

Modern Tools for Increasing the Effectiveness of Distance Education in the Conditions of Digitalization

Taras Kuzmenko^{1,2,*}, Alla Kondrashova³, Kostiantyn Lisetskyi³, Svitlana Moiseienko³, Olena Volkova³ & Serhii Khrapatyi⁴

¹Department of Event Management and Leisure Industry, Faculty Event Management and Show Business, Private Higher Educational Institution “Kyiv University of Culture”, Kyiv, Ukraine

²Kyiv National University of Culture and Arts, Kyiv, Ukraine

³Department of English for Engineering 1, Faculty of Linguistics, National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”, Kyiv, Ukraine

⁴Department of Computational Mathematics and Computer Modeling, Interregional Academy of Personnel Management, Kyiv, Ukraine

*Correspondence: Department of Event Management and Leisure Industry, Faculty Event Management and Show Business, Private Higher Educational Institution «Kyiv University of Culture»; Kyiv National University of Culture and Arts, Kyiv, Ukraine. E-mail: ktg76@ukr.net

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Abstract

The current stage of developing digital technologies creates favorable conditions for intensifying the improvement of innovative distance education tools, the need for which is due to the intensification of the latest challenges and dangers. The research purpose is to substantiate the theoretical and applied principles of identifying the influence of modern tools for increasing the effectiveness of distance education in the conditions of digitalization. The methodological basis of the research includes general scientific and special methods of economic analysis and fundamental scientific investigation, in particular: system analysis, synthesis, scientific abstraction, comparison, analogy, statistical analysis, cluster analysis (k-means method), tabular, graphic, generalization, and systematization. The research results have revealed that the effectiveness of distance education in the conditions of digitalization significantly depends on the country's development level. It has been found that three groups stand out among European countries, characterized by different levels of digitization and quality of distance education: highly developed countries (Denmark (MID: 0,90–1,00), Estonia (MID: 0,78–0,83), Ireland (MID: 0,76–0,80), Luxembourg (MID: 0,79–1,00), the Netherlands (MID: 0,91–0,95), Germany (MID: 0,81–0,88), Finland (MID: 0,88–0,90), Sweden (MID: 0,83–0,88); countries with an intermediate level of development (Bulgaria (MID: 0,58–0,62), Spain (MID: 0,62–0,64), Cyprus (MID: 0,64–0,67), Lithuania (MID: 0,63–0,66), Malta (MID: 0,64–0,70), Poland (MID: 0,54–0,64), Portugal (MID: 0,61–0,64), Romania (MID: 0,54–0,60), France (MID: 0,73–0,73), the Czech Republic (MID: 0,61–0,64), Slovenia (MID: 0,63–0,65), Azerbaijan (MID: 0,59–0,63) and countries with a low level of development (Greece (MID: 0,48–0,51), Italy (MID: 0,55–0,58), Latvia (MID: 0,55–0,59), Hungary (MID: 0,47–0,52), Slovakia (MID: 0,51–0,55), Croatia (MID: 0,46–0,50), Armenia (MID: 0,47–0,56), Georgia (MID: 0,48–0,50), Moldova (MID: 0,42–0,48), Ukraine (MID: 0,41–0,84). It has been proven that the most common digital tools for increasing the effectiveness of distance education are Viber (86,7%), an educational platform determined by the educational institution (60%), YouTube lessons (39,3%), Skype (13,3%) and Facebook (6%). It is proposed to increase the effectiveness of distance education by deepening society digitalization in countries with a low level of development and providing them with methodological assistance on the part of highly developed countries.

Keywords: education, distance learning, distance learning technologies, digitalization, innovative technologies, educational process, tools

1. Introduction

Strengthening the processes of globalization and European integration necessitates the unification of national educational systems into a single global one, where there are no borders and boundaries, and students get the opportunity to study in any country of the world. The internationalization of education has a positive effect on developing human capital. It helps students acquire high-quality knowledge and skills and become full-fledged and highly qualified specialists. It is obvious that the intensification of developing information and communication technologies opens up new opportunities for access to modern knowledge and the advantages of the educational process. The successful adaptation of educational systems can confirm this thesis to the challenges caused by the COVID-19 pandemic and the rapid transition to distance learning under quarantine restrictions. At the same time, the existing problems of nowadays, which are constantly present in educational activities, determine the need for systematic updating and improving distance education, which successfully enhances the quality of educational services. The outlined tendencies actualize the research topic and require in-depth study.

2. Literature Review

In the increasing challenges and dangers of modernity, there are problems of ensuring quality education available to different categories of the population. Under such conditions, the issue of involving innovative digital technologies in the education system at various levels is becoming actualized. According to Haleem et al., 2022, it was especially intensified under the influence of spreading the COVID-19 pandemic and the introduction of forced restrictive measures of a quarantine nature. At the same time, the scientists found that using digital technologies in education changed its paradigm and ambiguously influenced the quality of providing the educational process in countries with different levels of development. Those countries with a higher level of development of digital technologies quickly coped with the existing challenges. However, developing countries were forced to immediately consolidate all efforts to meet modern needs in the field of digitalization. Undoubtedly, the use of digital technologies in education is a powerful tool for modernizing education at all levels and contributes to improving its quality indicators.

Bykov et al. (2022) explain the need for intensifying distance education with the emergence of the latest challenges and dangers. In particular, the spread of the COVID-19 pandemic has reached crisis proportions and provoked significant restrictions on the access of students to the educational process in the usual mode, switching to a distance form of education.

In this context, Polych (2022) assesses the current state of the education sphere as transformational. The scholar claims that in conditions of uncertainty, the digital transformation of the educational sphere is due to the process of rethinking educational activities and preparing for the transition to the digital economy. Moreover, the scientist does not connect the use of modern digital tools in education with the challenges of the COVID-19 pandemic. However, he is convinced that the need arose due to modernizing the educational process's content and the search for innovative methods of its provision. At the same time, such tendencies contribute to increasing the effectiveness of distance education. Using artificial intelligence in educational activities nowadays is one of the most popular examples of progressive and effective digital transformation in education. Without denying the significant scientific heritage of Polych (2022), Rybchuk et al. (2022) claim that the digitalization of education is due to society development, innovative technologies and strengthening the processes of integration into the world's global space. New educational technologies, in turn, lead to updating the content of education and meeting the individual needs of students and scientific and pedagogical workers, expanding the boundaries of their capabilities and affirming personal and professional self-determination. Moreover, Hubenov & Nedelchev (2022) prove that the combination of the latest technologies and traditional teaching methods leads to a positive effect, forasmuch as it is possible to combine learning with the acquisition of practical skills effectively. Along with this, Schmidt & Tang (2020) argue that the transformative potential of digitization realized in distance education opens up new opportunities and potential perspectives for the future professional growth of both education seekers and teachers.

It is obvious that the accelerated pace of digitization is caused by the emergence of destabilizing modern challenges, which, according to Bejinaru (2019), have spread to the entire European continent and cause the need to intensify the development of distance education.

Kalimullina et al. (2021) proves that using digital technologies in education significantly intensified even in the pre-crisis period of spreading the coronavirus pandemic. The use of innovative training tools testified to the high level of specialists' qualifications.

However, Arthur-Nyarko et al. (2020) have established that there are several destabilizing factors for introducing

modern tools to increase the effectiveness of distance education. One of the most significant factors is students' unreadiness to switch to distance education. Their financial resources do not allow them to achieve high levels of provision with modern technological means, in particular, tablets, iPads, computers and laptops. The low level of access to the Internet and its absence in remote settlements are cited by scientists as the second major problem.

Zaimakis & Papadaki (2022), Iatsyshyn, et al. (2019), Leshchenko, et al. (2021) consider digitization of education and the introduction of distance learning as an integral component of the modern world. They emphasize their advantages due to flexible modalities in time and space. The scholars also convince that their inclusive practice meets the learners' social and educational needs. At the same time, scientists emphasize certain disadvantages of distance learning, mainly the separation of students from real life in the educational institution and the impossibility of their socialization (Zinovieva et al., 2021).

At the same time, Derkach & Levytska (2022) suggest paying increased attention to improving the effectiveness of distance education in conditions of digitalization and being scrupulous about the choice of modern distance learning tools. This will make it possible to achieve the set methodical goals and take into account the education seekers' interests. Concurrently, scientists prove that it is possible to increase distance education's effectiveness in digitalization conditions due to reducing the number of online platforms used in practical activities. In this context, Ainslee, 2018 claims that effective distance education methods in digitalization are as follows: (1) online courses; (2) online exams; (3) digital textbooks; (4) multimedia and animation. Mala (2022) convinces that modern distance education aims to achieve advanced pedagogical and methodical experience of leading international institutions. They try out the use of innovative pedagogical technologies and modern digitization tools, as a result of which the requests and needs of education seekers and teachers are sufficiently satisfied.

Kolomiets & Reznichenko (2021) hold a similar standpoint. They investigated the effectiveness indicators of the educational process in the conditions of distance learning and came to the conclusion that the majority of students have low motivation to study, feel excessive workload and lack of communication. At the same time, Godin & Terekhova, 2021 study the introduction of modern tools for increasing the effectiveness of distance education through the prism of implementing the conceptual principles of changing the forms of educational activity in educational institutions of various levels. The scholars justify the necessity to evaluate the effectiveness of changes from the perspective of pedagogy, digital technologies, and modernization of the educational process and the economic capacity of the educational institution to provide them.

It is noteworthy that the existing scientific approaches to studying modern tools of distance education in the conditions of digitalization are oriented towards the need to modernize the content of education at various levels according to the requirements of developing information and communication technologies. However, without denying the available significant scientific development in the indicated direction, the issue of increasing the effectiveness of distance education and meeting the educational needs of all participants in the educational process remains unresolved. Consequently, it requires further investigation and substantiation.

3. Research Aims

The purpose of the research is to substantiate the theoretical and applied principles of identifying the influence of modern tools for increasing the effectiveness of distance education in the conditions of digitalization.

4. Materials and Methods

General scientific and special methods of economic analysis and fundamental scientific research constitute the methodological basis of the research. Establishing the essence of distance education in the conditions of digitalization was carried out using the method of system analysis, synthesis and scientific abstraction. Applied studies and empirical calculations were conducted on the basis of methods of comparison, analogy and statistical analysis. Grouping of European and Eastern Partnership countries according to the indicator of the multidimensional digitization index was performed using the technology of cluster analysis (k-means method). Display of the research results was carried out using tabular and graphic methods. The formation of conclusions based on the results of the conducted research was performed using the method of generalization and systematization.

The research information base consists of the scientific works of leading domestic and foreign scientists, reporting data of international organizations for 2019–2022: DiGiX 2019 Update: A Multidimensional Index of Digitization according to the multidimensional index of digitization.

5. Results

Actualization of distance education in conditions of persistent instability and global uncertainty necessitates introducing new forms of providing educational services. After all, the existing format of education functioning under the influence of significant restrictions cannot satisfy the students' needs. It is obvious that there are significant obstacles to achieving the desired effect, because not all participants in the educational process are able to fully access distance education, caused by the low level of digitization in countries with an average and low level of development. Studying the current trends of the multidimensional index of digitization in countries with different development levels, it is possible to observe that education seekers have unequal conditions of access to the Internet and provision of technical education means. In particular, the multidimensional digitization index in the European Union's countries (Fig. 1) during 2019–2022 does not have a stable trend. It changes its value variously in different periods of time. The highest value of the multidimensional index of digitization in the analyzed period was recorded in Denmark (MID: 0,90–1,00), the Netherlands (MID: 0,91–0,95) and Finland (MID: 0,88–0,90), and the lowest in Greece (MID: 0,48–0,51), Hungary (MID: 0,47–0,52) and Croatia (MID: 0,46–0,50). This proves the high rates of access of the countries of the first group to Internet resources and the significant backwardness of the countries of the second group in this direction.

The unequal access to the internet and technical education means in countries with different levels of development is a significant challenge for the digitization of education. The multidimensional index of digitization in the European Union's countries during the period of 2019-2022 has shown that there is a significant variation in the level of digitization in different countries. Denmark, the Netherlands, and Finland have the highest multidimensional index of digitization, indicating better access to internet resources and more advanced technical education means. On the other hand, Greece, Hungary, and Croatia have the lowest multidimensional index of digitization, indicating significant underdevelopment in terms of access to internet resources and technical education means. This highlights the need for governments and education institutions to focus on improving access to internet resources and technical education means, especially in countries with lower multidimensional index of digitization.

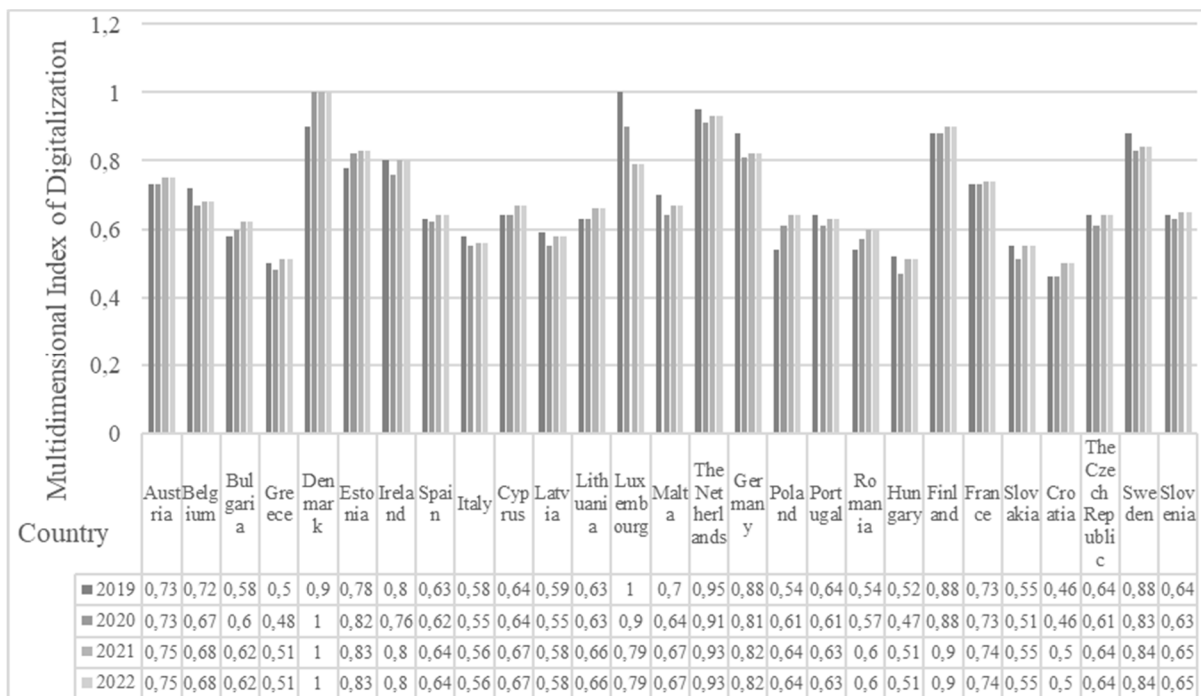


Figure 1. Status and Tendencies of Changes in the Multidimensional Index of Digitization in the European Union's Countries in 2019–2022

Calculated based on: DiGiX Update: A Multidimensional Index of Digitization, 2019–2022.

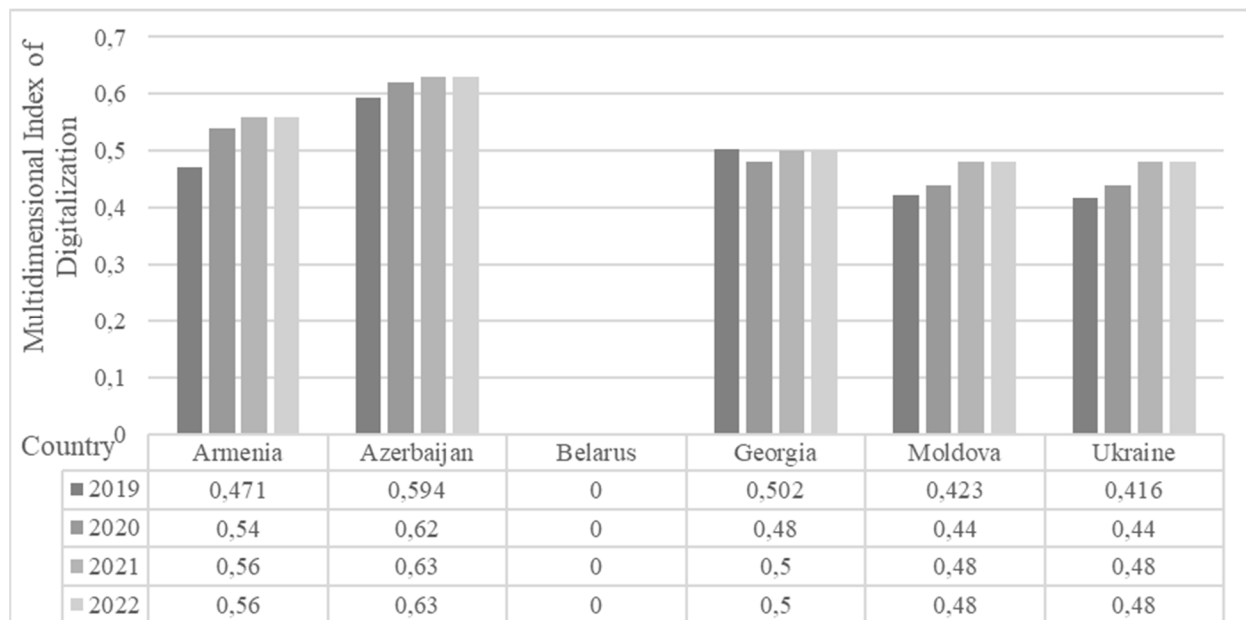


Figure 2. Status and Tendencies of Changes in the Multidimensional Index of Digitization in the Eastern Partnership Countries in 2019–2022

Calculated based on: DiGiX Update: A Multidimensional Index of Digitization, 2019–2022.

At the same time, comparing the values of the multidimensional index of digitization in the countries of the Eastern Partnership for the same period (2019–2022) (Fig. 2), it is worth noting it's overmuch low values, indicating the necessity to intensify digitization processes. In this analyzed group, the highest values of the multidimensional index of digitization correspond to the marks of the lowest indicators among the countries of the European Union. The conducted studies of the multidimensional index of digitization in the countries of the Eastern Partnership prove that the highest development level of modern digital technologies was recorded in Azerbaijan (MID: 0,59–0,63) and Armenia (MID: 0,47–0,56). This confirms the low indicators of the population's access to digital resources and its inability to fully ensure the purchase of means for conducting distance education. At the same time, it was revealed that the calculation of the indicated indicator was not carried out in Belarus during the entire analyzed period. Therefore, it is impossible to assess the country's ability to provide educational activities in a distance format.

Regrettably, the indicators of Ukraine and Moldova in terms of the multidimensional index of digitization are the lowest among all European countries, which requires increased attention on the part of public authorities and a revision of the existing state policy in the field of education and science.

Considering the outlined tendencies, we suggest deepening our studies and grouping the European countries selected for analysis according to the multidimensional index of digitization and identifying common signs of obtaining opportunities to use modern tools of distance education in order to increase its effectiveness. It is advisable to carry out the proposed studies using the cluster analysis technology based on the k-means method. The obtained results should be systematized in Table 1.

The results of the studies on grouping the European Union's countries and the Eastern Partnership's countries based on the indicator of the multidimensional index of digitization in 2019-2022 give reasons to claim that the European countries are divided into three main groups, characterizing different levels of society digitization and the effectiveness of educational activities in a remote form. In particular, the first group consists of highly developed countries. They have ensured high European standards of their development in all areas, position a binary system of higher education and offer a wide range of educational programs for training education seekers with maximum consideration of their educational needs. This group includes such countries as Denmark, Estonia, Ireland, Luxembourg, the Netherlands, Germany, Finland and Sweden.

Table 1. Grouping the European Union's Countries and the Eastern Partnership's Countries According to the Indicator of the Multidimensional Index of Digitization in 2019–2022

Multidimensional Index of Digitization							
2019		2020		2021		2022	
Country	Cluster number	Country	Cluster number	Country	Cluster number	Country	Cluster number
Denmark	1	Austria	1	Denmark	1	Denmark	1
Estonia		Denmark		Estonia		Estonia	
Ireland		Estonia		Ireland		Ireland	
Luxembourg		Ireland		Luxembourg		Luxembourg	
The Netherlands		Luxembourg		The Netherlands		The Netherlands	
Germany		The Netherlands		Germany		Germany	
Finland		Germany		Finland		Finland	
Sweden		Finland		Sweden		Sweden	
Austria	2	France		Austria	1	Austria	2
Belgium		Sweden		Belgium		Belgium	
Bulgaria		Belgium	2	Bulgaria		Bulgaria	
Spain		Bulgaria		Spain		Spain	
Italy		Spain		Cyprus		Cyprus	
Cyprus		Italy		Lithuania		Lithuania	
Latvia		Cyprus		Malta		Malta	
Lithuania		Latvia		Poland		Poland	
Malta		Lithuania		Portugal		Portugal	
Portugal		Malta		Romania		Romania	
France		Poland		France		France	
The Czech Republic		Portugal		The Czech Republic		The Czech Republic	
Slovenia		Romania		Slovenia		Slovenia	
Azerbaijan		The Czech Republic		Azerbaijan		Azerbaijan	
Greece	3	Slovenia		Greece	3	Greece	3
Poland		Azerbaijan		Italy		Italy	
Romania		Greece	3	Latvia		Latvia	
Hungary		Hungary		Hungary		Hungary	
Slovakia		Slovakia		Slovakia		Slovakia	
Croatia		Croatia		Croatia		Croatia	
Armenia		Armenia		Armenia		Armenia	
Georgia		Georgia		Georgia		Georgia	
Moldova		Moldova		Moldova		Moldova	
Ukraine		Ukraine		Ukraine		Ukraine	

Compiled based on: DiGiX Update: A Multidimensional Index of Digitization, 2019–2022.

The second group includes Bulgaria, Spain, Cyprus, Lithuania, Malta, Poland, Portugal, Romania, France, the Czech Republic, Slovenia and Azerbaijan, where the proper conditions for providing high-quality educational services are ensured both in face-to-face and in distance format. It should be noted that among the European Union's countries, a prominent place belongs to Azerbaijan. This country has a sufficiently high value of the digitization indicator, indicating the effectiveness of its national digitalization policy and a high level of security of access to digital resources. However, there are certain difficulties regarding the maximum coverage of the population with unhindered access to digital technologies and the Internet in the countries of this group. It is obvious that under such circumstances the effectiveness of distance education is lower than in highly developed countries. However, the existing modern tools of distance education, which are widely used in practical activities, allow successfully integrating into the system of European education standards and implementing the right of education seekers to receive high-quality and comprehensive education.

The third group consists of such countries as Greece, Italy, Latvia, Hungary, Slovakia, Croatia, Armenia, Georgia,

Moldova and Ukraine. They are in a state of incomplete transformation of the education system in accordance with European standards, and the level of digitalization is quite low. In addition, there are frequent problems with access to the Internet in such countries. Consequently, the provision of distance education is, in some places, impossible due to the limited ability of students to ensure the purchase and use of modern technical means. This significantly complicates the implementation of the educational process, the establishment of communication and the receipt of quality education, as well as causes the emergence of technical, organizational and psychological problems for education seekers.

In order to reduce significant tension and partially neutralize the destabilizing influence, the participants of the educational process resort to using widely available distance education tools, which increase the level of interaction between them. The conducted studies of the features of using digital tools to increase the effectiveness of distance education in Ukraine in 2021 (Fig. 4) have made it possible to single out the list of the most frequently used. They are: Viber (86,7 %), educational platform determined by the educational institution (60%) and YouTube lessons (39,3%) (Kolomiets & Reznichenko, 2021). Similar tendencies are observed in other countries of the transitive type. However, their list of digital tools is supplemented by using Facebook (6%) and Skype (13,3 %).

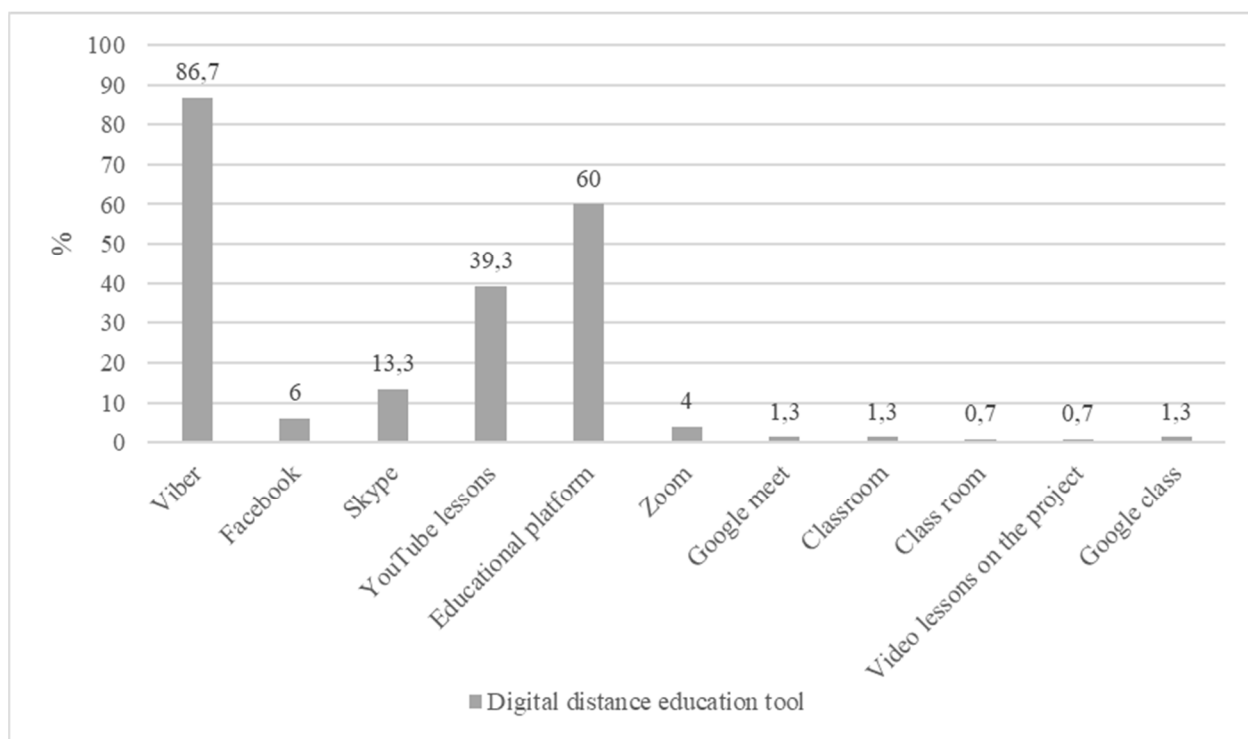


Figure 3. List of the Most Common Digital Tools Used to Improve the Effectiveness of Distance Education in Ukraine in 2021

Compiled based on: Kolomiets & Reznichenko, 2021.

Therefore, the research results make it possible to reveal the ambiguity of approaches to using modern digital tools of distance education in European countries, which differ in different levels of development and society digitalization. Undoubtedly, highly developed countries are able to provide higher quality indicators of distance education and offer education seekers more attractive distance learning conditions than developing countries. As for countries of the transitive type, the problem of using modern tools to improve the quality of distance education is becoming more urgent nowadays. It requires the search for effective methods for providing distance education in general and access to it for education seekers in particular.

6. Discussion

The intensification of digitization processes characterizes the current stage of global society development

(Arthur–Nyarko et al., 2020). This takes place especially quickly in the highly developed countries of the European Union and somewhat slower in the countries that have gone through the path of transformational restructuring and are at the stage of development and establishment (Derkach & Levytska, 2022). It is obvious that the national education systems of the analyzed group's countries are undergoing adaptation to the introduced European norms and standards. Moreover, it was established that the European countries selected for the analysis were divided into three groups according to the features of using modern digital tools to improve the effectiveness of distance learning: highly developed (Denmark, Estonia, Ireland, Luxembourg, the Netherlands, Germany, Finland, Sweden), countries with intermediate development indicators (Bulgaria, Spain, Cyprus, Lithuania, Malta, Poland, Portugal, Romania, France, the Czech Republic, Slovenia, Azerbaijan) and developing countries (Greece, Italy, Latvia, Hungary, Slovakia, Croatia, Armenia, Georgia, Moldova, Ukraine).

It has been revealed that highly developed countries are able to more effectively resist the challenges and threats of modernity and give a worthy response to the existing risks and threats in the educational sphere. Herewith, countries of the transitive type are not able to ensure the proper efficiency level of providing educational services in the conditions of distance learning, which reduces the quality of educational services and the level of professional qualifications of future specialists.

Given the identified problems, the process of society digitalization in countries with a low level of development and the provision of methodological assistance to them on the part of highly developed countries requires improvement. At the same time, a significant problem of modern times is the material situation of transitive countries' population, which is not able to provide education seekers with technological means, with the help of which training is conducted in a distance format.

7. Conclusions

Thus, the conducted research on the theoretical and applied principles of identifying the influence of modern tools for increasing the effectiveness of distance education in the conditions of digitalization made it possible to establish the dependence of the effectiveness of distance education on the digitalization level in a particular country. The research results proved that countries with a higher level of digitalization have better opportunities to provide relevant conditions for obtaining education in a distance format than developing countries, forasmuch as their digitalization indicators are significantly higher (Denmark (MID: 0,90–1,00), the Netherlands (MID: 0,91–0,95), Finland (MID: 0,88–0,90) than in countries of the transitive type (Greece (MID: 0,48–0,51), Hungary (MID: 0,47–0,52), Croatia (MID: 0,46–0,50). Several problems of increasing the effectiveness of distance education in the conditions of digitalization have been identified. The most important ones are as follows: (1) limited access to the Internet; (2) the low level of financial support of education seekers in countries of the transitive type, which prevents the acquisition of the necessary technical means of learning in remote conditions; (3) lack of proper communication between the participants of the educational process. It has been established that the most frequently used tools for increasing the effectiveness of distance education in conditions of digitalization are Viber (86,7%), an educational platform determined by the educational institution independently (60%), YouTube lessons (39,3%), Skype (13,3 %) and Facebook (6%). In order to increase the effectiveness of distance education, it is proposed to deepen and improve the process of society digitalization in countries with a low level of development and to provide them with methodological assistance on the part of highly developed countries.

So, modern tools for increasing the effectiveness of distance education in the conditions of digitalization have immense potential to revolutionize the education sector. The use of various digital tools and technologies has made it possible to overcome the limitations of traditional classroom-based learning and offer more flexible and personalized learning experiences to students. Future research directions could focus on the development of more sophisticated tools and technologies, as well as on the identification of effective pedagogical strategies for integrating these tools into distance education programs. Overall, the future of distance education looks promising with the use of modern tools and technologies.

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