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Ukrainian Teachers' Capacity to Teach Online Under Quarantine and Martial Law
Capacité des enseignants ukrainiens à enseigner en ligne sous quarantaine et loi martiale
Capacidad de los profesores ucranianos para enseñar en línea bajo cuarentena y ley marcial

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Résumé de l'article

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Abstract

The article analyzes the capacity of Ukrainian pedagogical university faculty and students to teach remotely under unstable conditions like quarantine and martial law. Issues associated with their self-directed preparation to teach online under these conditions are also discussed. The study involved 594 students at Vinnitsia State Pedagogical University (420 bachelor program students and 174 master program students), 387 faculty members (206 social sciences and liberal arts teachers, 181 natural sciences teachers), and forty-five experts (twenty-five university leaders and twenty regional stakeholders). To determine the level of skills and abilities of the pedagogical university students, the authors monitored their educational progress in fundamental, professional, and didactical disciplines beginning in June 2020 when the first wave of the COVID-19 pandemic started, until June 2023 when there was a partial adaptation of teachers and students to online teaching in emergency situations. Included in this period was the point at which Russia's invasion of Ukraine peaked in intensity, June 2022. The authors propose organizational and methodological activities to help improve the skills that pedagogical university teachers and students need for online teaching under quarantine and martial law. The effectiveness of the applied experimental methods was determined by analytical reports of all faculties regarding the quality of the acquired knowledge. Statistical analysis was used to determine the results of expert evaluation.

Keywords: COVID-19 pandemic, distance learning, martial law, online learning, quarantine, self-directed learning

Capacidad de los profesores ucranianos para enseñar en línea bajo cuarentena y ley marcial

Resumen

El artículo analiza la disposición de los profesores y estudiantes de las universidades pedagógicas de Ucrania para enseñar a distancia en condiciones inestables como la cuarentena y la ley marcial. También se analizan cuestiones asociadas con su preparación autodirigida para enseñar en línea en estas condiciones. En el estudio participaron 594 estudiantes de la Universidad Pedagógica Estatal de Vinnytsia (420 estudiantes de licenciatura, 174 estudiantes de maestría), 387 profesores (206 profesores de ciencias sociales y artes liberales, 181 profesores de ciencias naturales) y cuarenta y cinco expertos (25 líderes universitarios y veinte actores regionales). Para determinar el nivel de competencias y habilidades de los estudiantes universitarios pedagógicos, los autores monitorearon su progreso educativo en disciplinas fundamentales, profesionales y didácticas desde junio de 2020, cuando comenzó la primera ola de la pandemia COVID-19, hasta junio de 2023 cuando comenzó. Fue una adaptación parcial de profesores y estudiantes a la enseñanza en línea en situaciones de emergencia. En este período se incluyó el punto en el que la invasión rusa de Ucrania alcanzó su punto máximo de intensidad, junio de 2022. Los autores proponen actividades organizativas y metodológicas para ayudar a mejorar las habilidades que los profesores y estudiantes universitarios pedagógicos necesitan para la enseñanza en línea bajo cuarentena y ley marcial. La efectividad de los métodos experimentales aplicados estuvo determinada por los informes analíticos de todas las facultades sobre la calidad de los conocimientos adquiridos. Se utilizó análisis estadístico para determinar los resultados de la evaluación de expertos.

Palabras clave: Pandemia de COVID-19, educación a distancia, ley marcial, aprendizaje en línea, cuarentena, aprendizaje autodirigido.

Capacité des enseignants ukrainiens à enseigner en ligne sous quarantaine et loi martiale

Résumé

L'article analyse la disposition des professeurs et des étudiants des universités pédagogiques ukrainiennes à enseigner à distance dans des conditions instables telles que la quarantaine et la loi martiale. Les problèmes associés à leur préparation autonome à enseigner en ligne dans ces conditions sont également abordés. L'étude a impliqué 594 étudiants de l'Université pédagogique d'État de Vinnytsia (420 étudiants

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Mots clés : Pandémie de COVID-19, enseignement à distance, loi martiale, apprentissage en ligne, quarantaine, apprentissage autonome

Introduction

The COVID-19 global pandemic, numerous military conflicts, and other unstable environmental conditions created significant challenges for the entire world in many existential aspects, including the realm of education. Educators all over the world had to rebuild the very paradigm of education. In particular, educators were forced to quickly learn the basic functionalities and various possibilities of Information Communications Technology (ICT) to organize online distance learning, develop self-directed learning skills and foster a culture of self-organization in their students, and to establish new norms and rules of interaction for all participants in the educational process.

Unfortunately, the challenge faced by Ukrainian educators and students has been even more intense. Russia's full-scale invasion of Ukraine on February 24, 2022 further exacerbated the need for enhancing both students' online learning skills and teachers' online teaching skills. Pedagogical university faculty members and students suddenly found themselves facing difficult conditions for teaching and learning. In particular, pre-service students had to not only transition to distance learning themselves, but also quickly master the methods of teaching pupils online during their school practicums. Solving these problems required increasing these future teachers' capacity for self-directed learning and synchronous and asynchronous online teaching.

Some terms, concepts, and procedures used by the Ukrainian teacher education system may seem vague and even confusing to researchers who are unfamiliar with Ukraine's system. Therefore, to establish the context for the study we begin with a brief description of Ukraine's teacher education system through its pedagogical universities, and other related matters. The following 12 points will help readers understand the subject, the objectives, and the logic of our investigation.

- 1) In Ukraine, specialized pedagogical institutions of higher education (i.e., pedagogical universities and pedagogical colleges) are uniquely responsible for preparing teachers for classroom practice.
- 2) Pedagogical universities are independent specialized institutions of higher pedagogical education. They award bachelor of education (after 4 years), master of education (after 1.5 - 2 years of advanced study beyond a bachelor's degree), and doctor of education degrees (after 3 - 4 years of advanced study beyond the master's degree). This study deals strictly with pedagogical universities.
- 3) Pedagogical colleges are also independent specialized 4-year institutions of higher pedagogical education; however, they are less prestigious than pedagogical universities and award only associate (after 2 years) and bachelor degrees (after 4 years). Pedagogical colleges are not considered in this study.
- 4) Graduates with an associate of education degree can work as certified educators in kindergartens.
- 5) Graduates with a bachelor of education degree can work as certified teachers in public elementary and secondary schools.
- 6) Graduates with a master of education degree can work as assistant teachers in pedagogical universities and colleges.
- 7) Graduates with a doctor of education degree can work as senior teachers, lecturers, associate professors, and full professors in pedagogical universities and colleges.
- 8) The teaching staff in a typical Ukrainian pedagogical university mostly comprises specialists with a doctoral degree in education or other related fields (e.g., in Vinnytsia State Pedagogical University, the authors' home institution, 87% of faculty members have doctoral degrees and the remaining 13% have master of education degrees).
- 9) There are no so-called "pure" researchers in Ukrainian pedagogical universities. The teaching staff must teach (lecturing, as well as conducting seminars and practical and laboratory classes) for half of each day, and complete other activities (scientific research, methodological work, and organizational work) in the second half.

- 10) Pedagogical university teachers with doctoral degrees are professionally trained and eligible to teach in the public elementary and secondary school system, but they mostly prefer working in the system of higher pedagogical education.
- 11) Senior pre-service students are the pedagogical university students who are supposed to graduate within 1-2 years (3rd and 4th years of study in bachelor, master, and doctoral programs).
- 12) "Capacity" for distance online education is the key term of the study. It covers three main competences: the ability of pedagogical university faculty to plan and provide online learning for their pre-service students; the ability of those pre-service students to plan their independent self-directed online learning online in circumstances when traditional in-person classroom learning is problematic or impossible; and the ability of these pre-service students to plan and provide online learning for their elementary and secondary pupils during school practicums.

As in many countries, Ukrainian pedagogical university students were not actively trained in planning online distance learning until 2020 when the COVID-19 pandemic started. This was because almost 100% of teaching activities were conducted in traditional in-person classrooms.

Since 2020, in-person classroom learning has been problematic or even impossible because of the pandemic and the Russian invasion. So, for the last four years, both Ukrainian pedagogical university teachers and students have been doing their best to teach and learn online, including using online learning management systems. Continuous Russian missile attacks on critical infrastructure have caused debilitating problems with Ukraine's internal power supply system. Power outages have become a significant reality in Ukraine: electricity is supplied only a few hours a day. Within these hours, teachers and students must apply maximum effort to maintain the educational process on a reasonable level. Power outages also hamper synchronous online learning, so teachers also have to provide their students with recorded teaching materials prior to class for asynchronous self-directed learning. So, pre-service pedagogical university students must be ready to acquire the necessary skills for both synchronous and asynchronous online teaching and learning. The faculty members successfully help them with acquiring these skills.

The specific measures taken by Ukrainian pedagogical universities at the very beginning of the pandemic and the experience that their faculty members and students gained during the quarantine enabled them to confidently continue teaching and learning online, even under martial law. Pre-service university students' high level of readiness for self-directed learning, and university faculty preparedness for distance learning during the war indicate that the organizational and methodical activities that were introduced and implemented in the Ukrainian educational environment on time

were successful. This gives the authors a reason to share the Ukrainian experience with the international educational and scientific community.

Literature Review

An analysis of current research has shown that most countries experienced educational problems related to the COVID-19 pandemic. Scholars have offered different ways to overcome the difficulties of organizing an emergency transition to distance learning, different models of training university teachers for this form of conducting classes, and different methods of preparing students for self-directed learning. The last point is especially important because distance learning is regarded as requiring a higher degree of self-directed learning skills (see Ali, 2020; Biju et al., 2022; Chung et al., 2020; Juszczuk, and Kim, 2020; Pitula, and Grzyb, 2021; Tlili et al., 2022).

We consider the conclusion of these researchers to be quite correct: that the skills acquired during the pandemic in the use of various ICT tools (learning management systems, online learning platforms, and specific software and hardware) to improve the quality of the educational process will be useful in the future for continuous self-directed learning (see Baloran et al., 2021; Juszczuk et al., 2020; Matiash, et al., 2020; Pitula, 2021; Podolyanchuk, 2020; Rivers, et al., 2021; Zarak, et al., 2021).

We also consider the research of authors from India, Malaysia, and the United Arab Emirates (Ali, 2020; Biju et al., 2022; Chung, Subramaniam, and Dass, 2020) to be useful for Ukrainian pedagogical science regarding the training of university faculty members for the “new norm,” since self-directed learning and distance learning have already become the norm in Ukraine under martial law (Bakhmat et al., 2022; Kokun, and Bezverkhyi, 2024; Kolomiets, et al., 2023; Overchuk et al., 2023).

The results of a comparison of the effectiveness of distance learning methods at the Silesian University of Technology in Gliwice, Poland, and the Hankuk University of Foreign Studies in Seoul, South Korea, showed that teachers and students from completely different parts of the world were equally dissatisfied with the quality of this form of education (Juszczuk, and Kim, 2020).

We agree with Tlili et al. (2022), who claim that the vast majority of students have poorly developed self-directed learning skills, and that strategies for supporting and encouraging independent learning are not yet sufficiently developed in pedagogical science. Therefore, each institution of higher education develops its own mechanisms and models, which its teachers and students must adopt according to the conditions brought on by the pandemic and other disasters, as well as becoming accustomed to new educational processes in unfavorable circumstances (Pitula, and Grzyb, 2021; Rapanta et al., 2020).

Kuleshova et al. (2020) carried out a quantitative assessment of the effectiveness of various distance learning tools. The following factors were identified as crucial: internal

motivation increase, encouragement to independent work, increase of the students' cognitive interest and learning self-efficiency.

Dmitrenko et al. (2021) presented a distance learning strategy which positively affected the pedagogical university students' process of autonomous study of English for specific purposes. The study proved that properly organized autonomous learning makes the process of teacher training more effective, as it increases students' motivation and self-confidence, forms independence and autonomy, shows the interaction of foreign language learning strategies with other disciplines, makes the learning process open and clear, forms responsibility, and teaches self-analysis (Dmitrenko et.al., 2021).

In the work by Lazarenko and Ihnatova, the scholars assessed the effectiveness of distance learning under pandemic conditions by showing that emotional interest plays an important role in involving students in a blended learning format. The researchers concluded that the successful combination of innovative and traditional forms of education encourages much better results in the teachers' training. They also proved interdependence between the intensification of ICT-use in education and the pedagogical university students' readiness for self-directed learning (Lazarenko, and Ihnatova, 2022).

Methodology

The current study involved 594 Vinnitsia Pedagogical University students (420 pre-service bachelor of education and 174 master of education students), 387 pedagogical university teaching faculty (206 from the social sciences and liberal arts and 181 from natural sciences), and forty-five experts (twenty-five Vinnitsia Pedagogical University leaders—deans, heads of departments, and twenty regional stakeholders—school teachers, and education department authorities).

The study's main objectives were:

- 1) To determine the pedagogical university faculty members' capacity to organize online distance learning and to develop self-directed learning competency in their students under the conditions of quarantine and martial law;
- 2) To determine the pedagogical university students' capacity to exercise self-directed learning and to organize distance learning for their school pupils under the conditions of quarantine and martial law.

To determine the level of skills and abilities acquired by the pre-service students, we monitored their educational results in fundamental, professional, and didactical disciplines, beginning in June 2020 when the first wave of the COVID-19 pandemic started, continuing through June 2022 when the full-scale Russian invasion of Ukraine was at its highest point, through till June 2023 when there was a partial adaptation of

pedagogical university faculty and students to implementing distance learning in emergency situations.

The following research methods were used: analysis of the pre-service students' current academic progress; observations of their educational and cognitive activities during their independent preparation for classes; assessment of the students' creative activity in practical classes of computer oriented disciplines; analysis of exam results; analysis of the quality of written term papers, research projects papers, and creative individual assignments; analysis of examination commission reports; surveys of the pedagogical university faculty members to determine possible reasons for the low effectiveness of distance learning; analysis of pedagogical university faculty members' scientific publications covering the main distance learning issues; and analysis of the results of their self-assessment concerning their readiness to organize distance online learning and to form self-directed learning competence in their pre-service university students. Based on our analysis, a strategy was devised at the university to improve faculty member and student capacity for online learning. This strategy involved various activities aimed at improving their online learning competence, such as:

- a) developing pedagogical university faculty members' online teaching skills (scientific and methodological seminars and webinars, participation in video conferences and other development activities, study of distance learning organizing experiences, group classes in computer rooms);
- b) developing pedagogical university students' capacity for self-directed learning (detailed instructions for studying disciplines, lists of information sources, video presentations and organization of self-directed learning, integrated tasks in learning various disciplines, collaborative and individual projects);
- c) developing pedagogical university students' online teaching skills (computer oriented disciplines and studying distance learning basics, cyber-groups, blogs, professional online communities, course and diploma theses on distance learning topics, production of video-presentations).

The effectiveness of these experimental methods was determined by the analytical reports of all the faculties regarding the quality of the acquired knowledge. Statistical analysis of the data was used in the expert evaluation (using *t*-Student's criterion).

Three members of the research team analyzed the use of various distance learning forms at universities in India, Malaysia, Poland, South Korea, and the UAE, and developed their own distance learning methods. Two members of the research team investigated the issues associated with organizing education in various emergency situations (i.e., martial law, threats of terrorist attack, pandemics, and natural disasters). Research team members belonging to Vinnytsia Pedagogical University management staff carried out a comparative analysis, generalization, and statistical processing of the

obtained data (examination of commission reports, pedagogical university students' current academic progress reports, and stakeholders' feedback) on the effectiveness of the applied experimental methods.

To avoid possible conflicts of interest, the most experienced Vinnytsia Pedagogical University faculty members from ten faculties acted as experts. Their opinions concerning the capacity of the pedagogical university faculty members and students to teach remotely under unfavorable conditions like quarantine and martial law were agreed to using the concordance coefficient method and the Pearson criterion.

Results and Discussion

The ascertaining stage of the study (June 2020) showed the initial level of academic achievement for the pedagogical university students. All twenty-five members of the university leadership team attended practical and laboratory classes and studied the University Examination Commission's reports to ensure that the students successfully coped with the standard assignments for assessing their knowledge, skills, and abilities. However, certain assignments were very difficult to complete, particularly those involving the independent search and analysis of scientific information and on the creation of distance learning content for elementary and secondary school pupils.

The greatest challenges for the pedagogical university students were presented by assignments aimed at testing their ability to use existing knowledge to analyze, compare, and explain patterns and causal relationships found in the scientific information. This indicated a lack of practice in extrapolating previously acquired knowledge and skills and applying them to a new situation. In addition, the formation of skills to work with very large arrays of scientific data turned out to be at a low level as well (Kolomiiets et al., 2021). At the same time, the students' ability to use ICT tools were assessed only as satisfactory, particularly in self-directed online learning (Lazarenko and Kolomiiets, 2018; Korol, 2021).

The main indicators of determining the level of the pedagogical university students' readiness for self-directed learning are the combination of knowledge, skills, and abilities, especially as they relate to information search strategies, critical and competent evaluation of data, and purposeful and creative use of this data for self-directed learning.

We identified the indicators (skills) to be measured in order to obtain numerical equivalents of readiness for independent learning activities. The survey results are presented in Table 1. The obtained data (average scores) were based on the pedagogical university faculty expert evaluation results, where the maximum value is 5 and a complete absence of a certain skill is 0.

Improving the capacity of pedagogical university students (from junior to senior) for self-directed learning activities is best seen in Fig.1. Although the figure shows a certain development of abilities for self-directed learning activities during university studies, the

quality of such readiness cannot be characterized as sufficient (just a few indicators reach 4 points). Therefore, it was decided that the development of pedagogical university students' ability in self-directed learning should be carried out by the university faculty in the process of studying each discipline (both online and offline).

Table 1

Indicators for assessing pedagogical university students' readiness for self-directed learning activities at the ascertaining stage of the experiment (June 2020)

№	Skills	Year of Study				
		1st	2nd	3rd	4th	5th
1	Plan self-directed educational activities	2.89	2.98	3.02	3.21	3.38
2	Find specific information on a hard copy	3.12	3.26	3.47	3.68	3.96
3	Find specific information on the Internet	2.91	3.44	3.66	3.73	3.92
4	Work independently with large arrays of information	2.53	3.67	3.87	3.91	4.01
5	Integrate data from different sources	3.04	3.18	3.38	3.42	3.51
6	Interpret diagrams, drawings, graphs, charts	3.01	4.49	4.53	4.61	4.42
7	Use interactive educational software	2.11	2.43	2.83	2.91	3.02
8	Use educational resources on the Internet	0.91	1.43	1.96	2.51	2.92
9	Identify relevant data (for certain subjects)	1.35	2.41	3.56	3.79	4.41
10	Generalize data received from different sources	3.21	3.75	3.98	4.23	4.16
11	Establish links between the data received from different sources and at different times	1.14	2.43	3.57	3.78	4.02
12	Summarize the processed information	2.31	2.69	3.43	3.71	4.23
13	Structure the obtained data in a short report	2.74	2.91	3.12	3.42	3.75
14	Compare data obtained from different sources	2.03	2.98	3.17	3.25	3.48
15	Structure the obtained data in scientific articles	1.28	2.47	2.81	3.27	3.41
16	Reproduce educational materials in own words	2.43	2.73	2.87	3.47	3.21
17	Create own distance learning content	1.93	2.44	3.11	3.21	3.37
18	Create own video presentations	0.08	1.03	1.41	1.92	2.01

Certain conclusions were made based on these results. Some problems were regarded as inherent to the unique characteristics of each discipline while some were regarded as common to all disciplines at large. For example, explanatory-illustrative teaching methods were predominant; techniques aimed at the activation of independent cognitive activity were insufficiently introduced; and no special attention was given to various types of educational-cognitive practical tasks.

The analysis showed that about 32% of pedagogical university faculty understood the fact that one needs a set of knowledge, skills, and abilities to work with data (searching, storing, and using) to ensure effectiveness in online teaching and learning. Advanced familiarity with ICT tools as well as a high level of motivation for self-directed

learning and professional self-development are also regarded as crucial. However, at the beginning of the COVID-19 pandemic, only 69% of the pedagogical university faculty used ICT and only 54% involved their students in searching for educational content on the Internet.

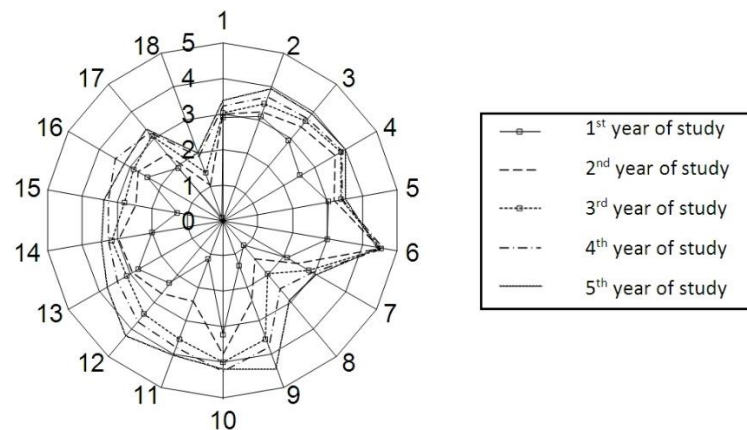


Figure 1. Comparison of the students' readiness for self-directed learning by year of study (where 1-18 are the skills from Table 1)

It was concluded that the following aspects were relevant for effective distance learning:

- A well-balanced combination of theoretical and practical assignments;
- Assignments for independent work with different sources of information (books, scientific journals, the Internet);
- Various forms of conducting classes and presenting teaching material;
- Use of Internet materials in the classroom and for independent work;
- Assignments for independent search, integration, and structuring data for the school pupils' distance learning;
- Individual approaches to the monitoring and evaluation of the pedagogical university students' academic progress.

Following the results of this study, the Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, as well as in many educational institutions in Ukraine and other countries, came to the realization that its faculty members and students required special training to effectively teach and learn online. Members of the university leadership team set the goal to create the conditions to intensify the pedagogical university students'

independent learning in this regard, considering that they will also have to organize distance learning for their future school pupils.

Implementing the ideas that emerged from analysing the survey data, we realized that readiness for self-directed learning and the organization of distance learning can be formed in two ways for the pedagogical university faculty: spontaneously and through planned activities. The second way, which takes place in the context of purposeful, consistent, and systematic activities to form a system of knowledge and skills for distance learning, should be regarded as predominant. The system of activities presented in the scheme outlined below in Figure 2 was aimed at enhancing the pedagogical university students' self-directed learning and their ability to organize online distance learning for their school pupils.

The first stage of implementation was training the pedagogical university faculty members for the organization of distance learning. Unfortunately, as practice shows, older faculty members were often not receptive to new strategies to improve their knowledge, skills, and abilities to work with the arsenal of innovative pedagogical technologies, including modern ICT distance learning tools.

However, we proceeded. Most teachers understood the need for regular training within their disciplines and the need for self-directed learning throughout their professional lives. But the pandemic heightened the importance of self-improvement in the field of ICT tools and distance learning methods. This component plays a particularly important role in the pedagogical university as its graduates must be ready for implementation of academic activities to enhance online distance learning capacity.

Therefore, in organizing the training of pedagogical university faculty members for the organization of distance learning, we realized that they could not apply a particular technology if they didn't first see its effectiveness. Therefore, the effectiveness of the "administrative" approach to their implementation would be doubtful. The factor to determine the successful organization of distance learning is the active work of the faculty members on scientific and methodological materials. The preparation of such materials requires the university teachers to carry out the following specific tasks:

- Selecting learning content in accordance with the didactic properties and capabilities of ICT tools;
- Predicting the possible impact of ICT tools on the educational process and the participants' way of thinking and behaviour;
- Choosing the possible ways to integrate ICT tools with traditional teaching methods and techniques;
- Creating the appropriate learning environment, i.e., formation of groups, organization of individual lessons, and self-directed learning.

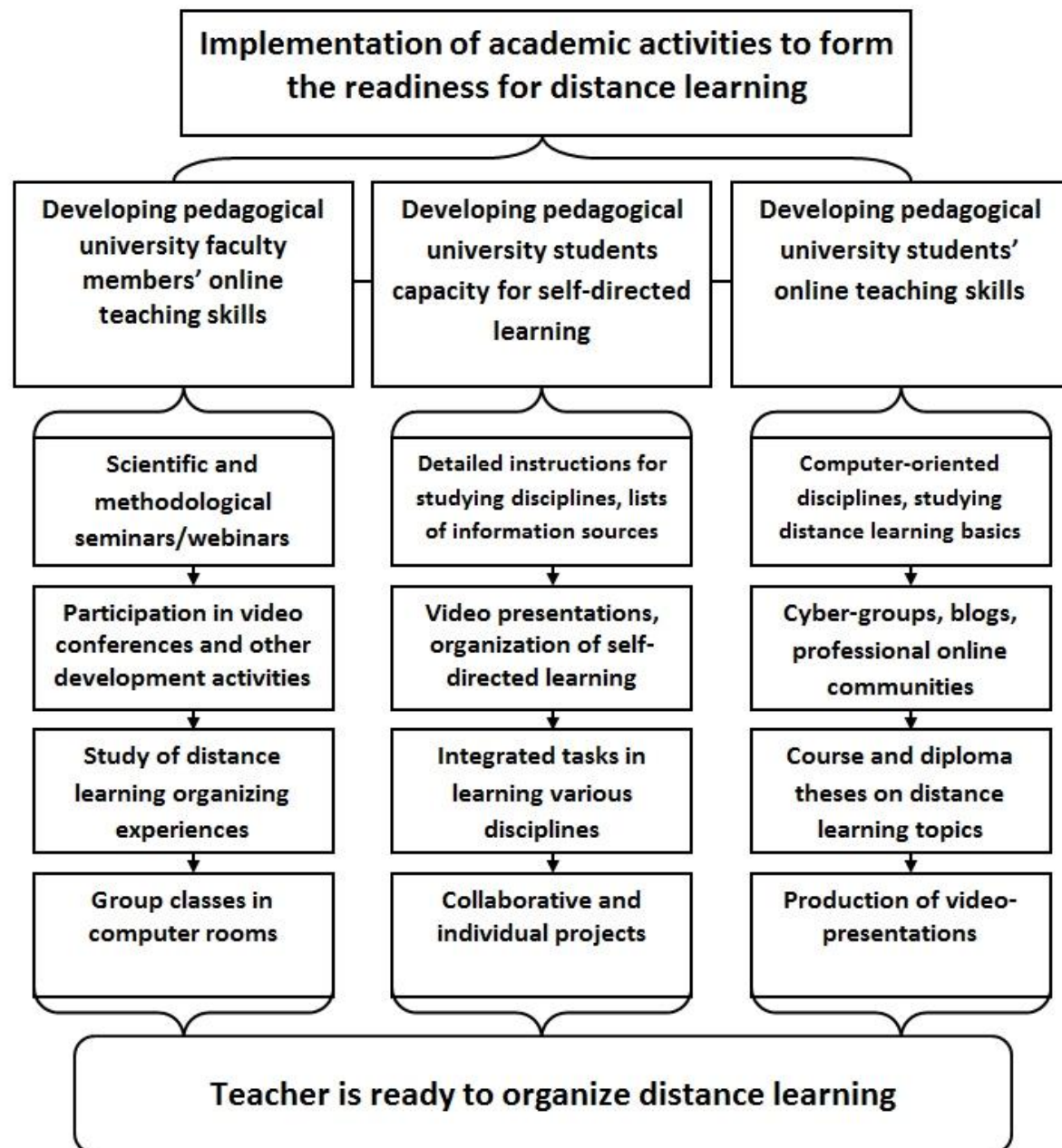


Figure 2. The scheme of academic activities to improve readiness for self-directed learning and organization of distance learning

During the first months of the pandemic, the following professional development activities were held to enhance the pedagogical university faculty members' skills in organizing distance learning and developing their students' self-directed learning:

- Offering the following methodological seminars: "Peculiarities of the educational process in the pandemic," "Distance learning as an urgent requirement of the

time,” “Pedagogical technologies for organizing and managing of self-directed learning,” “Research-oriented technologies for teachers training,” “Opportunities of the Internet in teachers training,” “Pedagogical online communities,” “The problem of knowledge control in distance learning,” “Possibilities of using social networks in the educational process,” “Working with the corporate platforms”;

- Attending open lectures on best practices in organizing distance learning;
- Participating in conferences devoted to the issues of teacher education in the information society;
- Working with digital teaching tools.

Several seminars were developed taking into account both the specific professional needs of certain participants and the general issues surrounding distance learning. Coordinators gave prominence to the training seminar “Distance Learning Technologies and Pedagogy,” which was developed from the assumption that the most effective training is focused on “knowledge transmitters,” i.e., the pedagogical university faculty members. The seminars included:

- Hands-on workshops to promote learning;
- Focus on personal professionally oriented results (didactic portfolio);
- Use of ICT tools to implement personal pedagogical ideas;
- Use of interactive teaching methods;
- Small group teaching strategies;
- Exchanging experiences within university faculty.

The series of training seminars at Vinnytsia pedagogical university aroused great interest among the teaching staff. The seminars helped establish a team of faculty members who are highly proficient in the use of distance learning tools, and encouraged productive collaboration between the university departments. The seminars’ success was confirmed both by the participants’ feedback and by the positive assessment from the university leaders after attending lessons conducted by the faculty members who participated in the training seminars.

The resulting didactic materials developed by the faculty members were placed in the university’s digital institutional repository and became a useful online resource for organizing distance teaching (Lazarenko et al., 2022). Some of these works deserve special attention. Khoruzhenko (2021) characterized the synchronous, asynchronous, and blended modalities of distance learning, as well as the unique challenges of conducting lectures and practical classes, academic advising, scientific research, and self-directed learning activities in an online environment. Kuleshova et al. (2020) analyze the organizational and pedagogical environment that tends to improve the educational process by creating tools for activating the students’ mental activity. Korol

(2021), regards certain ICT tools as effective in optimizing online speech therapy. She also analyses modern remote-interactive forms of therapy with the use of artificial intelligence.

Processing the papers by the pedagogical university faculty members and students on the organization of distance learning and self-directed professional development contributed greatly to:

- Acquaintance with the positive and negative aspects of distance learning;
- Understanding the role and place of ICT tools in distance learning;
- Developing skills for data creation, processing, presentation, and transfer;
- Selecting distance learning methods that align with specific educational process needs;
- Formation of knowledge about the didactic requirements for ICT tools;
- Motivating the pedagogical university faculty and students to pursue self-directed professional learning in distance education;
- Increasing the pedagogical university faculty and students' readiness to use distance learning tools.

The pedagogical university teaching staff's (n=387) level of readiness for organizing distance learning was affected by the following indicators:

- Indicator 1 - Awareness of Internet resources related to the teaching subject;
- Indicator 2 - Ability to utilize educational materials from the Internet in classes;
- Indicator 3 - Involvement of pedagogical students (undergraduate and master's) in web searches for scientific and educational information;
- Indicator 4 - Availability of original methodological content for self-directed learning;
- Indicator 5 - Ability to utilize the ICT tools for effective self-directed learning;
- Indicator 6 - Participation in scientific forums (conferences, seminars, webinars, trainings) on distance learning issues;
- Indicator 7 - Understanding the advantages and disadvantages of distance learning and the ability to effectively either use or overcome them.

A self-assessment was conducted anonymously to measure changes in these seven indicators after the implementation of the experimental methods described in Figure 2. The percentage of positive answers before and after their implementation is shown in Figure 3.

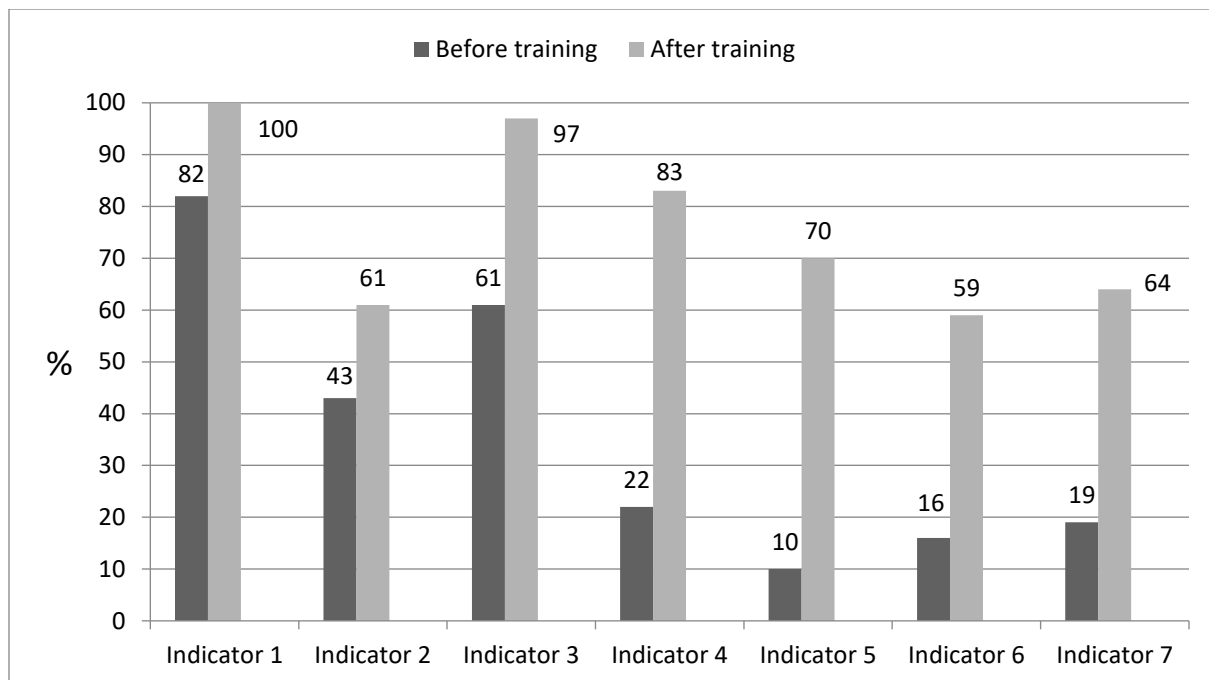


Figure 3: Capacity of Vinnytsia State Pedagogical University faculty to organize self-directed learning for their students, pre- and post training

Improvement in all seven indicators following training (see Figure 3) proves the effectiveness of the experimental academic activities aimed at improving the university staff's ability to organize distance learning (see Figure 2).

Turning to the pedagogical university students, their readiness for self-directed learning and ability to organize distance learning for school pupils were determined by twelve indicators, outlined below in Table 2. Self-assessments of their readiness for self-directed learning and organization of distance learning for school pupils were carried out ($n=594$ students). A control group ("CG") consisted of 295 students who had not been exposed to the experimental methods in Figure 2 and an experimental group ("EG") consisted of 299 students who had undergone training in those same experimental methods. The indicators were evaluated on a five-point scale and their average results are presented in Table 2, below.

Checking the effectiveness of the implemented measures, we submit two hypotheses: H_0 – there are no statistically significant differences between the results in CG and EG; H_1 – the differences between the results in CG and EG are statistically significant.

Table 2

Vinnitsya State Pedagogical university students' self-evaluation of capacity for self-directed learning and organizing distance learning for school pupils

Indexes	Scores	
	CG	EG
Ability to independently find the necessary information	3.2	4.1
Ability to determine the main ideas in the text	2.8	4.7
Ability to integrate scientific information from different sources	3.1	4.8
Ability to structure information in the form of a scientific report	3.4	4.6
Ability to structure information in the form of educational text	3.2	4.3
Ability to use different distance learning platforms	2.9	4.6
Ability to use film and video presentations for educational purposes	3.1	4.5
Awareness of the possibilities of various distance learning tools	2.5	4.2
Awareness of the advantages and disadvantages of distance learning	2.2	4.7
Awareness of interactive distance learning methods	1.8	4.2
Ability to create video presentations of educational material for pupils	1.3	3.8
Ability to create scenarios of lessons for distance learning for pupils	1.3	4.1
Average score on all indicators	2.6	4.4

To confirm the non-randomness of the differences between the indicators for the control and experimental groups, a paired two sample criterion of the significance of the differences between the two related samples (Student's t-test) was determined by the formula:

$$t = \frac{v_{CG} - v_{EG}}{\sqrt{\frac{v_{EG}^2}{2n_{EG}} + \frac{v_{CG}^2}{2n_{CG}}}}, \text{ where } v_{EG} = \frac{\sigma_{EG}}{x_{EG}} \text{ and } v_{CG} = \frac{\sigma_{CG}}{x_{CG}}$$

The average quadratic deviation was calculated by the formula: $\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}}$

where x_i is the corresponding indicator and \bar{x} is the arithmetic mean of the values of indicators in the sample (Rudenko, and Rudenko, 2009).

Table 3

Intermediate results of calculations

Sample	GPA (\bar{x})	Quadratic deviation (α)	Coefficients of variation (ν)	Squares of coefficient of variation (ν^2)	Number of indicators (n)
CG	2.6	0.75	0.288	0.083	12
EG	4.4	0.31	0.071	0.005	12

$$t = \frac{v_{CG} - v_{EG}}{\sqrt{\frac{v_{EG}^2}{2n_{EG}} + \frac{v_{CG}^2}{2n_{CG}}}} = \frac{0,288 - 0,071}{\sqrt{\frac{0,005}{2 \cdot 12} + \frac{0,083}{2 \cdot 12}}} = \frac{0,217}{0,06} = 3,617$$

The critical value of t -Student's criterion for the corresponding number of degrees of freedom $df = 12 + 12 - 1 = 23$ and a significance level of 0.05 is equal to $t_{crit} = 2.0687$ (Rudenko, and Rudenko, 2009).

The results of the calculations gave an empirical value for t -Student's criterion of 3.617, so that, $t_{emp} > t_{0,05}$ ($3,617 > 2.0687$) which indicates that the difference between the indicators for the control and experimental groups is significant at the level of 0.05.

This proves that implementing the experimental methods significantly improved the formation of the pedagogical university students' readiness for self-directed learning and organizing distance learning for their school pupils.

Conclusions

The results prove the effectiveness of the applied methods. The successful experience of the university faculty in forming student capacity for self-directed learning is described in many faculty publications. Taking into account our previous successful experiences of distance learning during the 2019-2021 pandemic and under conditions of martial law in 2022-2023 we drew the conclusions as for strong prospects for the further use of online education technologies in the emergency conditions.

The results of research on different distance learning issues obtained by the teaching and research staff at Vinnytsia State Pedagogical University were widely implemented into faculty members' and students' practice. The experience of successfully organizing distance learning at the university during the second and the third waves of the COVID-19 pandemic (in 2020-2022) and the conditions of martial law (in 2022-2023), as well as positive feedback from the school principals, where our

graduates continued further professional activity, confirmed the effectiveness of methods of training the pedagogical university students for self-directed learning and organizing school pupils' distance learning under unfavorable conditions.

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