

Information space of a higher school based on mobile technologies

Информационное пространство высшей школы на основе мобильных технологий

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Abstract

This article presents the author's vision of the content of the information space based on mobile technologies, which includes three synergistically interconnected areas: mobile Internet training, chat training and education based on mobile applications in the format of audio and video training. The purpose of the study: to develop the information space of a higher school based on mobile technologies and experimentally prove the effectiveness of its implementation in the training of students. The scientific novelty of the author's research lies in the originality of the approach to the formation and further diagnosis of students' information competencies based on the implementation of mobile learning. The study developed informational competencies of students in the following groups: overall cultural, overall professional and professional. The results of the study are statistically proven ($p < 0.05$) through an increase in the level of students' competencies in their informational education and independence when choosing an educational route through interactive and mobile technologies.

Аннотация

В данной статье представлено авторское видение содержания информационного пространства на основе мобильных технологий, включающее в себя три синергетически взаимосвязанные области: мобильное интернет-обучение, чат-обучение и образование на основе мобильных приложений в формате аудио и видео обучения. Цель исследования: разработать информационное пространство высшей школы на основе мобильных технологий и экспериментально доказать эффективность ее реализации в профессиональной подготовке студентов. Научная новизна авторского исследования заключена в оригинальности подхода к формированию и дальнейшей диагностике информационных компетенций студентов на основе реализации мобильного обучения. В исследовании разработаны информационные компетенции студентов по следующим группам: общие культурные, общие профессиональные и профессиональные. Результаты исследования статистически доказаны ($p < 0,05$) через повышение уровня сформированности у студентов компетенций в области их информационной образованности и самостоятельности при выборе

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образовательного маршрута через интерактивные и мобильные технологии.

Ключевые слова: информационное пространство, мобильные технологии, компетенции, студенты.

Introduction

Current trends in society indicate that the indicator of the level of its development is not financial and economic well-being, but mainly the spectrum, the dynamics of the educational movement in society, the leading carrier of which are university graduates (Bytiak et al., 2020). The main idea of professional education is the idea of developing and shaping the personality of a student (Ovcharenko et al., 2020). An important influence on its development is exerted by age, individual, cultural, and professional characteristics that generate internal contradictions of a different nature (Bryantseva et al., 2019). In turn, the emerging contradictions can act as a stimulus or an obstacle to the further effective self-development of the learner's personality (Nagovitsyn et al., 2019). One of the fundamental goals in resolving internal and external contradictions can be called creating the conditions for effective professional training of university students and the education of society as a whole (Vaganova et al., 2020). At the same time, the effectiveness of solving educational tasks to improve the professional skills of students pursues the main goal (Aljawarneh, 2020). Namely, the awakening of subjectivity in each participant in education in the learning process, the self-realization of his potential inherent in a young person (Nagovitsyn et al., 2019).

A condition, in particular, pedagogical, is understood as such a circumstance of the process of professional training of students, which is the result of organizational forms of learning to achieve the goal of professional self-development, as well as the result of the selection, design and application of elements of content and methods of teacher education (Osipov et al., 2018; Ovcharenko et al., 2020). Practice reveals that one of the leading conditions for the effectiveness of student training in terms of content and technology is the implementation of the university's information space (Pimmer et al., 2016). A student during his studies, technologically efficiently introduced into the information space, gets the opportunity for more effective comprehensive professional development, taking into account individual

characteristics in the context of the spread of scientific and technological progress (Dabbagh & Kitsantas, 2012). In its organic interconnection and interpenetration, a rationally constructed information space of the university will ensure the optimality of the functioning of vocational training separately and the general system of teacher education in general (Seppala & Alamaki, 2003).

Literature review

The analysis of special scientific and methodological literature revealed that at present there is a correlation between the implementation of the educational space and the information space of the university (Bryantseva et al., 2019; Maltseva, 2019). According to the methodology and theory of space, it is part, form of existence, functioning of pedagogical reality (Korableva, 2015; Solvberg & Rismark, 2012). It is predictable, streamlined, organized, and recognized as a favorable set of conditions for the personal self-development of the younger generation (Serin, 2020). The information space is defined as a system that includes a space of development, upbringing and training, in the center of which the student's personality (Bytiak et al., 2020). On the other hand, the information space can be understood as a dynamic unity of the subjects of the educational process and their virtual relationships (Huda et al., 2018). In this context, it should be noted the various component components of this space according to the classification, which are emphasized by leading experts:

- value: openness, differentiation, collegiality, unity of pedagogical efforts, tolerance of interaction, etc. (Anshari et al., 2016);
- personal: the definition of an individual educational trajectory, the ability to interact and communicate, the formation of the initiative of the student, the adoption of independence of the student, etc. (Chen et al., 2008; Nagovitsyn et al., 2017);
- procedural: the comfort of teachers and students in the implementation of educational activities, the success of joint

- activities of participants in the educational process, the formation of design traditions, life skills, professional self-determination of students, etc. (Serin, 2020; Vaganova et al., 2020);
- informative: the choice by the teacher and students of virtual means of the necessary information, the promotion of the analytical and creative skills of adolescents (Brett, 2011; Osipov et al., 2018);
 - material: the availability of the necessary multimedia equipment for the implementation of educational activities (Vaganova et al., 2019);
 - emotional: the promotion of emotionally receptive, emotionally promising and emotionally spontaneous acts of the implementation of activities (Bryantseva et al., 2019; Nagovitsyn et al., 2020).

Thus, the information space is a shell of virtual educational systems saturated with humanity (Serin, 2020). Only under such a shell does the atmosphere of a free search for knowledge and methods of activity arise (Bytiak et al., 2020). The idea of such a space is associated with the rejection of the idea of professional education, adopted in the previous paradigm, as an uncontested movement within the framework of normative training periods (Korableva, 2015). In this context, the information space acts as a system of organized structures, as a process of pedagogical interaction and mutual influence of subjects of various fields (Pimmer et al., 2016). In which the multidimensionality of personality formation is comprehended, it is realized in the dialectical unity of the material and ideal principles, ultimately as a result (Dabbagh & Kitsantas, 2012).

Despite the relevance and development of the declared topic, a number of problems associated with the study of the fundamentals of building an information space based on innovative approaches, such as mobile learning, taking into account the development of individualization of distance learning for a higher school students, require further detailed study. Thus, the aim of the study: to develop the information space of a higher school based on mobile technologies and experimentally prove the effectiveness of its implementation in practical activities.

Theoretical framework

Every year, the information or media space occupies an increasingly significant place in the holistic space of higher education institutions (Vaganova et al., 2020). It is based on distance

education, developed in Russia since the end of the 20th century, which consider education as an educational information environment consisting of modern means of transmitting and storing information (Korableva, 2015). At the center is the teacher, not as a lecturer providing knowledge, but as a coordinator or consultant in the cognitive process, whose functions include adjusting the taught course (Bryantseva et al., 2019). Its main function is to provide advisory assistance to students in all aspects of educational activities, including professional self-identification. At the same time, the student himself forms an individual educational trajectory from the modular components of the courses (Maltseva, 2019).

In the context of identifying the foundation of the information space, its key features should be noted: in the framework of using a developing model of education, a transition is provided from students mastering skills to developing their cognitive activity and mastering new types of creative and creative activities (Bytiak et al., 2020). As well as overcoming the remoteness between the educational process at the university and scientific research, the development of cognitive autonomy and creative abilities through mobile technologies (Huda et al., 2018). It should be noted that by the information space of a higher school we mean the inextricable unity of information, the means of its storage and production, working methods and technologies that ensure that subjects receive information for educational purposes (Serin, 2020). In turn, the components of this space are information resources, means of information interaction and information infrastructure (Vaganova et al., 2020).

The organization of the information space based on mobile technologies provides great opportunities for the development of training, consulting and monitoring programs aimed at enhancing the cognitive activity of students and the formation of students' physical culture (Chen et al., 2008). Innovative technologies in the development of mobile tools give distance education a leading advantage - mobility. So, mobile devices with which the learning process is possible can be used anywhere, anytime, including at home, on the train, on the bus, etc. (Pimmer et al., 2016) Such new technical devices like mobile phones, gadgets, gaming devices, etc., attract young people who may have lost interest in education (Solvberg & Rismark, 2012). Also, mobile teaching technologies have higher didactic effectiveness in comparison with traditional teaching support methods and means.

The construction of an information space based on mobile technologies includes three synergistically interconnected areas.

1. Computer Based Mobile Training - the use of computers in interactive distance learning and testing (Seppala & Alamaki, 2003). In computer classes, as well as at home or in a hostel, students have the opportunity to work with the sets of electronic textbooks, teaching aids and test materials they provide (Huda et al., 2018). One of the leading forms of this training is case-based or portfolio-based, which is based on the creation for training of specialized educational-methodological, modular complexes that help to master the educational material independently online or offline (Dabbagh & Kitsantas, 2012). The modular principle of training allows you to successfully combine the needs and capabilities of students in accordance with the requirements of educational standards (Nagovitsyn et al., 2019).
2. Electronic Learning or online learning - providing access to computer training programs through the Internet or corporate Internet networks, in the context of our study - through the local network of the university. Students are given the opportunity to access information: textbooks, educational and methodological guidelines, a bank of necessary and useful links to sites via the Internet in the university's local network and via the Wi-Fi wireless network created for users (Pimmer et al., 2016). In addition to case studies, one of the leading forms of training presented is web-based classes - access to the information space of students and teachers at any level of information resources via the Internet (Solvberg & Rismark, 2012). The next form of e-learning is a chat lesson. Chat sessions or web forums are distinguished by the possibility of longer work with asynchronous and synchronous interaction of students and teachers online and offline (Brett, 2011). With these forms, participants have simultaneous access to the chat. Many distance learning institutions have a chat school, which organizes distance learning courses for teachers and students using chat rooms (Anshari et al., 2016; Brett, 2011).
3. M-learning is based on the use of mobile devices (Seppala & Alamaki, 2003). Training takes place regardless of location using portable technology. The most important forms of mobile learning in

conjunction with the above technologies, which can also be applied here, are:

- A content form based on working with mobile applications for various types of mobile devices; To effectively organize the learning process through the implementation of mobile technologies, we have developed a special complex of mobile applications to facilitate the implementation of the educational process (Pimmer et al., 2016). The developed electronic courses for independent work of students in academic disciplines using special programs are downloaded in MP3 format to students' mobile phones and audio players (Maltseva et al., 2019). Electronic audio courses are designed taking into account the training load allocated to the extracurricular or independent work in the curriculum. The time allotted for listening to the course exactly corresponds to the amount of time approved by the curriculum for studying topics of independent work (Vaganova et al., 2019). Monitoring the implementation of independent work on a specific topic is carried out using the author's testing methodology. It is based on the inclusion in the text of the audio course of certain codes consisting of separate words or phrases off-topic of the course, which the student must hear and record. A positive test, namely the provision of a teacher after listening to the correct codes, allows you to determine whether or not extracurricular (independent) student learning has passed (Nagovitsyn et al., 2019).

Materials and Methods

The study was conducted at the Moscow Pedagogical State University for 10 months from September 2018 to July 2019. The experiment involved 249 fourth-year students, from 21 to 24 years old, regardless of gender. All study participants study at the bachelor's degree (two study profiles) for a five-year term of study. The direction of students' education is "Pedagogical education" in various fields of study. Before the start of the study, all participants in the experiment had the experience of self-study in a virtual or information environment, but were not systematized and fragmented. They also had initial skills in using mobile and information technologies. Each participant in the experiment

received written consent to participate in the study. Prior to the study, the focus group (n=249) was divided into the experimental (n=121) and control (n=128) groups. The experimental group (EG) included participants who, during the experimental period, were actively, under the control of mentors, tutors and curators, included in the information space of a higher school. Participants implementing information and mobile technologies on their own during the designated time were enrolled in the control group (CG).

Processing the results of the study was carried out using the statistical program SPSS Statistics 20. The significance of differences in the results was determined using Chi-square (X^2) at $p < 0.05$. Mathematical and statistical processing was carried out between the indicators of

experimental and control groups for each competence proposed in the study before the experiment (September 2018) and after the experiment (July 2019).

Results

Diagnostic procedures for identifying the impact of experimental work on the implementation of training were compiled based on the creation of special funds for assessment tools (Nagovitsyn et al., 2019). Assessment funds included monitoring the implementation of the educational program through a set of planned results that form the image of the graduate and expressed in the following characteristics of a bachelor of education: the formation of a group of overall cultural, overall professional and professional competencies (Table 1):

Table 1.

The results of competencies formation by groups: overall cultural, overall professional and professional.

Group	The result of competencies
Overall cultural	OC-1: The student has the ability to use natural science and mathematical knowledge for orientation in the modern information space
	OC-2: Ready for active oral communication in Russian and foreign languages to solve problems of interpersonal and intercultural interaction
	OC-3: Has the ability to self-organization and self-education in the implementation of vocational training for future pedagogical activities
Overall professional	OPC-1: The student is aware of the social significance of his future profession and is motivated to carry out professional activities in the field of preschool, primary and additional education of youth
	OPC-2 The student is able to carry out training, education and development taking into account social, age, psychophysical and individual characteristics, including the special educational needs of students
	OPC-3: The student is fluent in the basics of professional ethics and speech culture in the implementation of educational activities
Professional	PC-1: The student has the ability to use modern methods and technologies of training and diagnostics in practical activities
	PC-2: Ready for interaction with participants in the educational process: teachers, students, with students in teaching
	PC-3: The student has the ability to design individual educational routes for students

Each result of the formation of competencies in three groups was ranked in three categories: high, corresponding to an increased or maximum level of formation of competencies; average, which determines the basic level of student education

and low, corresponding to the threshold level of knowledge and skills of students.

A meaningful description of the level, indicators of formation and the main signs of determining the corresponding level are presented in Table 2:

Table 2:

A meaningful description of the levels by indicators of formation and the main features.

Level	Main features	Formation Indicator
High	The ability to independently make decisions, solve problems or tasks of a theoretical or applied nature based on the studied methods, techniques, technologies	The student showed a fairly strong knowledge of the main provisions of the discipline, the ability to independently solve specific practical tasks provided by the work program, navigate the recommended reference books, and be able to correctly evaluate the results
Average	The ability to collect, systematize, analyze and correctly use information from independently found theoretical sources and illustrate with them theoretical principles or justify the practice of application	The student revealed insignificant gaps in knowledge of the main provisions of the discipline, the ability with the help of a teacher to get the right solution to a specific practical problem from among those envisaged by the work program of the discipline
Low	Presentation of the theoretical and practical material within the objectives of the course	When answering the student, significant knowledge gaps are fixed, as well as the inability with the help of the teacher to get the right solution to a specific practical problem

The results of diagnostic procedures before and after the experiment to identify the impact of experimental work on the implementation of

training on the basis of monitoring special funds of assessment tools are presented in Table 3:

Table 3.

Results before (September 2018) and after (July 2019) experiment on competency groups in the EG and CG

Group	Competency Number	Stage	Number of respondents						P
			High		Average		Low		
			EG	CG	EG	CG	EG	CG	
OverOverall cultural all	OC-1	September 2018	23	19	41	48	57	61	> 0,05
		July 2019	47	22	51	44	23	62	< 0,05
	OC-2	September 2018	19	23	58	62	44	43	> 0,05
		July 2019	30	24	75	84	16	20	> 0,05
	OC-3	September 2018	7	10	83	89	31	29	> 0,05
		July 2019	32	21	87	93	2	14	< 0,05
OPC-1	September 2018	16	21	76	81	29	26	> 0,05	

Professional	OPC-2	July 2019	42	28	77	87	2	13	< 0,05
		September 2018	39	42	68	63	14	23	> 0,05
	OPC-3	July 2019	67	49	48	59	6	20	< 0,05
		September 2018	14	16	99	101	8	11	> 0,05
	PC-1	July 2019	34	21	87	98	0	9	< 0,05
		September 2018	32	29	69	74	20	25	> 0,05
	PC-2	July 2019	39	37	75	76	7	15	> 0,05
		September 2018	43	46	51	56	27	26	> 0,05
	PC-3	July 2019	64	50	57	65	0	13	< 0,05
		September 2018	34	29	76	75	11	24	> 0,05
		July 2019	51	31	67	70	3	27	< 0,05

Based on the obtained comparative results, prior to the experiment, a statistical uncertainty was revealed between the EG and the CG in all groups of students' competencies: overall cultural, overall professional and professional ($p > 0.05$). Thus, it can be summarized that before the start of the experimental work, the focus groups (EG and CG) were statistically significantly equal. This means that the participants in the experiment, prior to the implementation of the study, were at the same level of formation in all competence groups.

After the experiment, the data obtained showed an increase in level characteristics in both groups. However, statistical reliability between the EG and the CG ($p < 0.05$) was recorded for OC-1, OC-3, OPC-1, OPC-2, OPC-3, PC-2 and PC-3. According to OC-2 and PC-1, statistical uncertainty ($p > 0.05$) of differences between EG and CG after the experiment was revealed.

Discussion

The results are consistent with a number of research studies that prove that the implementation of the information space in student learning is the main component for improving the quality of education (Aljawarneh et al., 2020; Bytiak et al., 2020). When implementing the adjustment of the educational process of a higher educational institution based on the introduction of mobile technologies, a positive result was recorded ($p < 0.05$) in students' ability to use natural science and mathematical knowledge to orient themselves in the modern information space. As the statistical results of

this study show, the effectiveness in the ability of students to self-organization and self-education in the implementation of vocational training for future pedagogical activity ($p < 0.05$) was revealed. However, effectiveness has not been identified for all overall cultural competencies. In particular, students are ready for active oral communication in Russian and foreign languages to solve problems of interpersonal and intercultural interaction ($p > 0.05$). These results are consistent with the results of other studies (Pimmer et al., 2016; Vaganova et al., 2020), which substantiate the need to intensify full-time educational activities while increasing student communication (Anshari et al., 2020). A special interactive language environment is needed here (Bryantseva et al., 2019; Maltseva et al., 2019).

The study complements the research work proving the effectiveness of the information space in the formation of common professional competencies among students (Dabbagh & Kitsantas, 2012; Solvberg & Rismark, 2012). Thanks to the activation of mobile and distance technologies, students increase the social significance of their future profession and increase their motivation to carry out professional activities (Huda et al., 2018; Nagovitsyn et al., 2019). Some researchers place particular emphasis on the intervention of mobile technologies to increase the level of students' ability to provide training taking into account social, age, psychophysical and individual characteristics, including the special educational needs of students (Korableva, 2015; Seppala & Alamaki, 2003). In unison with these results, the data obtained in this study complement the

performance indicators in improving students' knowledge of the basics of professional ethics and speech culture in the implementation of pedagogical activity ($p < 0.05$).

The statistics obtained in the study are confirmed by studies (Aljawarneh et al., 2020; Vaganova et al., 2020), which experimentally prove that activating students' independence in choosing an educational route through interactive and mobile technologies contributes to the formation of their professional competencies (Huda et al., 2018; Osipov et al., 2018). In this environment, students form a willingness to interact with participants in the educational process, and also increases the ability to design individual educational routes for students ($p < 0.05$). Nevertheless, the author's conditions for the implementation of vocational training did not affect the ability of students to use modern methods of teaching and diagnostics in practice ($p > 0.05$). In support of this result, it should be noted a number of researchers who also did not receive effectiveness in the formation of competencies in this professional group (Vaganova et al., 2020). The formation of this competency requires not only pedagogical intervention, but also psychological impact (Bryantseva et al., 2019; Pimmer et al., 2016). The obtained inaccurate results ($p > 0.05$) in this study for this competence can be explained by the slow implementation of the experiment. This statement will require further research over a longer period.

Limitations

The presented experimental study was limited to a sample of students studying in one direction "Pedagogical education" with two training profiles of a particular a higher school. In this regard, the number of study participants in each focus group was heterogeneous in size. The sample obtained does not make it possible to cover the entire target audience, since the study was conducted only in one university and in one direction of preparation. In accordance with this, the results can be determined as initial, and for further more detailed analysis it is necessary to conduct a comparative analysis of several higher educational institutions of the region and the federal district.

Conclusion

Thus, in an experimental study, the author's vision of the content of the information space based on the implementation of mobile technologies in a higher school is presented. The

study developed a group of information competencies necessary for the formation of students during vocational training. Each group of competencies (overall cultural, overall professional and professional) was ranked by three competencies for students to possess information and mobile technologies for the implementation of the educational process. During the implementation of the experimental study, the main directions of the information space based on mobile technologies were developed, which includes three synergistically interconnected areas: computer-based mobile training, mobile online training or chat training, and mobile applications in the format of audio and video training. The work has experimentally proved the effectiveness of its implementation in practical activities by means of the main directions of the author's technology for the introduction of a higher school into vocational training.

The study obtained a fundamentally new result in the planning strategy for increasing the indicators of informational competence of students in the humanitarian and natural sciences areas of teacher education. New scientific data on the processes of increasing the interactive, distance and mobile activities of students and patterns existing in the studied pedagogical science on this issue are revealed. What ultimately, may be one of the key conditions for improving the quality indicators of professional training and the overall effectiveness of the training system for future teachers.

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