report on the strengths and weaknesses of the educational institution in the field of digital technology in the educational process is generated. The accuracy of the result largely depends on the number of respondents participating in the survey. Such analysis provides a solid ground for building the educational policy of the educational institution, and as a result its proper and rapid development, and consequently the development of all participants in the educational process. If necessary, the tool can be reused over time to assess the results of implementation.

The report on the summary of the survey results is available only to the respondent institution, so from an ethical point of view, we will not announce the name of the secondary school. Infographics are only available to the school in the personal account, and no one outside can access them. The survey was conducted during February 28, 2020 – March 19, 2020. 75% of managers, 74% of teachers and 84% of students participated (figure 4). Testing for students was conducted mainly during school hours, which is in line with the advice of the European Commission.

The study found that the leadership qualities of all participants in the educational process are above average: managers and teachers rank them by 4.5 points out of 5 possible, and students by

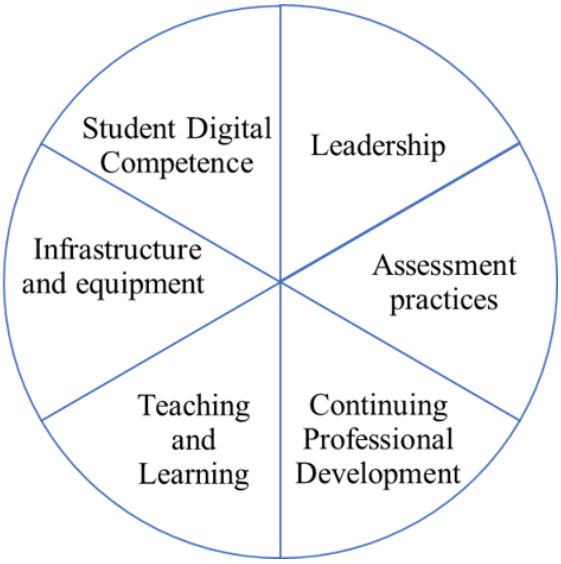

Figure 3: Structure of SELFIE questionnaire tools.

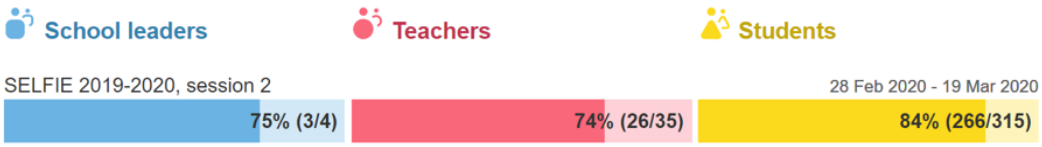

Figure 4: The number of respondents.

3.4 (figure 5). After discussion, it was found that the leading roles in the institution are mainly occupied by members of the student government; while the rest of the children are aimed at earning grades and admission (the school teaches 8-11 grades).

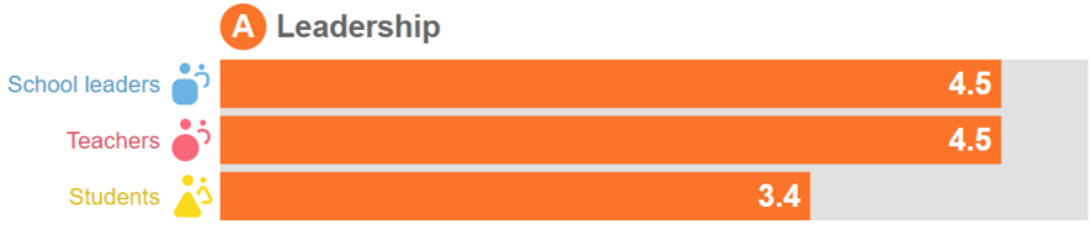

Figure 5: Average leadership indicators, points.

The equipment of the institution receives a high rating (figure 6). Students lack digital devices

for individual use. At the same time, the institution has a photo-video studio, a 3D farm and a robotics office.

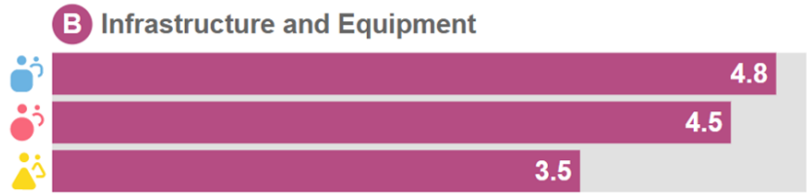

Figure 6: Average indicators of infrastructure and logistics satisfaction, points.

Continuing professional development of educators is ranked at 4.7 points (figure 7). Teachers note that the administration provides the tools and resources needed to enhance their digital competencies.

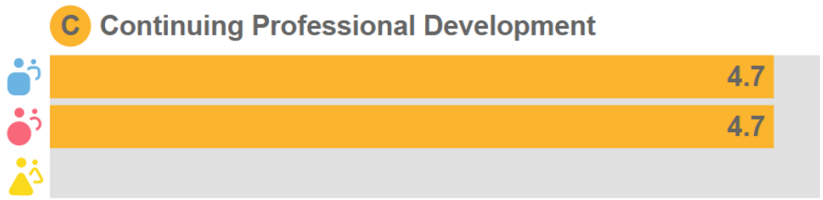

Figure 7: Average performance indicators of continuous professional development of teachers, scores.

Students' level of satisfaction with teaching and learning is on the average, because in their opinion, the educational process lacks innovation and relates poorly to real life (figure 8). In turn, teachers emphasize that they try to keep up with the times and innovation.

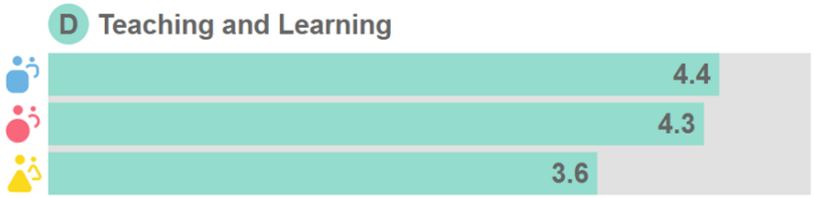

Figure 8: Average indicators of satisfaction with teaching and learning, points.

The school partially uses formative assessment, students note that they are interested in this approach to learning, but not all teachers adhere to the rules provided by its specifics (figure 9).

Managers rate students' digital competencies with the highest score, while students say they have insufficient knowledge of media literacy (figure 10).

Figure 9: Average satisfaction with assessment practices, scores.

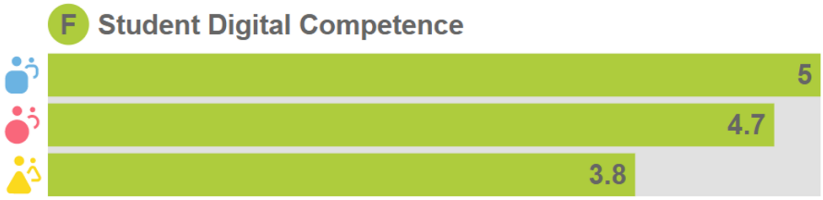

Figure 10: Average indicators of students' digital competencies level, points. Source: SELFIE tool

5. Conclusions

Generalization of foreign and domestic experience, analysis of scientific and methodological sources, methods, ways and tools of digital transformation of secondary education and self-assessment of all participants in the educational process on the introduction of digital technologies in educational policy, identification of ways to build a digital educational environment, the results of the survey allow us to draw the following conclusions.

1. The modern system of education in Ukraine and, the educational process of each individual educational institution, directly, needs a digital transformation that can ensure the quality and efficiency of the educational process. To ensure its effective provision, it is expedient to envisage and design educational policies at all levels of education, which will include aspects of digitalization and development of digital educational environment. A high level of digital competence of all stakeholders of the educational process is necessary and sufficient for its effective use.
   Due to the rapid development of digital technologies and modern techno trends, an integrated approach to the transformation of the education system involves comprehensive interaction of all participants in the educational process, to avoid resistance to digital technologies usage, it is important to outline the benefits of digital transformation in education. Understanding and applying educational digitization is the key to success, so it is important to prioritize it. By focusing on promoting the development of digital citizenship among teachers and students, making it the basis of the educational policy of the educational institution, it is possible to create an effective educational space of high-quality for the new generation. This, in turn, will help the educational institution to remain relevant, offering students a modern level of education that is needed for future success in life and further learning. The design, creation, development and use of a

modern digital educational environment is the right path to the digital maturity of all its participants.

2. To implement the model of digital educational environment we have built, it is necessary to create a team of like-minded people, defining the main goals and objectives, as well as technologies, methodologies and innovations that will be needed to achieve them. You then need to create a step-by-step action plan and notify all stakeholders. Cooperation with private and state-owned enterprises plays an important role in building digital transformation to address changes, adjustments and updates in educational programs and learning models. Technologies are used in enterprises on a daily basis, and joint activities of educators with representatives of the commercial sector will contribute to a better understanding of the needs of the time.
3. It is important to monitor the level of digital skills and digital readiness of all participants in the educational process, which is why it is necessary for each educational institution to set requirements for the level of digital competence of all participants and provide special seminars and training for their training and education. It is also important which tool is chosen by educational institutions to organize proper self-analysis and assess the level of readiness for digitalization of the educational process. The SELFIE tool helps educational institutions to analyze and assess the current state of digital competence, and improve the curricula and processes in the field of digitalization in the future.

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