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Digital educational space in the professional training of a musical art teacher

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ABSTRACT

The objective of this study was to determine whether higher education institutions, teachers and students of the specialization in musical art are prepared to create and use the digital educational space in the educational process. The study involved the following methods: literature review and analysis of the content of official documents of higher educational institutions that provide professional training for music teachers; survey; mathematical methods of data processing; Statistica software package. The research has shown that not all higher educational institutions have the necessary resources to implement learning in the digital education space. Besides, not all higher educational institutions teach subjects that help improve students' digital literacy. There are also teachers who have difficulties using the digital educational space in the learning process due to lack of digital literacy. The study demonstrated awareness of the importance of using the digital educational space in the education of future music teachers. But, it is necessary to pay attention to improving the digital literacy of all participants in the educational process, as well as provide educational institutions with proper modern recourses, software, hardware and equipment, including also computer music technologies and electronic musical instruments.

KEYWORDS: digital literacy; distance education; electronic learning; music education; educational resources.

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Espacio digital educativo en la formación profesional de un profesor de arte musical

RESUMEN

El objetivo de este estudio fue determinar si las instituciones de educación superior, los profesores y los estudiantes de la especialización en arte musical están preparados para crear y utilizar el espacio educativo digital en el proceso educativo. El estudio contó con los siguientes métodos: revisión de la literatura y análisis del contenido de los documentos oficiales de las instituciones de educación superior que brindan formación profesional a los profesores de música; encuesta; métodos matemáticos de procesamiento de datos; paquete de software Statistica. La investigación ha demostrado que no todas las instituciones de educación superior tienen los recursos necesarios para implementar el aprendizaje en el espacio de la educación digital. Además, no todas las instituciones de educación superior enseñan materias que ayudan a mejorar la alfabetización digital de los estudiantes. También hay profesores que tienen dificultades para utilizar el espacio educativo digital en el proceso de aprendizaje debido a la falta de alfabetización digital. El estudio demostró conciencia de la importancia de utilizar el espacio educativo digital en la formación de futuros profesores de música. Pero es necesario prestar atención a mejorar la alfabetización digital de todos los participantes en el proceso educativo, así como proporcionar a las instituciones educativas los recursos, software, hardware y equipos modernos adecuados, incluidas también tecnologías de música informática e instrumentos musicales electrónicos.

PALABRAS CLAVE: alfabetización digital; competencia digital; la educación a distancia; instrumentos musicales electrónicos; plataforma de aprendizaje; recurso electrónico.

Introduction

The search for optimal methods and approaches to teaching future music teachers was carried out in different countries, in particular, in European countries such as Poland, Germany, France, Sweden, Finland, Norway, Great Britain, Greece.

The main prerequisites for the introduction of digital technologies in education are: their emergence; one of the principles of sustainable development is lifelong learning, including self-education; the growing popularity of the introduction of gamification in the educational process; gadgetisation, etc.

Digital educational space performs the following functions: information and methodological support of the educational process; planning the learning process and providing it with the necessary resources; quality assessment and recording of learning

outcomes; search, collection, analysis, processing, storage and submission of information; remote communication between participants in the educational process, as well as communication between various educational institutions and other organizations that can help improve the effectiveness of learning.

Information culture has become an integral part of culture. It is necessary to combine traditional forms of education with digital in order to build effective interaction of participants in the learning process based on the interests of modern students, for whom the digital technological environment is comfortable.

The question of the use of digital educational space in higher educational institutions of Ukraine, where future specialists acquire professional competencies, remains open. The aim of this work was to investigate the degree of readiness of higher educational institutions of Ukraine to use the digital educational space in training music teachers. Achieving the aim involved fulfilling the following objectives:

1) study whether higher educational institutions that train music teachers have the necessary resources for the use of digital educational space in the educational process;

2) through survey of teachers and students determine their readiness to use the digital educational space and the degree of its use in the educational process of training music teachers.

1. Literature review

In today's information-rich world, a successful person is one who has digital competencies (Henseruk and Martynyuk, 2019, Koukopoulos and Koukopoulos, 2019), which describe a person as one who can think logically, manage information and have the skills to work with digital technologies.

The digital educational environment contributes to the development of digital competence of participants in the learning process (Henseruk and Martynyuk, 2019; Maymina et al., 2018). But it requires compliance with the following rules when creating it (Henseruk and Martynyuk, 2019): a student is an active subject of knowledge, who has some experience and individual characteristics, which should be directed to self-education and professional self-development not only during student years, but throughout life. After graduating from a pedagogical institution, the future music art teacher should acquire the

following professional competencies: the ability to use techniques to activate student's cognitive activity, thereby promoting the development of intelligence (Artemieva et al., 2020; Morozov and Kozlov, 2019); knowledge of the psychological and pedagogical features of the aesthetic and educational process and promotion of the comprehensive development of students by means of art; the ability to apply an individual approach to each student in order to meet their creative needs; have ICT user skills and apply them in the learning process, etc. (Prokopchuk, 2020).

Digital competencies that need to be developed in future teachers (Henseruk and Martynyuk, 2019): the ability to recognise and use digital educational resources depending on the goals and objectives of learning; ability to generate interactive tasks using digital resources; ability to carry out research using digital technologies; ability to organise and participate in group interaction in a digital educational environment; ability to motivate students to creative use of digital space (Cordie et al., 2021); ability to transfer the traditional educational process into the digital educational environment (Henseruk and Martynyuk, 2019, Mitchell and Appleget, 2021; Mullabayev et al., 2021)). ICTs also contribute to the development of the following competencies in future music teachers: independent musical thinking, building an auditory model of interpretation of a musical work, etc. (Havrilova et al., 2019).

Digital competence is also related to: understanding the structure and ways of interaction of digital technologies; awareness of the possibilities of digital technologies for innovative activities; assessing the reliability of information; skills and abilities to work with different programmes (Erstad and Silseth, 2019; Henseruk and Martynyuk, 2019).

Literature review on the topic of this study showed that there is no single approach to the definition of "digital educational space". Some scholars (Bayanov et al., 2019) understand the digital educational space of the educational institution as digital technologies of the online community of teachers and students. In this paper, an educational system with the following components will be considered as digital educational space: educational resources in electronic form (lecture texts, plans of seminars and practical classes, tasks for practical work, discussion topics, electronic libraries, catalogues, audio, video recordings, repositories, etc.); ICT (for example, various digital technical means, educational digital platforms, etc.), which make the interaction of the subjects of the educational process in the educational space possible (holding webinars, online conferences, consultations, etc.).

In order for a future music teacher to be able to adapt in the modern information space, it is necessary to introduce the subject Theoretical Foundations of Information Culture or Music Informatics into the curriculum (Gorbunova and Bazhukova, 2020). The main technical means should be music computer technology and electronic musical instruments. Increasing the efficiency of the use of digital educational space requires high information literacy of all participants in the educational process, so it is advisable to pay attention to the special information training of teachers.

The penetration of digital technologies into the art of music has led to the emergence of new prospects (Bowen et al., 2018) and the transition of the learning process to a higher level (Gorbunova and Hiner, 2019). Music computer technologies, keyboards, synthesizers, multimedia computers, etc. have become widely used (Gorbunova and Plotnikov, 2018). Their capabilities allow to improve musical skills in the course of interaction with a music computer (Gorbunova and Hiner, 2019), as well as led to the emergence of new, non-traditional technologies for performing musical works (Gorbunova, 2018).

To date, a number of interactive learning systems have been developed and used in music schools and clubs. These include (Gorbunova and Hiner, 2019, p. 125): Soft Way to Mozart, Music in Digital Space, Music and Informatics, Murzilka: The Lost Melody, Clifford: Guess the Melody, Music Class: Play and Learn, Ear Master School, Ear Power, Sight-Singing Trainer. Interactive learning systems have specialised software that allows using a computer and a connected numeric keypad as a musical instrument, while the music computer has a graphics card, has the ability to create computer graphics, animation, interact. It is also possible to support such activities as singing, playing musical instruments, composition and recompilation of music, they can be used in music-related areas of culture and art — theatre, choreography, music videos, etc. (Gorbunova and Plotnikov, 2019). However, the main purpose of, for example, the learning system Soft Way to Mozar" is to teach its users to play keyboard instruments (Gorbunova and Hiner, 2019). A number of mobile applications have also been developed (Zimmermann et al., 2019), such as Practicia (Wagner, 2017).

Music computer technology also allows applying all the experience of traditional music teaching in a distance form (Gorbunova and Pankova, 2020). Besides, ICTs allow all creative individuals to interact on a global scale, share experiences and be inspired by new achievements. It is necessary to have appropriate skills in working with ICT to be able to use

the global digital creative environment (Gorbunova and Hiner, 2019; Gorbunova, and Pankova, 2020).

As Gorbunova and Pankova (2020) demonstrated through teaching the subject Computer Technology in Music Education, music computer technology has software for musical creativity: arrangements, audio and video editors, sound libraries, virtual synthesizers, audio processing programmes, video recording programmes, audio file content analysis programmes, etc. They also have the tools needed to conduct a test of acquired knowledge of musical subjects. For example, music computer technology can be used for interactive testing, which includes questions from theoretical material, auditory assignments, musical dictation, etc.

The introduction of special music platforms, such as ConservatorioVirtual.com, into the educational space of music teachers is also promising (García-Gil and Andreu, 2017).

Another advantage of information technology is that it makes learning accessible to everybody (Gillett-Swan and Sargeant, 2018), and for people with disabilities (Tohara, (2021), for example, with visual impairments (Gorbunova and Voronov, 2018), as well as during natural disasters (Tudor and Popescu, 2020). Scholars have considered and classified the benefits and risks of implementing digital technologies in the educational process (Bayanov et al., 2019; Kratus, 2019).

It is also proposed to focus on the needs of the majority of students in music education provided in schools, rather than trying to grow 0.1% of musical geniuses, ignoring the interests of 99.9% of students who are forced to study music at school and acquire knowledge and skills which they will never need in adult and professional life (Kratus, 2019).

Researchers propose to include social networks, in particular, YouTube, in the digital educational space of professional training of music teachers, which will contribute to an even deeper immersion in the world of music art (Smith and Secoy, 2019).

2. Methods

The research procedure contained the following components:

1) The available resources for the creation of digital educational space in pedagogical education institutions that train teachers of music art were identified. In particular, they found out whether there are electronic libraries, music computer technologies, electronic

musical instruments in the studied HEIs. Besides, it was found whether digital educational platforms are used in the training of future teachers. It was also found out whether students' digital literacy is being enhanced through the study of subjects related to the use of ICTs in education and music.

2) A closed-ended questionnaire was created and a survey of teachers of specialised subjects in the major Secondary Education (Music Art) was conducted to determine their attitude to the use of digital educational space in the educational process, as well as their capabilities for the use of ICTs, music computer technologies and electronic musical instruments, as well as whether there are difficulties when working in the digital educational space.

3) A closed-ended questionnaire was created and a survey of students majoring in Secondary Education (Music Art) was conducted to find out how common among students is work in the digital educational space, whether ICT, music computer technologies, electronic musical instruments are used in the learning process and how they affect learning outcomes, as well as the acquisition of knowledge, skills and abilities necessary for the future professional activity of music teachers.

The first stage of the research involved content analysis of the official websites of the sample universities to identify the necessary informational, digital, theoretical, methodological and technical support that allows forming a digital educational space to train future music teachers. Besides, the content of educational and professional programmes and curricula for music teachers was analysed to identify subjects that contribute to improving the digital literacy of students needed for effective learning in the digital educational space.

The second and third stages of the study provided for the creation of questionnaires and conduct of surveys of teachers and students. The sample consisted of ten higher educational institutions of Ukraine selected at random according to one criterion — training in the major Secondary Education (Music Art). The sample included the following HEIs: Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, Berdyansk State Pedagogical University, Volodymyr Vynnychenko Central Ukrainian State Pedagogical University, South Ukrainian National Pedagogical University named after K.D. Ushynsky, Ukrainian Engineering Pedagogics Academy, H.S. Skovoroda Kharkiv National Pedagogical University, Pavlo Tychyna Uman State Pedagogical University, Taras Shevchenko National Pedagogical University of Chernihiv, Borys Grinchenko Kyiv University, V.O. Sukhomlinskiy

National University of Mykolaiv. The sample also included seventeen teachers of the studied HEIs who teach specialised subjects to students majoring in Secondary Education (Music Art), and 163 students studying in the selected HEIs in this major. The distribution of the sample by HEIs was as follows: 1-2 teachers from each selected educational institution of different ages, work experience, scientific degree and position; and 15-20 students from each studied HEI aged from 18 to 30 of the 3rd-4th years of study.

The obtained results were processed in Statistica software.

3. Results

Students need knowledge and skills in the field of modern ICT to effectively use the digital educational space to meet educational information needs.

In this paper, the prerequisites for creating and using digital educational space of research institutions were identified through the content of websites of Ukrainian pedagogical HEIs which provide educational services to future teachers of music, as well as curricula and educational and professional programmes. The obtained results are summarised in Table 1.

Table 1. The identified conditions for the creation and use of digital educational space in the sample universities

HEI	Subjects that promote digital literacy	Necessary provision of digital educational space	Availability of e-library	Source of information
Vinnytsia Mykhailo Kotsiubynsk yi State Pedagogical University	Innovations and Technologies in Contemporary Art	The use of Moodle	Yes	http://vspu.edu. ua/
	Organization of the Educational Process in the Digital Learning Ecosystem			
	Methods of Developing and Using Electronic Courses			
	Digital Environment Ecology			
	Distance Education Product Management			
	Digital Innovative Technologies			
	Work with Electronic Courses			
	Digital Technologies for Graphic Image, Animation and Video Processing			

	Modern Digital Technologies and Media Education			
	Distance Learning Software			
	Modern Information Technologies (for professional purposes)			
Berdyansk State Pedagogical University	Modern Information Technologies (for professional purposes)	Moodle distance learning platform	Yes	https://bdpu.org.ua/
Volodymyr Vynnychenko Central Ukrainian State Pedagogical University	Music and Information Technologies	Moodle distance learning platform, depository, electronic resources	No	http://kspu.kr.ua
South Ukrainian National Pedagogical University named after K.D. Ushynsky	Innovative Technologies of Teaching Art	work with the cloud environment Microsoft Office 365, Zoom, repository	Yes	http://pdpu.edu.ua/
H.S. Skovoroda Kharkiv National Pedagogical University	Music Informatics (elective)	training and information portal based on the Moodle platform; midi keyboard; electronic archive; repository; electronic catalogue, repository; educational and methodical complexes of subjects; internship programmes; blocks of elective subjects	No	http://pu.ac.kharkov.ua/

Pavlo Tychyna Uman State Pedagogical University	Music Informatics	virtual educational environment of the university; copyright development of teaching staff; electronic library resources; Moodle electronic environment platform; educational and methodical complexes of subjects	Yes	http://www.udpu.org.ua/
Taras Shevchenko National Pedagogical University of Chernihiv	ICT in the Field of Music Art Digital Musical Instruments	virtual educational university environment, author's development of teaching staff, electronic environment of the Moodle platform, educational and methodical complexes of subjects	Yes	http://chnpu.edu.ua/
Borys Grinchenko Kyiv University	Music Informatics	Microsoft cloud services, Webex software, electronic repository	Yes	
V.O. Sukhomlinskiy National University of Mykolaiv	Music Informatics (elective)	Moodle system	Yes	
Nizhyn Mykola Gogol State University	Information Learning Technologies Music Informatics	Moodle virtual learning environment	Yes	http://www.ndu.edu.ua/

Table 1 shows that all HEIs included in the sample of this study provide educational services in the major Secondary Education (Music Art). 100% of the curriculum provides for the development of digital literacy of future music teachers through the following subjects:

Music Informatics, Modern Information Technology, ICT in the Field of Music Art, Multimedia Technologies in Art Education and others. However, in 30% of HEIs these subjectsare elective.

The vast majority of HEIs use the traditional form of education: lectures, seminars, practical and individual classes, independent work and consultations, and assessment in the form of written or oral exams and tests, presentations, defence of internships, term papers, etc.

However, according to the information posted on the official websites, all HEIs of the sample also use digital teaching aids, in particular Moodle digital learning platform, through which the participants of the educational process interact in digital format by placing educational and methodological complexes of studied subjects, audio, video materials, repository, as well as online consultations, conferences, etc.

As the analysis of curricula and educational professional programmes showed, not all selected HEIs pay attention to the development of such knowledge, skills and abilities of future music teachers as knowledge of modern music computer programmes designed for sound processing, knowledge of sound recording, knowledge of music editors, skills and abilities to work with sound equipment, skills and abilities to use a computer as a music studio, skills of recording and processing sound using digital technologies, knowledge, skills and abilities to use music resources on the Internet.

This work also involved a survey of teachers and students of HEIs included in the sample. Sample description by age, gender and occupational characteristics are given in Table 2.

Table 2. Sample description

	Total	Men	Women	Age				
				18 - 24	25 - 34	35 - 44	45 - 54	55 - 65
Lecturers/professors:	17	5	12	2	3	6	5	3
PhD, Associate Professor	11	3	8	0	1	3	4	3
Lecturer, demonstrator	6	2	4	2	2	3	1	0
Students	163	48	115	154	9	0	0	0

The results of the survey conducted among teachers of the studied HEIs are presented in Table 3, and among the students of the sample — in Table 4.

Table 3. The results of the survey of teachers

Item No.	Questions of the questionnaire for students	Number/percentage of responses:		
		"Yes"	d	"No"
1.	Do you have the necessary ICT skills?	16 / 94 %	768	1 / 6 %
2.	Do you have the necessary skills to work with music computer technology?	10 / 58 %	552	7 / 42 %
3.	Do you have the necessary skills and abilities to work with electronic musical instruments?	8 / 48 %	554	9 / 52 %
4.	Do you prefer traditional and blended learning?	13 / 76 %	338	4 / 24 %
5.	Do you use the resources of the digital educational space in the learning process?	16 / 94 %	916	1 / 6 %
6.	Are there difficulties in organising learning in the digital educational space due to lack of digital literacy?	7 / 42 %	736	10 / 58 %
7.	Do you use music computer technology in your learning process?	5 / 29 %	1349	12 / 71 %
8.	Do you use electronic musical instruments in the learning process?	4 / 24 %	1235	13 / 76 %

As Table 3 shows, 6% of the surveyed HEI teachers do not have sufficient knowledge, skills and abilities to work with ICT to organise the educational process in the digital educational space of the university. However, 94% of teachers use the resources of the digital educational space in the educational process, the same number of respondents prefer traditional and blended forms of learning, because not all have sufficient skills to organise teaching and learning in the digital educational space so that students are interested in the subjects studied, motivation to study was not lost and, as a result, success was not reduced. Only 24% of teachers use electronic musical instruments in class, although 58% of respondents know how to work with them. The reason for this may be the low technical provision of pedagogical education institutions with modern information technologies that can be used in the training of future music teachers, in particular in the digital educational space. Intergroup variance d is the weighted sum of squares of deviations of group means from the general mean, due to the heterogeneity of the sample, namely the different conditions for creating a digital educational environment in different HEIs, is given in Tables 3, 4.

Table 4. The results of student surveys

Item No.	Questions of the questionnaire for students	Number/percentage of responses:		
		"Yes"	d	"No"
1.	Are digital resources available in your higher educational institution?	160 / 98 %	739	3 / 2 %
2.	Do you use digital educational resources in preparation for classes?	134 / 82 %	984	29 / 18 %
3.	Do you use digital educational resources during classes?	155 / 95 %	659	8 / 5 %
4.	Are ICT skills sufficient to use digital educational resources?	147 / 90 %	371	16 / 10 %
5.	Are there web conferences, webinars held between participants of the educational process?	155 / 95 %	976	8 / 5 %
6.	Is distance learning sufficiently organised?	132 / 81 %	983	31 / 19 %
7.	Are digital learning platforms used for learning?	161 / 99 %	912	2 / 1 %
8.	Do you have experience with music computer technology?	51 / 31 %	1397	112 / 69 %
9.	Does the use of ICT in learning have a positive impact on learning outcomes?	119 / 73 %	329	44 / 27 %
10.	Are there risks to learning in the digital educational space?	47 / 29 %	457	116 / 71 %
11.	Are electronic musical instruments used in the learning process?	33 / 20 %	1541	130 / 80 %
12.	Is there enough theoretical and methodological digital support for successful learning in the digital educational space of your university?	134 / 82 %	813	29 / 18 %
13.	Are the acquired ICT competencies sufficient for the future professional activity of a music art teacher?	116 / 71 %	589	47 / 29 %

A survey of students showed that 90% of them have the skills and abilities to work with ICT that are sufficient to use them in learning through the digital educational space, but only 82% of students use digital resources in preparation for classes; 20% of students say that electronic musical instruments are used in the classroom, and 31% are familiar with computer music technologies. There are 81% of students believing that distance learning in their educational institution is conducted at the appropriate level, 82% believe that theoretical material in digital format is sufficient for successful learning in the digital educational space, and according to 71% of respondents, their skills and abilities to work with ICT are already enough for future professional activity.

It was found that the standard deviation from the mean percentage of positive responses to the same question in different universities was different. In this case, the intergroup variance, which describes the fluctuations of these groups, and intragroup variance, which describes the fluctuations caused by random factors not taken into account, are not equal, which indicates the invalidity of the null hypothesis.

Besides, calculation of the value of χ_1^2 through chi-square test when answering the questionnaire "Are there enough ICT skills to use digital educational resources?", "Does the use of ICT in learning have a positive impact on learning outcomes?" in selected HEIs, where the study of Music Informatics is mandatory for all students

$$\chi_1^2 = 3{,}1 \tag{1}$$

compared with

$$\chi_2^2 = 0{,}3 \tag{2}$$

obtained for universities, where the study of this subject is elective, found that

$$\chi_1^2 > \chi_2^2 \tag{3}$$

This may indicate that there is reason to believe that there is some connection between the study of this subject and students' interest in using the digital educational space in the learning process.

4. Discussion

One of the components of the digital educational space is distance learning. The National Academy of Managerial State of Culture and Arts remotely teaches the following subjects: History of Music, Fundamentals of Musical Composition in Choreography, Current Issues of Contemporary Music Performance, Contemporary Ukrainian Music, and at the National Pedagogical Dragomanov University — Polyphony, Vocal, Methods of Music Education, etc. (Havrilova et al., 2019).

Havrilova et al. (2019) share the experience of distance teaching the course Basic Musical Instrument (Piano) to future teachers of music. It included theoretical (lecture texts, multimedia presentations, tables, diagrams, audio, video, photos and reproductions of works of art), practical parts, independent work of students, control of knowledge and skills in the form of testing conducted in MOODLE learning environment, which allows testing the

theoretical material leant, as well as the acquired ability to recognise musical compositions that can be listened to in this digital learning environment.

In the training of music teachers, ICTs help to immerse oneself in the life of a composer thanks to the following opportunities (Havrilova et al., 2019): finding the necessary information, listening to works, viewing photos and videos, etc. They also allow finding and listening to different interpretations of the same work, use electronic libraries of musical information, record one's own performance of musical works for its analysis, observe the relationship between music and painting. The experiment of introducing a distance form of learning in the study of Basic Musical Instrument (Piano) showed that despite the various methodological possibilities of ICTs, acquiring practical skills and abilities to play an instrument is not possible through this form of learning only. Therefore, a combination of distance and traditional forms of learning is proposed (Havrilova et al., 2019), which involves interaction between participants in the learning process not only by means of ICT, but also face to face.

According to a survey (Kuznetsova and Azhmukhamedov, 2020), the digital educational space can be dangerous in terms of negative impact on the physical health of participants in the learning process (for example, musculoskeletal system, brain, skin, respiratory system, cardiovascular system, etc.), as well as their psycho-emotional state (increased nervous tension, sleep disturbances, irritability) and cause risks that can be attributed to social (in particular, reduced motivation to learn). Researchers are studying the social and anthropogenic risks of digitalisation of the educational environment (Baeva and Grigorev, 2020).

Despite a number of risks posed by the use of the digital learning environment, surveys (Kuznetsova and Azhmukhamedov, 2020) showed that 90% of respondents consider digital education a promising alternative to traditional one, and 64% believe that the digital learning environment has a positive impact on learning outcomes.

Kamahina et al. (2019) conducted a survey of teachers to determine their readiness to effectively use the digital educational space in the educational process, which showed that more than 90% of respondents use digital tools in the educational process, such as electronic textbooks, digital educational environments and online services. In addition, the survey showed a high level of information literacy of respondents, almost 100% confident in their

information competence. And about 67% consider the digital educational space a highly effective tool for improving the level of acquired knowledge, skills and abilities of students.

The opinion of students about the effectiveness of the use of digital educational environment in teaching almost coincides with the opinion of teachers, about 60% of US students surveyed believe that the most effective combination is traditional forms of learning with digital ones (Sorokova, 2020). The latter have such advantages as access to training materials and assignments at any convenient time, online testing; possibility of consultations with the teacher, receive and perform assignments in the digital space, hyperlinks to various sources of information and video lectures of teachers, etc. Similar studies conducted through Likert scaling (Borisova, 2020) showed that the vast majority of students consider online testing as an adequate form of assessment of acquired knowledge and skills. In general, according to students, digitalisation helps to improve the learning process.

According to the computer scale of self-efficacy perception and the scale of evaluation of attitudes to digital technologies, a study was conducted among 102 students majoring at Music Art and found a relationship between the level of perception of ICT efficiency and attitudes to digital technologies (Gudek, 2019).

Gorbunova and Bazhukova(2020) showed that there is a mismatch between the level of knowledge, skills and abilities of information technology teachers of music faculties to modern requirements for the use of digital technologies in the educational process, as well as between the level of professional training of future teachers provided in the relevant educational standards and methodological support of the digital educational environment, which uses music computer technology and electronic musical instruments.

An experimental study conducted at a Finnish school (Juntunen, 2017), which was based on the use of tablets in music lessons, showed that the use of information technology in music lessons helps to increase student activity in creative activities. An experiment conducted among students of pedagogical universities (Hiner and Gorbunova, 2019) showed that all participants learned to play the piano with both hands thanks to Soft Way to Mozart, and 91% of them could reproduce the works studied in this way on acoustic piano.

In general, there is an intention (Belonovskaya et al., 2020) to unite the digital information space of all universities in the country into a single educational space. This will allow for the unhindered exchange of experience and equal opportunities for quality education, regardless of geographical location.

The research conducted in this paper showed that the effectiveness of the use of digital educational space in the educational process depends on many factors. For example, the information literacy of all participants in the learning process, as well as digital information and technical provision of universities.

Conclusions

The use of new forms and technologies of teaching and learning, in particular digital ones, which allow optimizing the educational process and promote the acquisition of the necessary competencies for future professional activities is an urgent and priority task of educators.

A study conducted in this paper showed that not all higher educational institutions that train music teachers have the full resources needed to use the digital educational space in the educational process, while not all teachers and students have a sufficient digital literacy. At the same time, sometimes there are no subjects that contribute to its development in educational and professional programmes and curricula. The study also showed that in order to increase the efficiency of the use of digital educational space, it is necessary to provide educational institutions, including music faculties, with the necessary technical means, such as computer music technologies, electronic musical instruments, etc.

The results of this study can be useful for heads of educational institutions, teachers and students involved in the educational process, actively using the digital educational space, as well as scholars looking for ways to optimise the learning process, including training music teachers. The study showed the imperfection of the digital educational space for training music teachers, so future research should deal with finding ways to improve it, as well as monitoring changes due to the rapid development of ICT in order to timely introduce them into the training of future music teachers.

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