

The Use of ICT Tools by Academic Teachers in the International Comparative Context*

Tatyana Noskova¹
noskovatn@gmail.com

Tatiana Pavlova¹
pavtatbor@gmail.com

Olga Yakovleva¹
o.yakovleva.home@gmail.com

Nataliia Morze²
n.morze@kubg.edu.ua

Sixto Cubo-Delgado³
sixto@unex.es

Laura Alonso-Díaz³
laulonso@unex.es

¹ Herzen State Pedagogical University of Russia
Saint Petersburg, Russian Federation

² Borys Grinchenko Kyiv University, Kiyv, Ukraine

³ University of Extremadura, Badajoz, Spain

Abstract

The paper presents the results of the international research on the ICT tools use by academic teachers. The research was based on the authors' typology of ICT tools comprising three groups of tools according to teaching objectives – information, communication and management ICT tools. The data analysis proved that teachers apply all three types of pedagogical ICT tools, however with a different degree of application intensity. They use a significant variety of ICT tools for developing digital learning resources with the main aim of providing students with a wide range of educational opportunities in the e-learning environment. Teachers tend to take into account students' preferences when providing them with digital resources for various learning purposes. The variety of ICT tools asset highly depends on teachers' experience, however, non les important is the educational policy of a particular university, setting the corporate standards for ICT competences and regulate the use of e-learning. Teachers are relatively far from using most of the possible advantages of the e-learning environment. We propose that professional training in the field of ICT for future and in-service teachers should focus on the system of skills and professional values that ensure the effective use of ICT tools for supporting students' autonomous learning activities. Authors show the prospective of the ICT tools connected with the use of intellectual technologies.

Keywords: *ICT tools, teacher ICT competences, e-learning, blended learning, e-learning environment, teaching activities, digital learning resources, intellectual technologies.*

*Copyright © 2019 for this paper by its authors. Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

1 Introduction

E-learning, b-learning and distance learning technologies are widely used in modern education, with the objective to achieve better educational outcomes, and this trend is international [Nunez et al., 2017]. Elaboration of an e-environment based on social-constructivist models of fully online learning is a necessary condition for the modern educational process design in the majority of advanced educational institutions [Blayone et al., 2017]. The main goal of ICT use for pedagogical purposes is supporting students' self-directed learning, expanding their independent behavior and initiative, since it is an important part of self-directed professional development and lifelong learning [Lopes et al., 2017].

New information and communication models of educational activity are formed as necessary conditions ensuring the development of competencies required for successful professional activity and self-realization in the information society [Baranova et al., 2016] within the sixth technological wave [Grinin et al., 2017]. Educational interaction in the e-environment should reflect the changes that are visible in the information behavior of 21-century youth and take into account the requests and preferences of students in terms of educational activity [Jamaludin et al., 2013].

2 Problem of Research

The achievement of a new quality of the educational process and the orientation towards innovative results in e-learning and b-learning environments requires new goals and new tools of professional activities. The main means of reaching pedagogical objectives become not face-to-face communication, but electronic educational resources and a variety of ICT tools for the mediated interactions [Noskova et al., 2017]. The core question of the paper is whether ICT tools allow a teacher taking the full advantage of the e-learning environment benefits.

We can identify a general idea in recent pedagogical research devoted to ICT tools: the idea of ICT tools for a teacher includes a set of information and communication technologies used for educational purposes [Top tools for learning ..., 2017]. Researchers name the areas of these tools application in education, draw out the spectrum of possible objectives to be reached, point out the interrelations between the achievements of educational results and the functionality of the means used. For example, various tools for collaboration are actively used [Kwok et al., 2017], including social media tools [?]. Teachers' satisfaction and level of interest influence on the choice of ICT tools [Schulz et al., 2015]. Overall, the starting points for the ICT tools typology are either the professional tasks targeted by a teacher, or the didactic capabilities of ICT tools [Musioł, 2013]. We witness the rapid development and evolution of ICT, and this situation explains why the merely technological approach is unpromising. To develop the competencies of future or practicing teachers, today it is not enough to train them how to use particular ICT for certain pedagogical objectives. It is necessary to motivate qualitative restructuring of pedagogical activity based on updated pedagogical methodology in the altering information conditions. An important basic component of this methodology is a new professional toolkit of a teacher.

3 Methodology of Research

General Background of Research. In this paper, we propose to clarify the concept of “pedagogical” ICT tools, to offer a typology of tools and a system of indicators that characterize their application in pedagogical practice. Today, ICT tools “in hands” of a teacher have evolved from a merely teaching tool into a multifunctional tool for creating varied educational opportunities for learners’ autonomy in the digital learning environment.

In this context, we suggest distinguishing three groups of ICT tools [Noskova et al., 2015]:

- ICT tools for presenting and organizing learning information acquisition in the electronic environment - information ICT tools;
- ICT tools for organizing educational communication in the electronic environment - communication ICT tools;
- ICT tools for managing educational and cognitive activities in the electronic environment - management ICT tools.

Consequently, the concept of “pedagogical” ICT tools is the synthesis of particular computer facilities (ICT) and digital learning resources. The main purpose of ICT tools is to organize and support the activities of students in the digital learning environment (in both blended learning and e-learning paradigms). Students’ self-guided work should gain the maximum benefit from pedagogical ICT tools. Pedagogical ICT tools of different types (information, communication, management), upon condition of their variable capabilities use, allow organizing educational interactions in the electronic environment that would fit up-to-date requirements for students’ training, e.g. access to distance education server resources, computational clouds, databases [Roszak et al., 2016]. In order to master pedagogical ICT tools, a teacher needs not only acquiring user skills, but also learning how to develop, select and apply electronic resources of different types [Ramírez-Montoya et al., 2017]. Moreover, it is important to bear in mind the expanding range of educational opportunities in the digital environment, new algorithms of learning activities, changing information and communication behavior and preferences of students [Priyaadharshini et al., 2017].

Research objectives. In this study, we pursued two main objectives. The first objective was to find out the degree of pedagogical ICT tools application by teachers from different universities (in accordance with the proposed typology of ICT tools) for the determination of ICT tools frequency and detection of problem areas. The second objective was to give recommendations on how to advance the development of pedagogical ICT competencies from the perspective of using pedagogical ICT tools of all types in accordance to the typology of objectives that a teacher outlines in the digital learning environment.

Research Questions. The main question of this study was the following: how intensively teachers in universities, participated in the research, apply different types of pedagogical ICT tools. To answer the main question, a number of specific research questions (RQ) were formulated according to the content of the three groups of pedagogic ICT tools:

- RQ1: How intensively do teachers use electronic equipment and various ICT tools?
- RQ2: How intensively do teachers use various digital educational resources?

- RQ3: Do teachers provide students with a variety of educational opportunities with the help of ICT tools?

- RQ4: Do teachers take into account students' preferences in using different types of digital educational resources?

Based on the RQ the hypothesis of the study was formed.

We assumed that academic teachers:

- apply all three types of pedagogical ICT tools, however with a different degree of application intensity;

- elaborate and apply digital learning resources with three main objectives - organizing a learning content acquisition, organizing network educational communications, and managing educational interactions in the e-environment;

- provide students with a wide range of educational opportunities in the digital learning environment;

- take into account students' preferences when providing them with digital resources for various learning purposes.

Sample of Research. The sample of research included 150 respondents: 20 academic teachers from the University of Extremadura (Spain), 50 academic teachers from the Borys Grinchenko Kyiv University (Ukraine), and 50 academic teachers from the Herzen State Pedagogical University (Russia).

Research Methods, Instrument and Procedures. The research methods included a survey with preceding questionnaire validation by international experts, statistical analysis (the hierarchical cluster analysis method) and a comparative qualitative analysis of data for three groups of respondents. As the variables we used normalized indices, characterising complex aspects of the practical application of pedagogical ICT tools.

The research included several stages. Firstly, a questionnaire was elaborated for teachers who actively use ICT in their professional activities, understand the essence and specificity of e-learning, and have a sufficient experience in using distance education technologies to facilitate students' activities. The main objective was identifying the specific application of pedagogical ICT tools.

The questionnaire comprised three groups of questions according to the three groups of pedagogical ICT tools. Questions in each group allowed obtaining data on several areas:

- a relevance of various ICT tools and electronic equipment for presenting educational content (for example, computers, multimedia projectors, document cameras, LMS, sites, mobile devices, virtual and augmented reality interfaces, etc.);

- a variety of electronic content (linear texts in electronic form, hypertext, computer presentations, video, audio, interactive digital models, virtual and augmented reality);

- a variety of opportunities for learning the content (selecting the necessary content, choosing the preferred formats of educational content, contextual help, automated self-control, the ability to interactively manipulate learning objects, etc.).

In addition, two questions were proposed that allowed determining the correlation between the digital learning resources actually used by teachers and the opinion of teachers about the relevance of these types of resources for students. In particular, the questions named such resources as electronic textbooks, text and hypertext resources of own development, records of own lectures, digital educational objects, tests, foreign-language

resources, open online courses, etc.

The second group of questions (ICT tools for organizing educational communication in the electronic environment) covered several aspects:

- a variety of communication ICT tools in teaching activities (e-mail, forums, blogs, social networks, multi-user documents, multi-user virtual environments, video conferencing facilities, etc.);
- networking and communication opportunities provided for students (individual support, application of knowledge and skills in practice, support of educational motivation, development of professional and social competencies, support of self-realization in learning and satisfaction in an individual communication request, etc.);
- a variety of resources helping to organize educational communication on the web (rules, regulations, recommendations for network interaction, problem-based tasks, cases, topics for discussion, archives of discourses, links to external resources, etc.).

In addition, as in the first group, two questions were proposed to identify the correlation between the tools for interactions used by teachers and students' demand for these tools (individual support, pair and small group work, discussions, webinars, online lectures and seminars, etc.).

The third group of questions (ICT tools for managing educational and cognitive activities in the electronic environment) primarily aimed at identifying an extent to which various ICT tools are used to manage educational and cognitive activities in the electronic environment (electronic calendars and organizers, online questionnaires, criterial rubrics editors, testing programs, on-line polls, learning analytics, etc.).

Two questions were proposed to identify the correlation between ICT tools used for managing educational and cognitive activities and the relevance of these tools for students (plans, graphs, online questionnaires, tests, online voting, evaluation criteria, ratings, electronic journals of progress and achievement, electronic portfolio).

In each of the questions, respondents were asked to assess the degree of application or preference of ICT tool on a 5-point scale (1 point - never or almost never, 2 points - very rarely, 3 - rarely, 4 - quite often, 5 - very often or constantly).

The questionnaire passed the initial validation: it was analyzed, and each issue was evaluated and commented on by Russian, Ukrainian and Spanish experts (academic teachers). Some of the issues were modified (content or stylistic) recommended by the scientific community. All questions were presented in Russian, Ukrainian and English with the aim of dissemination.

Data Analysis. During the study we obtained data on 95 variables. This paper presents the results on 13 variables processed with the use of hierarchical cluster analysis method. As the variables we used normalized indices of variability, characterizing complex aspects of the practical application of pedagogical ICT tools. To construct clusters, the Ward's minimum variance method was used. For the visual presentation of the results, we created a dendrogram. To test the hypothesis and concretize the situation characterizing the use of pedagogical ICT tools, a comparative analysis of the data for three groups of respondents was made with the respect to the variables characterizing the use of each type of ICT tools.

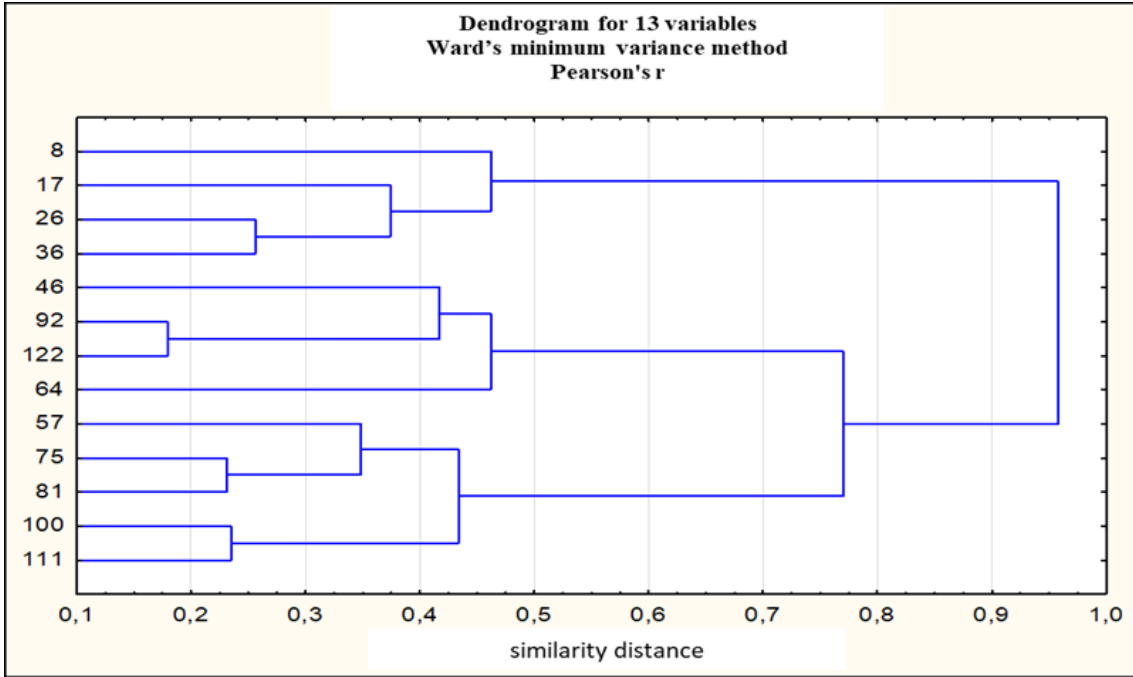


Figure 1: Dendrogram of pedagogical ICT tools application

4 Results of Research and Discussion

Based on the visual presentation of the results, we can see that at a similarity distance of up to 0.46, the analyzed indices of ICT tools application form four natural clusters (Figure 1).

The first cluster comprises the following indices:

- the Index of ICT tools variability (8)
- the Index of electronic content variability (17)
- the Index of learning opportunities variability (26)
- the Index of digital learning recourses variability (36)

We call this cluster - a “Cluster of information ICT tools”. This is a very natural and expected agglomeration. Teachers who are aware of the importance of individualization and the expansion of the opportunities for presenting and delivering educational information in the electronic environment tend to provide them through a variety of interactive multimedia content, the use of computer models, video, animation, etc. They strive to provide students with the following opportunities: choice of the necessary hypertext navigation tools in the excessive learning content; selection of the preferred formats of educational content (text, audio, video); contextual help and tips; ability to interactively manipulate learning objects; gamification; automated self-control; digital tools for content processing (digital references, cognitive maps, automated annotations, abstracting, results presentation in an electronic format, etc.).

The Index of learning opportunities variability (26) merges with the Index of digital learning recourses variability (36) at the value of 0.25. At the value of 0.37, the Index of electronic content variability (17) is added to the cluster and at the value of 0.45 the Index of ICT tools variability (8) is added. This indicates that teachers are eager to provide students with a wide range of opportunities to learn the content by equipping

the learning process with digital resources of different types, and by using different types of educational content and devices for content delivery. The combination of all these indices in one cluster gives grounds to believe that teachers are aware of information pedagogical ICT tools broad opportunities for learning the content. That is why they try to use different types of electronic educational content, different types of digital learning recourses, and ICT tools for presenting the content.

The second cluster comprises the following indices:

- Index of students' preferences allowance in the use of digital learning resources (46)
- Index of students' preferences allowance in the use of electronic communication resources (92)
- Index of students' preferences allowance in the use of electronic management resources (122)
- Index of educational communication opportunities diversity (64)

We call this cluster a "Cluster of students' preferences allowance in e-environment". We see that the Index of students' preferences allowance in the use of electronic communication resources (46) and Index of students' preferences allowance in using electronic management resources (122) are the closes members, with the distance value of 0.18. At the value of 0.43, the Index of students' preferences allowance in the use of electronic communication resources (92) is merged with the cluster. This agglomeration is natural, since educational communication in the e-environment is a way of solving a number of important educational problems when using communication resources, and managing educational interactions.

The analysis shows that teachers understand students' preferences in the use of digital educational resources, and this creates real conditions and prerequisites for individualization of learning activities.

The third cluster comprises the following indices:

- the Index of communication means variability (57)
- the Index of educational interaction forms variability (75)
- the Index of communication resources variability (81).

We call this cluster a "Cluster of communication pedagogical ICT tools". The dendrogram shows the closest relation is between the the Index of communication means variability (57) and the Index of educational interaction forms variability (75). The e-learning environment provides a wide range of communication tools (from messaging services to multi-user synchronous and asynchronous environments) that are used for educational purposes. With their help teachers organize such types of network educational interaction as consultations, individual help, pair and group work, discussions, seminars, conferences, network projects and other networking events. Each form of network educational interactions requires a special type of communication resources. A high degree of correlation of the indicated variables shows that the teachers see this relationship. The agglomeration of these indeces in one cluster gives grounds to presume that teachers are aware of the potential of communicative pedagogical ICT tools in terms of expanding the range of educational opportunities and enriching the content of competences formed. That is why teachers tend to use different types of network educational communication on the basis of various communication tools.

The fourth cluster comprises the following indices:

- the Index of management means variability (100)
- the Index of electronic management resources variability (111).

We call this cluster – a “Cluster of pedagogical management ICT tools”. These indices are joined at a distance of 0.24. Agglomeration of these indices in one cluster shows that teachers who consciously accompany educational interaction in the electronic environment with special resources that provide indirect management of educational interaction with the use of various ICT tools, are aware of the potential of pedagogical management ICT tools for flexible management of learning. This conclusion is important, because the electronic environment is created in order to provide students with a flexible pedagogical support and management, which presume the priority of high learner’s autonomy [Boyadzhieva, 2016], reflexive self-management and cooperative learning [Stingu et al., 2012].

At a distance of 0.43 the Cluster of communication pedagogical ICT tools and the Cluster of pedagogical management ICT tools merge. This agglomeration is quite natural, because the separation of electronic resources for communication from the electronic resources for management is rather conditionally. Generally, their functions are closely interrelated and they are often embodied in comprehensive electronic resources.

5 Comparative analysis of the pedagogical ICT tools application for different groups of respondents

ICT tools for presenting and organizing learning information acquisition in the electronic environment.

The differences between three countries are presented in Figure 2.

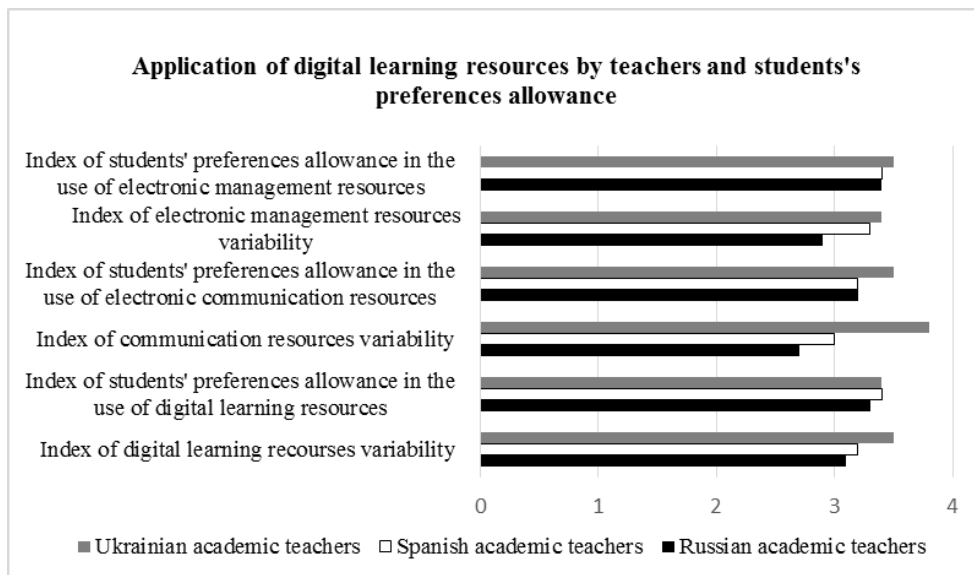


Figure 2: Cluster of information ICT tools

The diagram proves that Spanish teachers show an excess in all indices characterizing the use of information pedagogical ICT tools, especially in terms of the variability of the opportunities provided for mastering the educational content. In particular, the detailed analysis of respondents' answers showed that Spanish teachers more actively use LMS, they frequently refer to foreign language e-resources, they use video recordings of own lectures. As Spanish teachers more actively use LMS, we can be presume that they also record own lectures for their e-courses. It is obvious that the realities of academic cooperation and interaction within the European Union encourage Spanish teachers to use foreign language e-resources actively.

At the same time, we should note that respondents had to relate their degree of ICT tools use on a five-point scale, and for all groups of respondents the issue of improving their competence of using information pedagogical ICT tools is relevant. A rather monotonous data distribution on different aspects of the ICT tools application by teachers indicates a fairly balanced ratio of the tools used, together with the diversity of digital information resources types and the opportunities for students to learn the content. Accordingly, the improvement of competences for all types of ICT tools use should occur in all the designated areas.

ICT tools for organizing educational communication in the electronic environment. The differences between two countries are presented in Figure 3. In the area

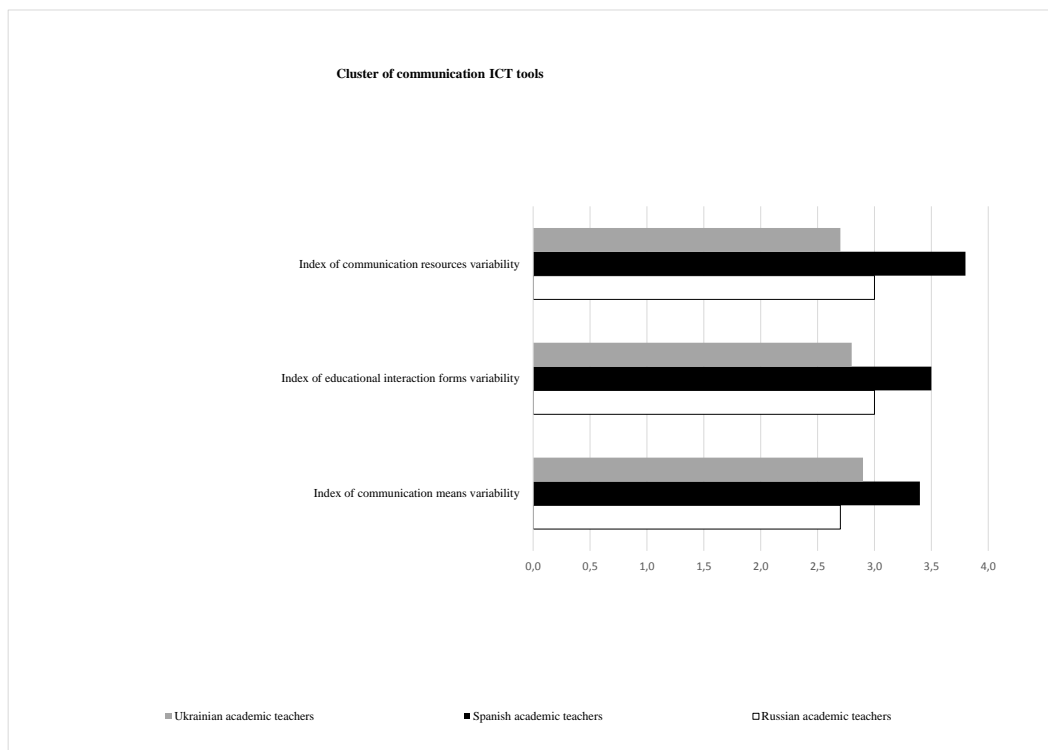


Figure 3: Cluster of communication ICT tools

of communication pedagogical ICT tools, the situation is not so balanced. For all three groups of respondents, a high level of variability in the educational opportunities provided was demonstrated (the normalized index tends to the value of 4). This indicates

that teachers actively use ICT communication tools to organize educational interaction in the digital environment.

Spanish teachers use a greater variety of specialized communication resources, forms of network interaction and network communication tools. In particular, we presume that the activity of Spanish teachers in the application of LMS is related to their preferences in the ICT tools for organizing educational communication. ICT tools that they apply are available in LMS and they provide rich opportunities for facilitating communication and interactions. It is important that most of teachers provide learners with rules, regulations and terms of network interactions, since it is a significant condition for an effective mediated communication.

This visual representation of the results shows an ambiguous situation. On the one hand, Russian and Ukrainian teachers say that they provide their students with quite a variety of communication opportunities, but at the same time, they do not use all means of communication for this and have significant potential for improvement in terms of developing specialized communication resources. The identified problem zone associated with the use of communication resources requires close attention, since this type of resources ensures the regulation, stability, convenience and, as a consequence, the effectiveness of network educational communication, which can make a significant contribution to the development of students' competencies.

ICT tools for managing educational and cognitive activities in the electronic environment. The differences between two countries are presented in Figure 4. The

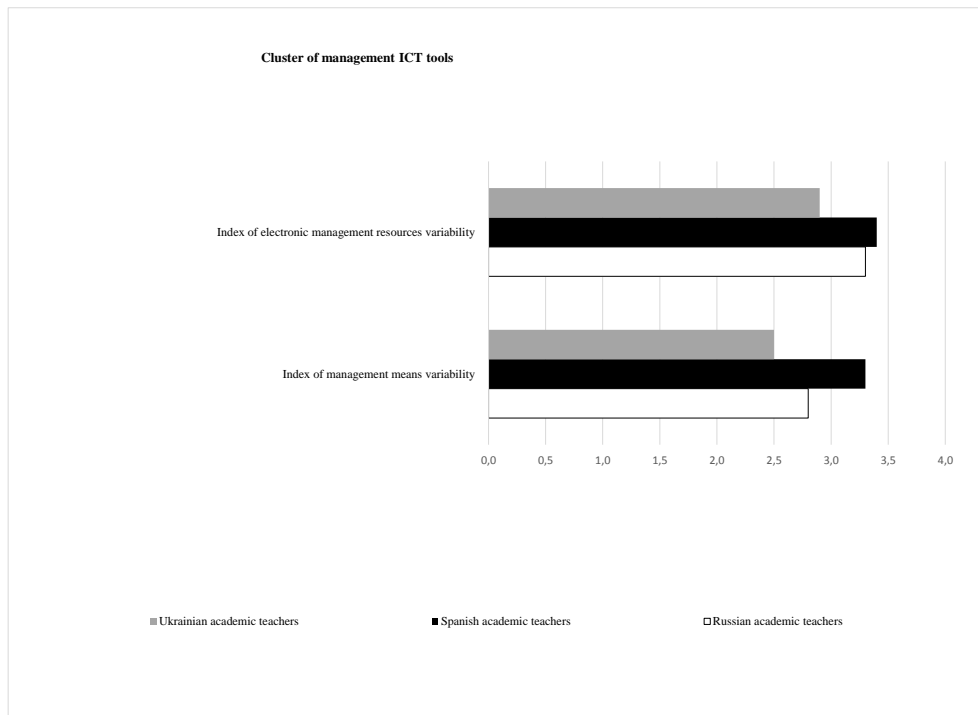


Figure 4: Cluster of management ICT tools The data characterizing pedagogical ICT management

data characterizing pedagogical ICT management tools demonstrate a low level of indices for all groups of respondents. It is especially important to note this with respect to the general variability of the digital management resources used. In the questionnaire for assessing the degree of application, teachers were offered many types of digital management resources and ICT tools that can be used for indirect management of educational interaction in the electronic environment. The data obtained indicates that the teachers do not pay enough attention to the use of this type of tools. This is an important sign, since management ICT tools are very important for flexible control and assessment (including self-assessment and peer assessment) and they can provide a high degree of autonomy for students. In general, Spanish teachers repeatedly use this kind of tools versus their Russian and Ukrainian colleagues. We can again logically relate this trend to the activity of LMS application by Spanish teachers. The latest editions of the most well-known LMS have wide built-in capabilities for implementing objectives of educational and cognitive activities management.

Application of digital educational resources by teachers and their foresight of students' preferences in using resources of different types. The diagram (see Figure 5) shows the ratio of the values of indices characterizing the use of digital educational resources of different types and indexes reflecting teachers' understanding of students' preferences in using different types of resources.

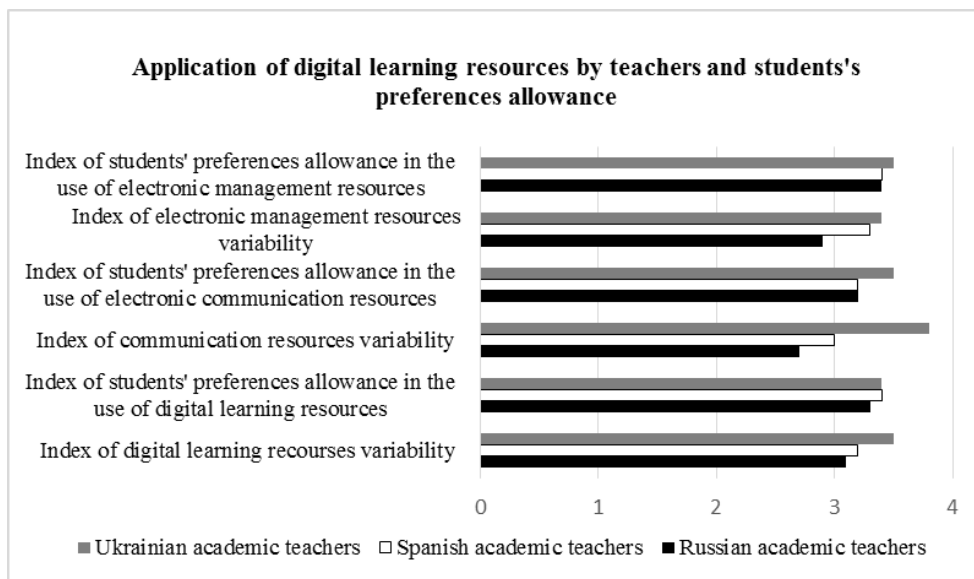


Figure 5: Application of digital learning resources by teachers and students's preferences allowance

The diagram shows that the indices of students' preferences for different types of digital learning resources for all groups of respondents, although not significantly, differ

from the values of indices characterizing the variability of the digital learning resources provided in real practice. The most balanced situation is observed with the information resources for all groups of respondents.

Regarding digital communication resources and management resources, Russian teachers demonstrate that the index of students' preferences allowance exceeds the index of the variability of the resources provided. The data of Ukrainian teachers regarding communication resources shows that students get a wide variety of communication resources, but not all of them meet the students' preferences. All this indicates that there is a need not in merely "adjusting" the digital educational resources to the request of students, but in coordinating teaching and learning activities in the e-learning environment. In addition, we should note that the average values of the indices is 3.5, which indicates the need both for further research on the use of pedagogical ICT tools of various types and improvement of teachers' competences.

Summing up the results of the comparative analysis, we can underline that for all groups of respondents we see a sufficiently large variance of values, which can signal an uneven readiness of teachers for effective use of different pedagogical ICT tools.

6 Conclusions

The results of the study confirmed that teachers, participants of the survey, have sufficient experience in pedagogical ICT tools application. Nevertheless, the level of their competences in his area still needs some improvement. Teachers, representing different countries and universities, have similar competences in the field of pedagogical ICT tools, and this indicates common trends in the e-environments of universities integrated into the global information space.

The data analysis made it possible to identify the problem areas that need special attention. The variability and application intensity depends on the groups of ICT tools. In general, teachers use ICT tools for content presentation and delivery actively, while they pay less attention to communication and management ICT tools. The variety of ICT tools asset often depends on teachers' experience. Teachers from Russia and Ukraine assess students' needs and preferences higher than the actual diversity and opportunities provided they provide for students in the e-environment.

One of the important factors that can influence teachers' activity in the application of ICT tools is the educational policy of a particular university. In particular, the University of Extremadura has extensive experience in implementing e-learning and providing distance education services to Latin American countries through the Virtual Campus of UEX [Gutiérrez-Esteban et al., 2016], as well as participating in the CVC-G9 consortium. Still, the main reason, in our opinion, is the lack of understanding the advantages of blended learning as the prerequisite for smart education in the open knowledge economy [Morze et al., 2016]. Assessment and teachers-students interactions remain the most controversial issues [Horvat et al., 2015]. The main advantage is a variety of educational opportunities for students in the e-environment, which allow redistributing rationally teaching and learning activities in the classroom and e-environment with the help of pedagogical ICT tools. For example, meta-cognitive strategies as arranging and planning learning, affective strategies as confidence enhancement, and social strategies as cooperating with others [Al Zumor et al., 2018].

Pedagogical ICT tools based on the use of intellectual technologies have a special potential today. They make it possible organizing adaptive learning at the new technological level, providing contextual help for students in the process of educational strategies choice. Intellectual pedagogical tools allow setting new tasks in training and forming students' competencies in accordance with the demands of the digital labor market. Intellectual tools allow making the educational process more diverse with digital learning environments, gamification, virtual reality, chat bots, etc.

Intellectual tools are presented in each of the groups of ICT tools, described in the paper. Information tools allow building a student's interaction with expanded data files, moving from the translation of didactically transformed information to an individualized process of knowledge extraction (intellectual search, adaptive training systems with regard to preferred information formats, etc.). Communication tools provide an individualized dialogue in the automated mode; they give assistance to the learner in electronic space, for example, chat bots. Management tools use big data. They allow the transition from linear pedagogical technologies to nonlinear multivariate practices with flexible individualized trajectories for students in digital environments (for example, descriptive, predictive, and prescriptive learning analytics).

The research showed that teachers are relatively far from using most of the possible advantages of e-learning environment. Programs of professional training in the field of ICT for future and in-service teachers should focus on the system of skills and professional values that ensure the effective use of pedagogical ICT tools for supporting students' autonomous learning activities. The main idea in teacher training in the field of ICT is the e-environment design that includes the systematic use of pedagogical ICT tools (information, communication and management tools) for effective interaction between teachers and learners.

7 Acknowledgements

Acknowledgments The research was supported by the Russian Science Foundation (RSF), Project "Digitalisation of the high school professional training in the context of education foresight 2035" № 19-18-00108.

References

- [Al Zumor et al., 2018] Al Zumor, A. W. Q., Al Refaai, I. K., Bader Eddin, E. A., Aziz Al-Rahman, F. H. (2013). EFL students' perceptions of a blended learning environment: Advantages, limitations and suggestions for improvement. *English Language Teaching*, 6(10), 95-110. doi:10.5539/elt.v6n10p95.
- [Baranova et al., 2016] Baranova, A. R., Valeev, A. A. (2016). Pedagogical conditions of students' self-realization capacity development. *Social Sciences (Pakistan)*, 11(14), 3618-3622.
- [Boyadzhieva, 2016] Boyadzhieva, E., Learner-centered teaching and learner autonomy. (2016). *Procedia - Social and Behavioral Sciences*, 232, 35-40.

- [Blayone et al., 2017] Blayone, T. J. B., van Oostveen, R., Barber, W., DiGiuseppe, M., Childs, E. (2017). Democratizing digital learning: Theorizing the fully online learning community model. *International Journal of Educational Technology in Higher Education*, 14(1) doi:10.1186/s41239-017-0051-4.
- [Grinin et al., 2017] Grinin, L. E., Grinin, A. L., Korotayev, A. (2017). Forthcoming Kondratieff wave, cybernetic revolution, and global ageing. *Technological Forecasting and Social Change*, 115, 52-68. doi:10.1016/j.techfore.2016.09.017.
- [Gutiérrez-Esteban et al., 2016] Gutiérrez-Esteban, P., Yuste-Tosina, R., Arias-Masa, J., Cubo-Delgado, S., Alonso-Díaz, L. (2016). Evaluation of teaching design in synchronous virtual classrooms. *International Journal of Continuing Engineering Education and Life-Long Learning*, 26(1), 72-89. doi:10.1504/IJCEELL.2016.075040.
- [Horvat et al., 2015] Horvat, T., Alajbeg, T., Predanić, S. (2015). Experiences and practices in blended learning environment. In *38th International Convention on Information and Communication Technology, Electronics and Microelectronics, MIPRO 2015*, 938-942. doi:10.1109/MIPRO.2015.7160409.
- [Kwok et al., 2017] Kwok, D., Yang, S. (2017). Evaluating the intention to use ICT collaborative tools in a social constructivist environment. *International Journal of Educational Technology in Higher Education*, 14(32) doi:10.1186/s41239-017-0070-1.
- [Lopes et al., 2017] Lopes, J. B., Cunha, A. E. (2017). Self-directed professional development to improve effective teaching: Key points for a model. *Teaching and Teacher Education*, 68, 262-274. doi:10.1016/j.tate.2017.09.009.
- [Nunez et al., 2017] Nunez J. L., Bravo Ramos, J. L., Hilera Gonzalez, J. R. (2017). Indicators for assessing the quality of a blended university course. *Revista Iberoamericana De Tecnologias Del Aprendizaje*, 12(2), 94-105. doi:10.1109/RITA.2017.2697799.
- [Morze et al., 2016] Morze, N., Smyrnova-Trybulska, E., Glazunova, O. (2017). Design of a University Learning Environment for SMART Education. In *Smart Technology Applications in Business Environments*. Hershey, PA: IGI Global, 221-248. doi: 10.4018/978-1-5225-249-2.ch011.
- [Musioł, 2013] Musioł, M. (2013). Didactic and educational implications of applying ICT in homework completion. *New Educational Review*, 33(3), 205-214.
- [Noskova et al., 2017] Noskova, T., Pavlova, T., Yakovleva O. (2017). Pedagogical activity tools in electronic environment. *Higher education in Russia*, 8-9, 121-130.
- [Noskova et al., 2017] Noskova, T., Pavlova, T., Yakovleva O. (2017). Electronic communication in education: a study of new opportunities. In *Simulation and Communication 'DLSC 2017'*: Brno, University of Defence, 214-223.

- [Noskova et al., 2015] Noskova, T., Yakovleva O. (2015). Educational Interactions Quality in E-Learning Environment. Mkrttchian, V., Bershadsky, A., Bozhday, A., Kataev, M., Kataev, S. In Handbook of Research on Estimation and Control Techniques in E-Learning Systems. Hershey, PA: IGI Global, 216-232 doi:10.4018/978-1-4666-9489-7.
- [Jamaludin et al., 2013] Jamaludin, A., Chee, Y. S. (2013). Investigating youth's life online phenomena: Subverting dichotomies through negotiation of offline and online identities. In Design, utilization, and analysis of simulations and game-based educational worlds, 206-224 doi:10.4018/978-1-4666-4018-4.ch013.
- [Priyaadharshini et al., 2017] Priyaadharshini, M., Vinayaga Sundaram, B. (2017). Life-long learning: Analyzing behavioral models using cloud based flipped classroom. Journal of Computational and Theoretical Nanoscience, 14(12), 5770-5779. doi:10.1166/jctn.2017.7011.
- [Ramírez-Montoya et al., 2017] Ramírez-Montoya, M., Mena, J., Rodríguez-Arroyo, J. A. (2017). In-service teachers' self-perceptions of digital competence and OER use as determined by a xMOOC training course. Computers in Human Behavior, 77, 356-364. doi:10.1016/j.chb.2017.09.010.
- [Roszak et al., 2016] Roszak, M., Kolodziejczak, B., Kowalewski, W., Ren-Kurc, A. (2016). Implementation of e-learning portal for academic education and life-long learning. International Journal of Continuing Engineering Education and Life-Long Learning, 26(2), 135-152. doi:10.1504/IJCEELL.2016.0760011.
- [Rudžioniene, 2016] Rudžioniene, J. (2013). Information behavior of university students: From today's information and communication student towards tomorrow's excellent information specialist doi:10.1007/978-3-319-03919-08_1.
- [Schulz et al., 2015] Schulz, R., Isabwe, G. M., Reichert, F. (2015). Investigating teachers motivation to use ICT tools in higher education. In Internet Technologies and Applications, ITA 2015 - Proceedings of the 6th International Conference, 62-67. doi:10.1109/ITechA.2015.7317371.
- [Stîngu et al., 2012] Stîngu, M. M., Reflexive practice in teacher education: facts and trends. (2012). Procedia - Social and Behavioral Sciences, 33, 617-621.
- [Top tools for learning ..., 2017] Top tools for learning 2017. Retrieved 20/12/2017, from: <http://c4lpt.co.uk/top100tools/>