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Digital transformation of educational content in the pedagogical higher educational institution

Transformación digital de contenidos educativos en una institución de educación superior pedagógica

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Resumen
El presente artículo tiene como objetivo investigar el contenido de la educación que se transforma bajo la influencia de la digitalización en la institución de educación superior pedagógica. Metodológicamente, la investigación fue apoyada por varios métodos teóricos y empíricos que incluyen observación, análisis y diseño pedagógicos, análisis e interpretación de datos de encuestas. Como resultado del estudio se han caracterizado cambios cualitativos en los siguientes aspectos del sistema educativo: contenido de la educación, sistema de evaluación de los resultados de aprendizaje planificados, habilidades del profesorado académico y entorno educativo. Se han identificado las principales líneas de actuación para adquirir, controlar el propio campo de información personal y utilizarlos de forma conjunta en el proceso de puesta en práctica del sistema de interacción “profesor - entorno de información digital - alumno”. En conclusión, se demostró que existen mayores oportunidades para que los docentes ofrezcan y difundan el modelo moderno de entorno educativo, con el uso del aprendizaje en línea basado en redes de información y telecomunicaciones que requiere de ellos una experiencia altamente desarrollada en la organización de la individualización del aprendizaje para los estudiantes. y dar forma a sus competencias profesionales, cultura de la información y alfabetización digital sobre esta base. Finalmente, los autores también han propuesto y justificado las condiciones para que la transformación digital por etapas del contenido educativo sea eficiente.

Palabras clave: Digitalización de la educación, contenidos educativos, transformación, institución de educación superior pedagógica, futuros docentes.

Abstract
The article is aimed at researching the content of education getting transformed under the influence of digitization in the pedagogical higher educational institution. Methodologically the research was supported by various theoretical and empirical methods including pedagogical observation,

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analysis and design, survey data analysis and interpretation. As a result of the study qualitative changes in the following aspects of the educational system have been characterized: content of education, system for assessing the planned learning outcomes, skills of the academic teaching staff, and educational environment. The principal lines of action in acquiring, controlling one's personal information field, and using them jointly in the process of putting the interaction system "teacher – digital information environment – student" into practice have been identified. In conclusion it was shown that there are wider opportunities for teachers to offer and broadcast the modern model of educational environment, with the use of online learning based on information and telecommunication networks that requires from them highly developed expertise in organizing the individualization of learning for students and shaping their professional competencies, information culture, and digital literacy on this basis. Eventually, the authors have also proposed and justified conditions for stage wise digital transformation of educational content to be efficient.

Keywords: digitization of education, educational content, transformation, pedagogical higher educational institution, future teachers.

Introduction

In the modern society, rapid propagation of digital technologies demands that teachers develop new competencies. So, both beginner and experienced teachers have to know specific features of and be able to work with various software and interfaces; to be aware of data and privacy protection aspects; to be able to not only mine information using various digital sources but also to differentiate between them; to assess security and validity of the information. Alongside having these competencies, teachers must transfer the knowledge they have to the rising generation, as interaction with digital gadgets is already a part and parcel of life for modern schoolchildren. This is exactly why digital literacy is incorporated into the PISA system for assessing academic and research achievement. The complexity consists in the fact that the continuous process of updating and improving digital tools brings about change for an entire range of professional competencies. And, consequently, teachers' training qualification depends on the quality of the content within their educational process.

Digital technologies have ensured relevance to the system of education offering help for the rising generation in preparing it for leading the modern life in the digital society while also meeting requirements for employees of whatever professional spheres and skill levels (Uvarov et al., 2019b). Accordingly, all aspects of the educational system have undergone qualitative change: content of education, system for assessing the planned learning outcomes, skills of the academic teaching staff (ATS), and educational environment (Chikova, 2020).

The world's education systems are extensively using and implementing e-learning technologies and distance educational technologies bringing along a higher education quality level (Yang, 2018). Their use has an instrumental effect on the process of shaping a fundamentally

different generation of teachers – ones having competencies that are in line with digitization of education.

In present-day conditions, training of the future teachers for developing and using electronic educational resources, for creating and delivering digital (online) courses is especially relevant. The problem lies in the fact that in specialities based on natural sciences and technology, training has always implied the use of technical teaching aids, so the quality of education in this profile has scaled up massively, after digital laboratories and virtual educational environments were created. Meanwhile, in the humanitarian profiles of pedagogical education, training has always relied on personal contact with teachers, and it is teachers who have always been broadcasters of knowledge. So, in conditions of modern digitization of education, it is vital to transform the content of education for the future teachers in such a way as to enable supplementing the system of traditional learning with opportunities of the new information technologies.

Literature Review

For the recent decade, the issue of digital transformation of the content of education has been the subject of debate both in Russian and in foreign pedagogy. It is in work by Badea, Badea, and Clinci-Tudorel (2012) that the educational model experience for e-learning is described the most thoroughly.

The fact is certain that digital educational environment allows expanding opportunities for learners. Analyzing experimental distance learning at universities of Linard (2006) writes that technification of learning and materialization of active methods of student-centered learning implies establishing new strategies of cognition and learning, developing new individual abilities, such as solving problems and learning. Blin and Wilson (1995), Crookall, Coleman, Oxford (1992) have drawn the attention of pedagogical community to the opportunities of using digital resources in linguistic training of students. As emphasized by Crookall (1992), computer-mediated learning provides great opportunities for bringing more active students from the shade thus benefiting their personal development. With regard to this, researchers point out the necessity of creating such educational content as to ensure the development of students' skills in setting and achieving goals due to regular self-assessment procedures In her studies, Blin (1998) proved it was essential to create such a social structure within educational organizations as to promote broader rights and opportunities by means of digitization. She justified compulsory adoption of the computer tool concept, too.

Shaping digital competencies in modern teachers is the subject of the research work by J. López-Belmonte, Pozo-Sánchez, Fuentes-Cabrera, and Trujillo-Torres (2019). Another problem of transformation of the content of education in conditions of digitization is highlighted by Linard

(2006): educational content cannot be standardized. In other words, the information and communication form in which the material under study is represented differs depending on the system of education it is used in; there are no general standard solutions for the content of digital information and educational environments.

The emergence of new information technologies has resulted in reconsidering the content of education in Russian studies as well: the rise of the system of e-learning in foreign research has been analyzed (Shtanko, 2019; Dmitrova et al., 2019); the expedience of implementing mobile learning, including that using various gadgets and mobile apps, has been identified (Kabanova and Vetrova, 2019; Soboleva and Fedotenko, 2019; Soltovets et al., 2019; Kadakin et al., 2019); efficient digital educational technologies and opportunities of VR-technologies have been identified (Kuznetsova and Yankina, 2018; Petrova and Bondareva, 2019; Zaitseva et al., 2019; Safonov et al., 2019). Thus, analysis of the current state of the research problem has enabled the authors to identify focus areas of digital transformation of the content of education as discussed in scientists' works:

- updating the content of education proceeding from the realia of digital economy, intrasubject communications, and readiness for living in the modern society;
- transferring independent work into the digital information and educational environment which would allow individualizing the education;
- designing digital information and educational environments based on the independence and training individualization principles;
- ensuring mobility of the digital information and educational environment, with implementation of both new information technologies and traditional training technologies borne in mind;
- expanding the opportunities of using digital tools of academic work in the educational process;
- reviewing the role of teacher in training, creating project teams for developing educational content within digital environment.

Methodology

The purpose of this paper is to identify basic concepts in digital transformation of the content of education. The set objective has determined a number of tasks to complete: 1) analyzing the concept digital transformation of the content of education (Soboleva and Fedotenko, 2019; Safonov et al., 2019; Chikova, 2020); 2) finding out difficulties both teachers and students currently have which are associated with changes of the content of education in conditions of digitization; 3) identifying the lines for digital transformation of the content of education. In this

paper both qualitative and quantitative research methods were used: theoretical analysis of pedagogical experience (Petrova and Bondareva, 2019), scientific data interpretation (Uvarov et al., 2019b), the method of pedagogical design (planning, modeling, and holding classes; Chikova, 2020), and empirical data analysis in the form of the survey (Uvarov et al., 2019a).

Results

Modern system of education of the RF has undergone change for some decades now. The objective of its upgrade is defined as the process of shaping the modern infrastructure of general education which ensures implementing innovation methods and technologies of training, including ones for students having special educational needs; the process furthers both creation of an efficient system for identifying and promoting abilities, talents in all categories of learners and improvement of the education quality assessment system, too (Message of the RF President to the Federal Assembly, 2020). In the system of education, the most essential modifications are associated with introduction and dynamic development of information and communication technologies. Updates have touched on all focus areas of work of educational organizations: content of education, facilities and resources, staffing of the organizations.

The term transformation is defined as conversion, transfiguration, modification (Yevghenyeva, 1999). All conversions and modifications occur under the effect or on condition of something. Speaking about digital transformation, one can suggest that modifications take place under the effect of digital content and information and communication technologies. Digital transformation stemmed from the profound conversion of all kinds and spheres of activity at industrial enterprises (Westerman et al., 2014). Its basis was made up by the emerging digital technologies, and the process of transformation depended on their subsequent progress directly.

The emergence and further development of digital technologies in education has entailed the update process for all spheres of the educational activity. Definition of the concept “digital transformation of education” is presented and described by Uvarov et al. (2019a). So, researchers define digital transformation of education as

> systemic update of the required educational outcomes, content of education, organizational forms and methods of academic work, assessment of educational outcomes in the rapidly developing digital educational environment, with the update being aimed at preparing learners for living and acting in conditions of digital civilization; using the potential of digital technologies for enhancing the efficiency of the educational process" (Uvarov et al., 2019a, p.182).

According to educational research, the content of education is defined as a pedagogical model of culture of the humanity which is represented in terms of social experience; its structural components are knowledge, abilities to act both according to an example and in non-standard

situations, and a system of personal orientations (Kraevskiy and Khutorskoy, 2007). The content of education acts in conjunction with the process of learning; so, it is now possible to explore the processes within digital transformation of the content of education through the lens of the procedural aspect of learning. As applied to higher education, the content of education can be viewed as a total of systemized theoretical knowledge, professional abilities and skills guaranteeing the formation of professional competencies, as well as a certain development level of cognitive powers achieved as a result of academic and upbringing activity in conditions of higher educational institutions. Then, the content of education finds its representation in educational programs.

For the other hand, an educational program regulates requirements for planned learning outcomes, the content of learning in subjects under study, forms and technologies of organization of the educational process, and the system for assessing educational outcomes. Thus, within this research, the authors define the concept “digital transformation of the content of education” as the systemic update of all academic areas in the educational process. The content of pedagogical education has to be updated with the realia of digital economy and interdisciplinary requirements taken into account. The scope of the said content must rely on the development of key competencies.

Let it be analyzed to what extent pedagogical higher educational institutions proved to be prepared for digital transformation of the content of education due to the forced transition to e-learning with the use of distance educational technologies in the second half of academic year 2019-2020. Results of the analysis highlight difficulties which both students and teachers of the FSBEI HE “Mordovian State Pedagogical University named after M. E. Evseviev” (namely, those of the faculty of pedagogical and artistic education and the faculty of secondary vocational education) had to face due to transition to the distance learning form. The selection of faculties is not random: it is here that future primary school teachers are trained. The analysis was performed as applied to their linguistic and methodological training. For this purpose, the authors conducted questionnaire survey of the students and teachers. The survey covered 172 final-year students in both intramural and extramural forms of study of the faculty of pedagogical and artistic education and the faculty of secondary vocational education; it involved 64 teachers, too. With most respondents, age limits fell within 18-25 years old (73%), yet more senior students took part in the research as well (26-35 years old (18%); 36-45 years old (6%); over 46 (3%)). The age parameters for teachers participating in the survey range from 25 years old and more, with over half of them aged over 45; 67% of the teachers surveyed have work experience of over 15 years.

At the beginning of the survey, the authors attempted to find out how well the respondents manage digital devices. Within their educational activity, the students use the entire range of digital

devices: smartphones (65%), tablet PCs (5%), laptops (77%), and desktop PCs (43%); the teachers only use laptops (58%) and desktop PCs (42%) in their work (see Table 1).

Table 1

Digital devices used by participants of the educational process (%)

Participants of the educational process	Digital devices			
	Smartphones	Tablet PCs	Laptops	Desktop PCs
The students	65	5	77	43
The teachers	-	-	58	42

Source: the authors.

As it can be seen in Table 2, in the process of training, both the students and teachers made extensive use of various software means and services, among them online resources (85%), MS Office related products (47%), social networks (42%), file storages (25%), and YouTube (19%).

Table 2

Types of software tools / services used by participants of the educational process (%)

Participants of the educational process	Types of software tools / services				
	Online resources	MS Office related products	Social networks	File storages	YouTube
The students, the teachers	85	47	42	25	19

Source: the authors.

From the diversity of online resources, it was digital libraries (44%) and Wikipedia (23%) that were the most sought-after with the students, while student forums (14%) and video lessons (10%) were less popular with them (see Table 3). The least hits percentage (0,6%) was registered for the materials of scientific and methodological papers.

Table 3

Popularity of online resources among students (%)

Participants of the educational process	Online resources				
	Digital libraries	Wikipedia	Student forums	Video lessons	The materials of scientific and methodological papers
The students	44	23	14	10	0,6

Source: the authors.

The list of online resources utilized by participants of the educational process is substantial, with electronic library systems among them. For the ATS, the most sought-after content is video, audio files, forums, with blogs being less popular. The forced transition to e-learning has highlighted the difficulties of digital transformation of education. In particular, 42% of the teachers have mixed impressions from participating in the distance learning format. Negative views are caused by “round-the-clock stay at the workplace”, “having to develop e-content”, “having to master e-teaching skills fast”, and so on.

Nevertheless, 58% of the teachers evaluated distance learning as a positive form of work. Among the students, it was only 28% who gave a positive answer to the question “What is your general impression from the distance format of work?” 61% of the students had difficulty voicing a decisive opinion as for distance learning. They motivated it as follows: “The volume of independent work has been increased”, “There is no habitual direct communication with the teacher and groupmates”, “We had to master new skills on a tight schedule”, “Physical activity has been cut down”. The lack of direct student-to-teacher interaction, living speech, and emotional exchange has affected the perception of information and reduced the extent of understanding of the material.

However, alongside this, 46% of the respondents believe in this term, the quality of their own academic work has remained at the same level as compared to the traditional format of learning, with 20% noting that their “academic work has become more efficient”. On balance, the students would like to see e-content developed by the teachers themselves within distance learning: video lectures, test simulators, e-textbooks, dialog simulators, and multimedia presentations. Meanwhile, 55% of the teachers use in their work multimedia presentations only, 35% introduce digital training test simulators into their work, and 4% (!) – dialog simulators.

Having to develop e-content in short terms has caused a certain number of complaints from the teachers, too. Only 33% of the teachers had no difficulty in this kind of activity, while 41% of the surveyed ones noted the lack of the required software (programs for developing e-courses were in question), and 12% – the lack of time. The remaining 14% reported the lack of special abilities and skills.

Discussion

Among difficulties which teachers and students had to face due to transition to distance education, the ones that are the most relevant for this research can be noted: designing the high-quality e-content and introducing it into the educational process; having special knowledge in information and communication technologies and practical experience of activity in the digital

educational environment.

It goes in line with the ideas expressed by Virtič, Dolenc, Šorgo (2021) and Marek, Chew, Wu (2021) who explored the experiences of students and teachers converted classes to distance learning during the COVID-19 pandemic.

The organization of the educational process in a digital environment requires compliance with certain requirements was stated by many scholars in the previous researches (Bond et al., 2018; Khalid et al., 2018; Scherer et al., 2019), dedicated to various forms and peculiarities of interaction between students and teachers using digital technologies. Based on research by Grenčíková, Kordoš, Navickas (2021) and Benedek (2020), we also consider that, the above circumstances dictate the need for stage wise digital transformation of the content of education. This process will be the most efficient if a number of conditions are observed, namely:

1) The process of substituting, transforming traditional teaching aids with new digital tools must be gradual. Meanwhile, digital tools have to improve the quality of the material under study, e.g., expand the capacity for visual representation of the material or grant an opportunity to resolve professional situation problems in a new way;

2) The educational e-content must bear up against specific features of the subject in question. For example, when learning methodological fundamentals of a topic, students have to plunge into the virtual environment of the lesson. When designing study material, teachers have to use not only materials of textbooks, but also open educational resources (academic and scientific resources in public domain or published under the Creative Commons or a similar license). Teachers get an opportunity to create higher quality training content utilizing multimedia resources which require special technical and media skills; similarly, they can learn about new techniques of teaching, create resources, and discuss them with peers, joining professional communities;

3) Within digital information and educational environment, the content of education in academic subjects must ensure motivation of cognitive activity, academic independence, and develop students' creative capacities;

4) Information and communication services used in teaching academic subjects must ensure the development of communicative competency in students;

5) ATS of higher educational institutions have to carry out pedagogical design of study materials and digital design of electronic (online) courses. With regard to this, enhancing teachers' pedagogical expertise in mastery of educational information technologies is essential, which will enable them to not only learn tools for boosting students' motivation but also know how to change the design of their programs in line with student engagement.

Conclusion

Thus, in the course of the research, digital transformation of the content of education has been found to be targeted at qualitative renewal of the system of education. Scientific analysis of the specific features of pedagogical education and the available experience of transforming the contemporary digital information and educational environment in practice allow speaking about the educational paradigm shift in terms of the content of education.

As the survey findings confirm, the current condition of pedagogical education demands introducing digital technologies into the educational process and changing the methods of academic work imperatively. The research conducted has identified the following principal lines for digital transformation of the content of education in conditions of pedagogical higher educational institutions:

1) the content of pedagogical education has to be reviewed: key competencies have to be included into the planned learning outcomes;

2) digital infrastructure of educational organizations has to be developed;

3) digital teaching and learning resources, digital assessment framework have to be designed;

4) public domain digital collections of teaching and learning resources, toolkits, and services have to relied on for training bachelor degree students of pedagogical specialities;

5) process digitization has to be implemented: digital information and educational environment has to ensure mobility, remote access, as well as automation of all processes.

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