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Information and Communication Technologies for Training Future Teachers: an Adaptation to the Aspects of the Postmodern Society

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Abstract: The study examines the need to train future teachers using current information and communication technologies in the context of adaptation to the aspects of postmodern society. It was found that contemporary post-modern education is impossible without application of information and communication technologies, the use of which gradually leads to changes in the content, the methods and technologies of training future teachers. The analysis of scientific literature, which confirms recognition of ICT as a key technology of the 21st century and the urgency of the problem of development and application of educational technologies capable of modernizing and reforming traditional forms of education in order to meet the level of education of future teachers to the present-day requirements. The current trends of ICT in the training of future teachers in postmodern times are considered, current practices (scenarios) of ICT use which are the most popular in the educational process of future teachers are singled out. The content of the following compulsory components, according to the authors, of professional training of future teachers, is generalized and concretized: didactic, legal, social and methodological. Discussion issues and perspective directions of future scientific research related to complex ethical contradictions due to uncertainty or lack of necessary knowledge, unexpected effects and insufficient transparency of functioning of information and communication technologies are outlined.

Keywords: *Training of future teachers, information and communication technologies, postmodernism, informatization, globalization.*

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Introduction

The defining characteristic of a contemporary society is its informatization. One of the paradoxes of our time is the contradiction between the processes of globalization and the postmodern culture. The main features of postmodernism, such as destruction of the hierarchy of values, a new meaning of word and text and perception of the world as a text, computer culture as a new aesthetics and the new reality that led to the cult of information - all this significantly change both the content and purpose of education, Semenenko (2020), when the teacher ceases to be a carrier of knowledge, Horishna (2020), and the process of "reproduction of knowledge" changes to the process of "production of one's own knowledge", Busarieva (2018). The purpose of education in this case is to form in students the key competencies of the 21st century humans, including information culture, which is based on information literacy. The same purpose is fixed in Article 12 of the Law of Ukraine on Education, where information and communication competence of general secondary education students is defined as the key competence (Law of Ukraine on Education, 2017) and as a component of educational outcomes in accordance with the National Qualifications Framework (2011). And the level of formation of these competencies in students depends entirely on the level of development of information and communication competence of their future teachers.

The purpose of the article is to summarize the key components of the content of professional training of future teachers with the use of information and communication technologies in the context of adaptation to the aspects of postmodern society.

In order to achieve the purpose of the research, the following theoretical methods were used: comparison, analysis and generalization of psychological and pedagogical, methodological and special literature on the problem of research, analysis of the regulatory framework.

Theoretical and methodological principles of training future teachers in a postmodern society

The problem of training future teachers for professional activity with the use of information and communication technologies is not new. Various aspects of the problems of introduction of information and communication technologies in the educational process of future teachers have been the subject of research by domestic scientists, in particular Bykov (2010), Osadcha, Osadchyi, Spirin, & Kruhlyk (2021). Thus, Bykov (2010)

emphasizes the importance of informatization of education of future teachers, which is the basis for both the education system of Ukraine and for the innovative development of society as a whole. Osadcha, Osadchyi, Spirin, Kruhlyk (2021) define the conceptual basis for development of an adaptive system of individualization and personalization of training of future professionals in a blended learning environment, which is based on the integrated use of recent information and communication technologies in higher education institutions. The research of Enache, Gorghiu, Crișan, & Petrescu (2019) is devoted to the general question of peculiarities of training future teachers in postmodern society.

In her research Juraeva (2020) draws attention to the use of current information technology as a tool to increase motivation to study in future teachers.

The study of Roman-Gravan, Hervas-Gomez, Martin-Padilla, Fernandez-Marquez (2020) focuses on one of the UN's Millennium Development Goals, namely elimination of gender disparities in primary and secondary schools by training future teachers ready to advance current information and communication technologies in their future careers.

The theoretical and methodological principles of training future teachers are considered in the works of Frytsiuk (2017), Ovcharuk, et al., (2021), Komogorova, et al., (2021), Sheremet, et al., (2019) in which he substantiates organizational and pedagogical conditions for successful implementation of the model of training future teachers, in which he focuses on motivation to the continuous process of professional self-development.

Peculiarities of training future teachers to use information and communication technologies are considered by Morze, Buinytska, Kocharian (2015) and Kocharian (2016), who emphasize the unwillingness of teachers to use recent information and communication technologies in their professional activities.

Peculiarities of training future teachers in the context of aspects of postmodern society are considered in the work of Shevchenko, et al. (2021), Nerubasska & Maksymchuk (2020), Nerubasska, Palshkov, & Maksymchuk (2020) who reveals the essence and content of future teachers' readiness for innovative pedagogical activity in postmodern society, determines the components, criteria and levels of its formation. Rawson (2020) emphasizes the urgent need to create a postmodern educational space for spirituality and explains the epistemology that informs this approach; offers a special view on self-development as a transformation of learning and connects it with the process of spiritual development, which will contribute to a holistic and integrated approach to educational development.

Wright & Monsour (2020) focus on the development of formative assessment in the postmodern approach to education, describe and demonstrate the effectiveness of using the formative assessment experience in primary and secondary education to support critical and creative thinking.

Given the key role of the formative assessment in the effective school practice (Black & Wiliam, 2009) and the spread of ICT, online formative assessment (IT-based formative assessment) is attracting increasing attention from researchers in postmodern society (Gikandi, et al., 2011). Thus, the topic of formative assessment using ICT tools in the context of the COVID19 pandemic is studied by Zou, Kong and Lee (2021), who single out a list of online tools for foreign language teachers. Their research identifies different types of teacher interaction with the online formative assessment and individual, contextual, and technological factors that influence teacher involvement in the process. The results generally support the conclusion that teachers, under the influence of their socio-technical systems, tend to take different positions on formative assessment (Marshall & Drummond, 2006).

Thus, our analysis of scientific literature from open sources and the author's experience show that the use of information and communication technologies in the training of future teachers in the context of aspects of postmodern society is not new in scientific research. However, despite a significant number of studies devoted to this issue, these studies are separate, not combined together and require systematic application. The issue of application of information and communication technologies in the training of future teachers in the context of postmodern society has not received sufficient comprehensive study in domestic pedagogical research and is insufficiently included in current training programs for future teachers and their further training.

Theoretical analysis of application of information and communication technologies in training of future teachers

The need to use current information and communication technologies in the training of future teachers is reflected both in regulatory documents governing professional training and in the scientific works of researchers. Thus, the inconsistency of the structure of training of future employees with the current and future problems of the labour market is outlined in the Strategy for Higher Education Development in Ukraine for 2021-2031 and it was emphasized that education lags behind the digitalization process (Higher Education Development Strategy, 2020).

In our research, under information technology (IT) we understand and use a generalizing concept that describes various methods, ways and algorithms of collecting, storing, processing, presenting and transmitting information, Zhaldak (2011). The information technologies are also understood as methods and means of collecting, processing and transmitting information in order to obtain new information about the object under study, or a set of knowledge about ways and means of working with information resources.

It should be noted that in scientific research of the last ten years, the concept of "Information and Communication Technologies" (ICT) is more commonly used among researchers. The term "ICT" is sometimes used as a synonym for information technology (IT), although ICT is a more general term that emphasizes the role of communication through IT. In our work we use the definition of ICT, which was clarified by Kocharian (2016) – "ICT is a technology for creating, accumulating, storing and accessing web resources of academic disciplines and / or programs, as well as providing organization and support of the educational process through specialized software and means of information and communication, including the Internet".

Osadcha, Osadchyi, Spirin, Kruhlyk (2021); Enache, Gorghiu, Crișan, Petrescu (2019); Morze, Buinytska, & Kocharian (2015); Shevchenko, Makhynia, Polishchuk, Sotska, et al., (2021), in their research note that since outdated teaching methods and tools do not meet current requirements and are not subject to trends of rapid technological progress, globalization processes in postmodern society, this should encourage an active introduction of current ICT in innovative teaching methods for future teachers. And if the research of previous years concerned mainly the scenarios of current ICT in the educational process, development of information and communication competence of teachers, the research of recent years is focused on a systematic approach and use of ICT, specifically: building an open electronic educational space at an education institution, Nikolaienko (2021), deployment and use of full-fledged distance learning systems, Tyshchenko (2020), construction and implementation of models of blended (Boltianskyi & Boltianska, 2021) and the adaptive learning (Vasylenko & Shmyher, 2021).

Therefore, analysing the available scientific works on training of future teachers, we can state recognition of ICT as the key technology of the 21st century, which is the main driver of scientific and technological progress; informatization of education is defined as part of the global process; the problems of development and application of educational

technologies that are capable of modernization and reform of traditional forms of education in order to match the level of education of future teachers to the requirements of the moment remain relevant.

ICT in the process of teacher training as an adaptation to the aspects of postmodern society

Informatization of education today is at a qualitatively new level, researchers (Morze, Buinytska & Kocharian, 2015) in their work summarize the successful experience of effective use of e-learning resources, creation and use of e-learning environment, the use of blended learning scenarios to design the educational process for future teachers. To organize a learning process with the use of electronic educational resources, it is important for future teachers to learn to search and select such resources in accordance with the existing conditions, determine the appropriateness of their use at different stages of the lesson and evaluate student performance with their use. However, updating the content and the emergence of new types of electronic educational resources are not always correlated with the constant changes in the requirements for the educational process in terms of informatization. That is why there is a need to train teachers not only to use the didactic capabilities of the ready-made electronic educational resources, but also to develop them.

We agree with the researchers (Morze, Buinytska, Kocharian, 2015; Kocharian, 2016) and also believe that in today's information and communication competence of the teacher is part of his professional competence. Discussions of standards and models of information and communication competence continue to this day. In our study, we rely on the framework structure of information and communication competence of teachers according to UNESCO recommendations (UNESCO, 2018), where the third level of its development involves creation of "new knowledge" through ICT, and the National Qualifications Framework (2011), which is represented by a hierarchical cross-cutting sequence of general qualification levels and their features, covering the whole range of qualifications.

Analysing the scientific literature on the training of future teachers and trends in contemporary ICT, we agree with researchers (Nikolaienko, 2021; Roman-Gravan, Hervas-Gomez, Martin-Padilla, Fernandez-Marquez, 2020) on the trend to change the forms of organization and content of the educational process in postmodern times. If previously e-learning was separated from traditional learning and was seen as its expansion, improvement and technological innovation, in postmodern society e-learning is seen as a system of blended learning and acts "on an equal

footing" with traditional training of future teachers. In addition, the COVID19 pandemic contributes to more active use of distance learning, which is not based on individual scenarios of individual software products, but on the use of full-fledged systems (platforms) of distance learning, which already allows educational institutions to go completely online.

Based on the above, we can state the following current trends in the use of ICT in the training of future teachers.

1. Transition of teachers from scenarios of single use of ready-made ICT products in the educational process (visualization, presentation, testing, videoconferencing, etc.) to scenarios of creating their own electronic educational products, Kocharian (2016).

2. Transition from scenarios of using single ICT to creation of a single electronic educational space (Morze, Buinytska & Kocharian, 2015). Thus, platforms for webinars (Skype, Teams, Google Met, Zoome, MyOwnConference, etc.) were previously actively used. Today there is a tendency to move to full-fledged distance learning platforms, where these resources for webinars are already integrated and do not require separate settings (Microsoft Office 365, LMS NEO, etc.).

3. Transition from blended learning scenarios to full-fledged distance learning using distance learning platforms, which are a structural element of the architecture of the educational institution's own single electronic space (Osadcha, Osadchyi, Spirin, Kruhlyk, 2021). If before the COVID19 pandemic and at the beginning of it, social networks and messengers such as Facebook, Viber, Twitter, Telegram were actively used in blended learning scenarios, now participants in the educational process are moving to full-fledged distance learning platforms such as Moodle, NEO LMS, Microsoft Office 365 (according to the plan for educational institutions), which already have their own built-in communication channels, which do not require additional integration and settings.

Thus, given these trends in the use of ICT in the training of future teachers in the postmodern times, we can identify certain practices of using ICT, which are presently the most popular and promising for use in the educational process of future teachers.

1. Expansion of the Backchannel practice means the use of networked computers to support online conversation in real time alongside core group activities (Marx, Mirbabaie, Brendel, Zander, 2021). The practice of Backchannel allows communicating interactively during classes, activates the processes of interaction of participants in the educational process, and provides quick fixation and preservation of the necessary educational material and its use in the future.

2. Use of shared resources and platforms, which allows working collectively online on a specific project, idea or document. Thus, scenarios of collaboration in Office 365 Online documents, Google documents, when several participants work online on a specific document at the same time, have proved successful. Twiddla (https://www.twiddla.com), Miro (https://miro.com/signup), IDroo (https://idroo.com), Whiteboard Fox (https://r9.whiteboardfox.com), Conceptboard (https://conceptboard.com) and others are a prime example of online boards that can be shared online. These tools allow using text, images, mathematical formulas, there are options to embed documents and html-code, communicate in a chat.

3. Application of Augmented Reality (AR) technology in the educational process (Hincapie, et al., 2021), which combines virtual objects with real ones, superimposes images of a virtual object and a real object. In most cases this can be done by pointing the camera of a smartphone at a real object, and the screen of the smartphone displays an image of a real object with an image of a virtual object superimposed on it. For example, LiCo.Organic (https://play.google.com/store/apps/details?id=com.LiCo.Organic) is the application, which is used when studying the topic "Organic compounds"; StarWalk2 **(**https://play.google.com/store/apps/details?id=com.vitotechnology.StarWalk2Free**)** is the application, which is used to explore space; Atom Visualizer **(**https://play.google.com/store/apps/details?id=com.signalgarden.atomvisualizer**)** is the application for studying the structure of atoms, etc. The number of such applications for smartphones that use augmented reality is constantly increasing, which confirms the trend towards their widespread use.

4. The use of Virtual Reality (VR) technology in the educational processes of future teachers, which means immersing a person in an artificial simulated world with the involvement of sight, hearing, sensation and, sometimes, taste and smell. Application of virtual reality technologies in education has led to the emergence of a virtual educational environment, successful examples of which today are the following available virtual educational environments: Mondly VR (https://www.mondly.com/vr), VirtualSpeech (https://virtualspeech.com), Immersive VR Education (https://immersivevreducation.com), AltspaceVR (https://altvr.com) and ClassVR (https://www.classvr.com).

Therefore, taking into account these trends in the use of ICT in the training of future teachers in postmodern times and highlighting certain practices of their application, we can summarize the following, mandatory in our opinion components of the content of professional training of future teachers (Table 1).

Table 1. *Components of the content of professional training of future teachers in the context of adaptation to aspects of postmodern society (developed by the authors)*

Methodological component
1. Conceptual substantiation of the use of contemporary ICT with the use of TPACK methodology (Technological Pedagogical Content Knowledge, 2018) in the process of training future teachers. 2. Implementation of methods and approaches of professional activity in the context of the use of contemporary ICT in the educational process and creation of own electronic educational resources.
Social component
1. Ensuring equal access to higher education for all students through the development and use of distance learning. 2. Establishing cooperation between international educational institutions and organizations to implement potentialities of academic and social mobility, including through distance participation.
Didactic component
1. Active, systematic and consistent implementation of various forms and methods of teaching with the use of current ICT in educational institutions that train future teachers. 2. Implementation of individual and personal approaches to students through the use of various ICT. 3. Continuous training and advanced training of scientific and pedagogical staff of educational institutions on information and communication competence. 4. Motivation of scientific and pedagogical workers of educational institutions to create their own electronic educational resources. 5. Motivation of students, future teachers for constant use of contemporary ICT in order to address most of the educational and other issues (e-government, e-document management, use of e-library resources, payment for online education, etc.).
Legal component
1. Development and application of policies and standards at the national level on information and communication competence of the research and teaching staff. 2. In case there is no policies and standards at the national level on information and communication competence of the research and teaching staff - development and application at the institution level. 3. Development and compliance with standards of information and communication competence of bachelors and / or masters graduates - future teachers.

Thus, the main goal of training future teachers in the context of adaptation to aspects of postmodernism is to train highly professional teachers who are ready for the challenges of contemporary society, motivated and able to provide professional and quality educational services in educational institutions, preparing students for real life in the 21st century. Given the global digitalization of postmodern society, it is the use of contemporary ICT in the process of such training that should make such training of high quality and effectiveness. Awareness of the ineffectiveness of established, traditional forms and methods of teaching in postmodern times and the active and systematic use of new technologies will achieve this goal.

Discussion issues and prospects for further research

The technological progress of the postmodern era is characterized by overcoming the distinction between science and politics, the connection of scientific facts with the interests and values of society, the approach to nature and society as an object of transformation to achieve the desired future, i.e., radical change in human life, Delgado (2016). Technological innovations are seen as the key to solving the problems of population aging, climate change, energy security, etc. The same applies to the education system - the latest technologies are seen not only as a tool for solving social problems, but are recognized as the technological basis of a new phase of socio-political relations, which hides new social challenges.

Let's highlight the key trends that, in our opinion, will determine the priorities of the following studies of the ethical aspects of this process:

The speed of the processes of digitalization of education significantly exceeds development of analytical potential necessary for comprehensive awareness of them by both the administration institutions of educational establishments, and academic institutions and research and teaching staff;

The urgent nature of digitalization of training processes for future teachers is usually due to the need to respond immediately to sudden threats. Since 2019, this threatening condition is represented by the COVID19 pandemic;

The experimental nature of digitalization is an inevitable side effect of its rapid implementation, and a student-pedagogue is forced to act as the object of the experiment, which will be the carrier of knowledge and values in their professional activities in the future;

Contemporary ICT is gradually becoming a necessary channel of access to realization of the right to education, creating new forms of

institutional control over the observance of this right and freedoms of students, their confidential and personal data, etc.;

Inherent in postmodernism critical and sometimes negative attitude to the traditions of classical humanities knowledge leads to a cardinal impact on contemporary adolescents and young people. Clipping and fragmentary thinking leads to complications of logical cognitive operations, such as analysis and synthesis, and future teachers should be ready to work under conditions of such changes.

Summing up, we note that introduction of contemporary ICT in the system of training future teachers has a significant transformative (reform) potential. At the same time, this potential is accompanied by complex contradictions of an ethical nature due to uncertainty, lack of necessary knowledge, unpredictability of consequences and insufficient transparency of their functioning. Therefore, in our opinion, this issue remains open, debatable and may be a continuation of this study.

Conclusion

The process of influence of postmodernism affected all branches of society and education in particular. Moreover, the greatest reform is needed by the education system itself, which has already begun to move from traditional learning to the search of a new one, specifically to improve quality and comfort of the educational process, ensuring individualization of the educational process taking into account the characteristics, needs and abilities of each student. At the same time, the idea of the concept of lifelong learning is embodied, which envisages the process of lifelong learning throughout the life of the individual, a change of roles, when the teacher can also be a student in the learning process.

Teachers who accept current ideas of postmodernism define their professional tasks in the form of changing the learning process from a "process of influence" to a "process of interaction", which reveals the abilities, opportunities of students, future teachers.

It is clear that the primary pedagogical project in the contemporary concept of postmodern education is the teacher of the future, where the main emphasis is on "learning-discovery", and it is contemporary ICT that allow it to be done effectively and affordably. The problematic issue of the current stage of development of the education system remains the information and communication competence of the research and teaching staff who train future teachers, because the professional competence of students depends on their level of formation.

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