

**Olena Dudar***

PhD in Psychological Sciences, Associate Professor
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskoh Str., Pereiaslav, Ukraine
<https://orcid.org/0000-0003-0541-5646>

Yaroslav Shchogolev

Senior Lecturer
Hryhorii Skovoroda University in Pereiaslav
08401, 30 Sukhomlynskoh Str., Pereiaslav, Ukraine
<https://orcid.org/0009-0007-7814-638>

Educational communications in the digital society: New formats of interaction between lecturer and student

Abstract. The study aimed to determine the impact of digital technologies on the nature and organisation of interactions between lecturers and students in modern education. The research methodology included a theoretical analysis of scholarly sources, comparative analysis, systems analysis, systematisation and generalisation. The results indicate a steady increase in the effectiveness of digital educational communications. This is evidenced by the rise in participation in online learning, which increased from 21.4% to 34.8% in the European Union, and the high level of integration of Learning Management Systems. These systems are used regularly by approximately 78% of students. Synchronous formats were found to be most effective when explaining complex material and providing immediate feedback, while asynchronous environments and combined platforms were more effective in developing student autonomy, in-depth engagement with educational content, and organising group interaction. Student-centred, collaborative and connectivist approaches contribute to developing student independence and intensifying their interaction. These approaches enable the combination of individual learning and team-based activity, creating conditions for a flexible educational process. Digital platforms were found to provide automated, personalised assessment of students' learning achievements. They enable the provision of timely feedback and dynamic progress monitoring. They also facilitate the organisation of group work through collaborative projects and discussions. Taken together, these factors improve the quality of educational interaction. Videoconferencing ensures direct contact between participants in the learning process and enables immediate feedback. The results of the study may be used by lecturers, the administration of higher education institutions and developers of educational programmes to improve the organisation of digital educational communication and enhance the effectiveness of interaction between lecturer and student

Keywords: information dissemination; pedagogical function; multimedia content; forum discussions; knowledge transfer

INTRODUCTION

The digitalisation of education is transforming the way lecturers and students interact, creating new communication models based on interactivity, mobility, and rapid information exchange. Educational communication is increasingly

taking place through online platforms, social networks, video conferencing and digital services. This affects the organisation of the learning process, the level of student engagement, and the methods of knowledge transfer. In this

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*Corresponding author (dudarlenushka@gmail.com)



context, studying new formats of interaction between lecturers and students is important because they influence the effectiveness of learning, the quality of feedback, and the potential for personalising the educational environment.

In the context of digital society, educational communications have undergone transformations as a result of the spread of digital technologies. This has contributed to the formation of new interaction formats between lecturers and students, as well as changing approaches to organising the learning process. R. Cramarenco *et al.* (2023) reviewed students' perceptions of online education and digital technologies during the pandemic. The researchers concluded that using digital platforms ensures the continuity of the educational process and expands the possibilities for communication between those involved in learning. However, they also found that the effectiveness of interaction depends on lecturers' digital preparedness, how the learning environment is organised, and the ability to maintain an active dialogue with students. Similar trends are reflected in the study by S. Salarvand *et al.* (2023), which highlighted communication and collaboration difficulties in online classrooms. The scholars established that distance learning is accompanied by decreased emotional interaction, insufficient non-verbal communication, and limited opportunities for immediate feedback. However, it was also demonstrated that interactive teaching methods and the use of digital services can activate students' participation in the learning process. M. Laskar (2023) work examined the issue of digital inequality, presenting a comparative analysis of the development of digital society in urban and rural regions of India. The author found that access to digital resources directly affects students' opportunities to participate in the learning process and communicate with lecturers. Insufficient technical provision and limited internet access complicate distance learning, thereby exacerbating educational inequality. In this regard, digital communications are considered not only as a learning tool, but also as a means of social integration and improving educational accessibility.

The adaptation of educational programmes to the conditions of digital society was examined in a study by A. Lazareva *et al.* (2024). The researchers demonstrated that updating learning content and introducing digital interaction formats contributes to improving the effectiveness of the educational process in Ukraine. They also paid attention to the development of digital literacy among lecturers and students, which they regard as a necessary condition for high-quality educational communication. These results are consistent with the conclusions of J. Tondeur *et al.* (2023), who proposed the concept of digital competence for lecturers in higher education institutions. This approach emphasises that a lecturer's ability to use digital tools, maintain interactive engagement, and adapt teaching methods to the online environment determines the effectiveness of educational communication. L. Mialkovska *et al.* (2023) also investigated the issue of digital communications in higher education. The scholars demonstrated that social

management and digital communication have become integral to the functioning of higher education institutions. Digital platforms facilitate the rapid exchange of information, the coordination of educational activities, and interaction between all participants in the learning process. However, it was also found that the effectiveness of digital communication depends on the organisation of the information environment and the willingness of lecturers to use new interaction formats. M. Ohara (2023) analysed the role of social networks in the system of educational communication. It was determined that social media facilitate constant contact between lecturers and students, ensure the rapid dissemination of information, and intensify learning interactions.

O. Yemelyanova *et al.* (2023) examined the problems of the educational crisis in the information and digital society. They concluded that changes in communication methods necessitate a rethinking of traditional teaching approaches and the development of new lecturer-student interaction models. Conversely, N. Nychkalo *et al.* (2024) demonstrated that the use of digital tools facilitates the integration of Ukrainian children and young people into Slovakia's educational environment. This shows that digital communication not only organises the learning process, but also maintains social adaptation and intercultural interaction. Meanwhile, J. Vega-Ramírez *et al.* (2023) investigated how educational policy outcomes are communicated in the context of digital society. They established that effective dissemination of information and use of digital communication channels influences the level of public engagement in educational processes. They considered digital communication to be a multi-level system of interaction, encompassing not only lecturers and students, but also the wider educational environment. Despite the points raised by the aforementioned authors, there has been insufficient research into the impact of new digital formats of interaction on the quality of communication between lecturers and students. The specific features of combining interactive platforms, social networks, and distance services within a single educational environment have only been analysed to a limited extent. Insufficient attention has been given to maintaining effective feedback and encouraging students' communication in the digital learning space. This study aimed to determine the role of digital technologies in transforming interaction between lecturers and students. The study aimed to characterise the specific features of digital educational communication, assess the effectiveness of modern interaction formats in the educational process, and conduct a comparative analysis of pedagogical communication models in the digital environment.

MATERIALS AND METHODS

The research design adopted a mixed-methods approach combining theory and analysis. This included a systems analysis of scholarly sources, a comparative examination of models of pedagogical interaction, and the generalisation of statistical data on the use of digital educational

platforms in the context of online education. A theoretical analysis of scholarly sources on the organisation of educational communications in digital societies was conducted, focusing particularly on formats of digital communication in online education and the functional capabilities of digital educational platforms. Scholarly sources were searched for in the international academic databases Google Scholar, Scopus and Web of Science. Sources were selected according to criteria including relevance, scholarly validity, representativeness with regard to digital educational communications, availability of empirical data, and correspondence with the topic of synchronous and asynchronous forms of learning interaction. The study analysed synchronous and asynchronous forms of learning interaction, tools for providing feedback and approaches to organising group and individual learning activities in a digital educational environment. Additionally, statistical data was presented, including the level of user participation in online learning within European Union countries, growth dynamics in the use of digital educational materials between 2019 and 2025, indicators of uneven digital engagement, and the frequency with which Learning Management Systems (LMSs) are used by students. The material basis of the study consisted of official statistical reports by Eurostat (European Commission, 2026) and analytical materials from the Ministry of Digital Transformation of Ukraine (2025).

The comparative method was used to analyse traditional and digital formats of pedagogical interaction. The teacher-centred communication model (Ghafar, 2023), the student-centred communication model (Europass Teacher Academy, 2024), the collaborative learning model (Education Endowment Foundation, n.d.) and the connectivist communication model (Pace, 2026) were compared within the study. The comparison was carried out according to criteria such as the level of interactivity, effectiveness of feedback, degree of student autonomy, opportunities for collaborative work organisation, and use of digital tools in the learning process. This approach revealed the advantages of digital communication formats in facilitating flexible and interactive engagement between participants in the educational process.

Systems analysis was used to study the functional capabilities of digital educational platforms within the online education system. This covered Moodle (n.d.), Google Classroom (n.d.), Microsoft Teams (n.d.), Zoom (n.d.) and Canvas (n.d.). Tools for synchronous and asynchronous communication, group work organisation, feedback mechanisms, digital assessment and multimedia content integration were analysed during the study. This enabled the specific features of using digital platforms to ensure effective pedagogical interaction and optimise communication between lecturers and students to be determined. A method of systematisation and generalisation based on scholarly sources was employed to classify digital educational communication formats and determine their pedagogical functions. The specific features of using chats, forums,

videoconferencing, interactive whiteboards and learning management systems in the modern educational environment were identified using the method of systems analysis. One limitation of the study was that the analysis was mainly based on open statistical data and scholarly sources from the last five years. This may not fully reflect the rapid changes in digital educational technologies and how they are implemented in different countries and educational institutions.

RESULTS

In the digital society, educational communications are formed as a system of interaction between lecturer and student. This system combines synchronous and asynchronous methods of information exchange, organisation of learning activities, and support for feedback. Synchronous methods enable real-time interaction, facilitating explanations of educational material, clarification of complex issues, demonstration of examples, and prompt checking of understanding. Asynchronous methods allow for an individual pace of work, repeated engagement with educational content, and extended written interaction. This contributes to a deeper understanding of the material and the formation of stable knowledge. Digital platforms' functional capabilities determine the organisation of the educational process by structuring educational content, placing assignments, conducting assessment and recording learning outcomes (Epitech, n.d.). These environments provide a unified system for accessing educational materials and communication tools, enabling both individual and group work within a single course. One such component is support for various channels of interaction, including individual consultations, group discussions, and automated forms of knowledge assessment. This creates a multi-level structure within the educational process.

Official statistical data shows a steady increase in the use of digital educational formats in Europe and around the world. According to Eurostat, 34.8% of internet users in EU countries participated in online courses or used digital learning materials in 2025, compared to 33.4% in 2024 and 21.4% in 2019. This indicates the gradual institutionalisation of digital learning as part of educational practice. However, uneven participation across countries is evident: in the Netherlands, for example, the level of engagement in online learning exceeds 60%, whereas in some Eastern European countries this figure is lower, reflecting digital inequality in access to educational technologies (European Commission, 2026).

One aspect of digital educational communication is the use of LMSs, which organise the learning process and provide access to materials, communication, and control of learning outcomes. Studies in the United States indicate that LMS implementation is widespread: up to 98% of educational institutions use such platforms, and approximately 78% of students regularly log in to complete tasks and interact with lecturers (ZipDo, 2026). Concurrently, the average student activity level in these systems is characterised by regular logins throughout the week and

lengthy learning sessions, indicating the integration of digital tools into everyday educational practice. Overall, these data confirm that digital educational communications are becoming systemic, ensuring flexibility and continuity of learning, as well as expanding opportunities for interaction between lecturers and students in the modern educational environment.

By 2025, Ukraine's education system will have undergone significant digital transformation, characterised by high levels of digital activity among the population and rapid development of educational platforms. According to the Ministry of Digital Transformation of Ukraine, 96% of Ukrainians possess digital skills and 58% have a basic level of digital literacy, corresponding to the EU average. Furthermore, 42% of adults and 70% of adolescents utilise artificial intelligence tools for learning and everyday activities, highlighting the integration of digital communication into the educational process (Ministry of Digital Transformation of Ukraine, 2025). Ukraine is actively developing online learning infrastructure and distance education platforms in the context of digital education. Analytical materials on the digital transformation of education by the State Scientific Institution 'Institute of Educational Analytics' (n.d.) reveal that the country is implementing electronic registers, online platforms, distance courses, and blended learning, while also providing pupils and students with access to educational materials through state digital services. It is also noted that teachers are

undertaking professional development in digital literacy, contributing to effective pedagogical communication in the online environment (Koshevets, 2026). Digital education in Ukraine is developing into a resilient educational ecosystem that includes LMS platforms, adaptive technologies, and networked educational resources. In times of crisis, particularly during war, digital tools have become essential for ensuring the continuity of learning and facilitating interaction between lecturers and students.

In the digital educational environment, the relationship between lecturer and student is characterised by continuous interaction, combining the transfer of knowledge, its joint construction, and the reciprocal exchange of information. The lecturer organises the learning process, moderates communication and provides methodological support, while the student is an active participant who receives educational material and participates in its discussion, interpretation and practical application (Xia *et al.*, 2023). This interaction is facilitated through various digital channels, ensuring both synchronous and asynchronous information exchange. This enables prompt responses to learning requests, correction of errors, and maintenance of the continuity of the educational process. Consequently, a dynamic system of pedagogical communication emerges, wherein both parties are equal participants in a learning process aimed at achieving educational outcomes and fostering the student's learning autonomy. Table 1 examines the respective roles of lecturers and students in the digital environment.

Table 1. The role of the lecturer and the student in the digital environment

Role of the lecturer	Role of the student
Organiser of the educational process, who structures educational content and determines the logic of the course	Active participant in the learning process, who completes assignments and takes part in interaction
Facilitator, who guides learning activity and supports cognitive engagement	Researcher, who independently works through the material and searches for additional sources of information
Moderator of communication, who regulates discussions and ensures learning interaction	Co-creator of knowledge, who participates in group discussions and collaborative projects
Consultant, who provides explanations, recommendations and individual feedback	Independent subject of learning, who plans their own educational trajectory
Assessor of learning outcomes, who monitors and conducts final assessment	Performer and reflective participant, who analyses their own results and improves learning actions

Source: compiled by the authors based on Woolap (2024), Vertex University (2026)

Chats facilitate rapid information exchange, clarification of learning tasks, and coordination of collaborative student activity. They provide a constant channel for brief communications. Forum discussions aim to facilitate in-depth analytical interaction, encouraging argumentation, the exchange of opinions, and reflection on educational material. Video communication enables direct contact between participants in the educational process, facilitating explanations of complex topics, demonstrations and discussions of completed assignments. Interactive collaborative tools support the collective creation of educational products, the structuring of information, and the visualisation of educational material, thereby activating students' cognitive activity. In the digital environment, feedback is

implemented as a multi-level system of interaction, including assessment by the lecturer, peer review among students, and self-monitoring of learning outcomes. This organisation ensures the continuity of correction in learning activities and improves the quality of material acquisition (Maier & Klotz, 2022). Group learning activities are based on role distribution, joint project completion and collective decision-making, which fosters cooperation and responsibility for shared outcomes. Individual work involves independent engagement with material, the choice of learning pace, and the formation of a personal learning trajectory according to one's needs. Digital educational communication combines various interaction formats, creating flexible learning conditions, increasing student engagement

and expanding the educational environment's possibilities. In such a system, learning acquires a multidimensional character, combining individual, group and networked forms of interaction, which contributes to the development of learning autonomy, communication skills and the ability to work in a digital environment.

In a digital society, models of educational communication organise interaction between lecturers and students, determining the methods by which knowledge is transferred, acquired and exchanged during the educational process. They facilitate the structuring of learning activities, the regulation of student engagement levels and the formation of effective feedback mechanisms. Consequently, learning becomes more manageable, consistent, and adapted to the conditions of the digital environment,

in which online platforms, interactive resources, and remote working play an important role (Al Salameh & Abdelaziz, 2025). Such approaches also improve the quality of educational interaction by contributing to the development of student autonomy, activating group collaboration and expanding access to global sources of knowledge. They enable the combination of individual learning and collective activity, creating conditions for a more flexible educational process. Consequently, a new type of pedagogical interaction emerges, centred on constant information exchange, the development of digital competencies, and the enhancement of learning effectiveness in the context of the digital transformation of education. Table 2 presents a comparative analysis of models of educational communication in the digital environment.

Table 2. Comparative analysis of models of educational communication according to interaction criteria

Criterion	Teacher-centred communication model	Student-centred communication model	Collaborative learning model	Connectivist communication model
Level of interactivity	The lecturer delivers a lecture via Zoom/Microsoft Teams; students listen and answer questions only at the end of the session	The student works with interactive tasks (Kahoot, Quizizz) and asks questions in the chat during learning	Students interact with one another in groups via Microsoft Teams and discuss tasks in chats and video meetings	Students interact through online communities (forums, YouTube comments, MOOCs); communication takes place beyond the lesson
Effectiveness of feedback	The lecturer checks work in Moodle/Google Classroom and assigns grades with comments after completion	The lecturer provides individual comments in Google Classroom, responds in the chat or conducts brief consultations	Feedback takes place between students through peer review in Google Docs and discussion of group results	Feedback is obtained through online communities, forums and comments on educational platforms
Degree of student autonomy	The student completes assignments according to the lecturer's instructions and does not change the structure of learning	The student independently chooses the order of completing tasks in Google Classroom and the pace of learning	The student independently performs a role in the group and makes decisions within the project	The student independently forms a learning pathway through Coursera, YouTube, blogs and forums
Opportunities for organising collaborative work	Collaborative work is almost absent; individual assignments are completed through Moodle	Discussions in chats and joint discussions in Padlet or forums	The main form of learning is group projects in Google Docs, Microsoft Teams and Trello	Collaboration takes place in global online communities and open educational networks
Use of digital tools	Zoom, Moodle, PowerPoint, electronic tests	Google Classroom, Kahoot, Quizizz, Padlet	Microsoft Teams, Google Docs, Miro, Trello	Coursera, edX, YouTube, blogs, forums, Discord

Note: MOOCs – Massive Open Online Courses

Source: compiled by the authors based on Zoom (n.d.), Microsoft Teams (n.d.), Moodle (n.d.), Google Classroom (n.d.), Kahoot (n.d.), Quizizz (n.d.), Padlet (n.d.), Google Docs (n.d.), Trello (n.d.), Miro (n.d.), Coursera (n.d.), edX (n.d.), YouTube (n.d.), Discord (n.d.), Z.N. Ghafar (2023), Europass Teacher Academy (2024), Education Endowment Foundation (n.d.), K. Pace (2026)

The advantages of digital communication formats in education primarily consist of increasing flexibility, interactivity and accessibility, since interaction between lecturers and students can take place in both synchronous and asynchronous modes, without being restricted to the classroom. This enables students to independently regulate the pace at which they absorb material, revisit educational content at a convenient time, and combine learning with other activities. This is particularly important in the context of digital society (Haleem *et al.*, 2022). Another advantage is improved feedback quality, as digital tools allow lecturers

to mark assignments quickly, provide comments and correct students' work almost in real time. This contributes to more effective knowledge acquisition, as students immediately receive information about errors and have the opportunity to correct them without delay. Additionally, digital formats offer greater potential for personalised learning, fostering student autonomy, teamwork skills, and a culture of digital communication – all of which are essential competencies in the modern educational landscape.

A comparative analysis of educational communication models shows that teacher-centred models have low

interactivity, limited feedback and minimal student autonomy, but ensure structured learning. The student-centred model increases engagement and the customisation of learning while expanding autonomy and improving feedback quality. The collaborative learning model is the most effective for developing teamwork skills, communication, and the practical application of knowledge, thanks to its high level of interactivity and active peer-to-peer exchange. The connectivist model offers students maximum autonomy and extensive opportunities for networked interaction. However, it requires a high level of self-regulation, making it most effective in digital environments for motivated learners.

The effectiveness of digital educational platforms within the online education system is determined by their ability to organise, manage and support the entire learning process within a unified digital environment. Such platforms combine synchronous and asynchronous interaction, enabling direct, real-time communication between lecturers and students, as well as delayed interaction through assignments, materials, and discussions. This allows for flexible organisation of learning, enabling students to work through material at their own pace while allowing lecturers to structure the course, monitor activity, and ensure

continuity of the educational process, regardless of participants' physical presence. Particular importance is attached to functions such as feedback, assessment and the organisation of collaborative activity, which facilitate effective pedagogical interaction in the digital environment. Platforms enable automated, personalised assessment of learning achievements, provide feedback on completed assignments and dynamically monitor students' progress. Another important feature is support for group work, implemented through collaborative projects, discussions, and the coordination of learning activities. Additionally, digital platforms integrate multimedia content, expanding the possibilities for presenting educational material and increasing the level of assimilation. Taken together, these features form a multifunctional educational environment that facilitates effective communication between lecturers and students, thereby improving the quality of online education. Table 3 presents the results of a systems analysis of the functional capabilities of digital educational platforms within the online education system. The analysis focuses particularly on ensuring synchronous and asynchronous communication, organising group work, providing feedback and assessments, and integrating multimedia content into the educational process.

Table 3. Functional capabilities of digital educational platforms in the system of online education

Digital platform	Synchronous communication	Asynchronous communication	Group work	Feedback and assessment	Integration of multimedia content
Moodle	Support for online meetings through integrated modules	Forum discussions, placement of materials and assignments	Group courses, collaborative assignments	Tests, automated assessment, lecturer's comments	Videos, presentations, documents, interactive elements
Google Classroom	Limited synchronous interaction through integrations	Assignments, announcements, comments	Collaborative projects through assignments	Comments, assessment rubrics, rapid feedback	Documents, presentations, video materials
Microsoft Teams	Video classes, real-time chat	Chats, channels, storage of materials	Team spaces, projects	Discussions, comments, assessment of assignments	Videos, presentations, shared files
Zoom	Main tool for videoconferencing	Recording of classes for later viewing	Use in group discussions	Oral feedback during classes	Screen sharing, presentations
Canvas	Integrated video and synchronous sessions	Assignments, modules, messages	Group spaces for learning	Learning analytics, assessment, comments	Videos, interactive modules, files

Source: compiled by the authors based on Moodle (n.d.), Google Classroom (n.d.), Microsoft Teams (n.d.), Zoom (n.d.), Canvas (n.d.)

Digital educational platforms provide comprehensive support for pedagogical interaction by integrating synchronous and asynchronous communication channels. This makes it possible to organise the learning process in various formats. Synchronous tools facilitate direct, real-time interaction between lecturers and students, and can be used to deliver explanations of educational material, conduct consultations, discuss complex issues, and provide immediate feedback. Asynchronous capabilities, in turn, enable independent engagement with material, the completion of assignments at a convenient pace, and participation in forum discussions. This contributes to deeper knowledge acquisition and the development of students' learning autonomy. Digital platforms are distinguished by their ability to support group learning

activities, such as collaborative projects, team assignments and collective discussion of results. This fosters the development of communication and teamwork skills, as well as the ability to make joint decisions. Digital assessment and feedback functions should also be noted, as they enable lecturers to promptly monitor students' learning achievements, provide comments and adjust the learning trajectory. Taken together, these capabilities ensure effective pedagogical interaction, improve communication quality between educational process participants and contribute to learning individualisation in the digital environment (Shyshenko, 2022). The comparative analysis shows that, for full-scale courses involving systematic assessment and asynchronous learning, Moodle and Canvas are the most effective; Microsoft Teams is optimal for blended

learning and team interaction; Google Classroom is suitable for rapidly organising the learning process and providing basic feedback; and Zoom is ideal for synchronous classes and online lectures. Overall, these results suggest that the most effective approach is to combine platforms depending on the educational scenario.

Digital educational communication formats are classified according to the type of interaction, the method of organising the learning process, and the functional purpose of the teaching tools. Within synchronous communication,

videoconferencing plays a key role as it enables direct, real-time interaction between lecturers and students. It can be used for lectures, seminars, project defence and consultations, enabling material to be explained, complex issues to be clarified and understanding of the topic to be checked promptly. The pedagogical function of this format lies in providing immediate feedback, monitoring learning activity, and maintaining learning discipline in a distance learning environment (Sultonovna, 2025). Table 4 presents the classification of digital educational communication formats.

Table 4. Classification of formats of digital educational communication

Format of digital communication	Type of interaction	Pedagogical functions	Features of use in the educational process
Videoconferencing	Synchronous, real-time	Explanation of new material, organisation of lectures and seminars, immediate feedback, monitoring of learning activity	Used for online lectures, consultations and project defence; ensures direct interaction between lecturer and students
Chats	Asynchronous/ semi-synchronous	Prompt communication, clarification of assignments, coordination of learning activity	Used for quick responses, organisational messages and support for group interaction outside classes
Forums	Asynchronous	Development of analytical thinking, argumentation, discussion, reflection	Allow extended responses, repeated review of discussions and in-depth engagement with educational material
Interactive whiteboards	Synchronous/ asynchronous	Visualisation of knowledge, collaborative construction of information, development of critical thinking	Used to create diagrams, mind maps, collective work on assignments and structuring of educational material
LMSs	Integrated, synchronous and asynchronous	Organisation of the learning process, assessment, progress monitoring, course management	Ensure the centralisation of educational materials, assignments, testing and communication between participants in the educational process

Source: compiled by the authors based on Y. Skiba (2025)

Asynchronous communication is facilitated via forums and chat rooms, enabling students to interact outside of class time. Chats are used to quickly answer organisational questions, clarify assignments and coordinate group work. They ensure a continuous channel of communication and support learning interaction outside of classroom time. Forum discussions encourage deeper engagement with educational topics, the articulation of arguments and analytical thinking, as students can formulate extended responses, analyse the views of other participants and revisit discussions at any time. Interactive whiteboards are used to visualise educational material and create content collaboratively. They enable lecturers to demonstrate diagrams, concept maps and algorithms for solving tasks, while students can contribute their own ideas, add comments and organise information (Hanna, 2024). Interactive whiteboards facilitate visual and activity-based learning, critical thinking, and the collective construction of knowledge when educational material is created through interaction. Learning Management Systems integrate all formats of digital communication into a single educational platform. Within these systems, educational materials are stored, assignments are organised, testing and assessment are carried out and student learning activity is monitored (Al-Dhief *et al.*, 2024). Their pedagogical function is to manage the learning process, ensure the structured nature of

educational content, and record learning outcomes. LMSs also support the individualisation of learning by adapting assignments and monitoring each student's progress. This allows lecturers to adjust the educational trajectory according to students' levels of preparedness. It has been shown that digital communication formats perform inter-related pedagogical functions: synchronous tools ensure immediate interaction and learning control, asynchronous tools support in-depth engagement with content and the development of autonomy, interactive whiteboards support collaborative knowledge construction, and LMSs ensure the systematic organisation of the entire educational process. Together, they form a multi-level model of educational communication in which learning takes place through constant interaction, information exchange, and collaborative activity between lecturers and students within a digital environment.

DISCUSSION

In the digital society, educational communication has undergone a structural transformation in the way lecturers and students interact. This interaction has become hybridised through digital platforms, social networks, mobile applications and artificial intelligence tools. The effectiveness of this interaction is determined by the digital competence of the participants and the level of digital infrastructure

at the educational institution. This transformation increases the accessibility of educational resources, expands opportunities for personalised learning and establishes new models of pedagogical interaction in the context of educational digitalisation. The facts identified regarding educational communications corresponded with the conclusions of M. Alenezi *et al.* (2023), who demonstrated that integrating digital education into higher education involves restructuring methods of interaction and requires lecturers to adapt to digital environments. The authors emphasised the existence of organisational and technical barriers, a finding that was confirmed by the results concerning the influence of infrastructural conditions on communication. The obtained data were corroborated by A. Almusaed *et al.* (2023) study, which found that using artificial intelligence in hybrid learning increases student engagement and alters the nature of educational interaction. This study emphasised AI's role as a mediator of communication, corresponding with the identified trend of automating some learning processes. The observed results coincided with the conclusions of B. Cabellos *et al.* (2024). It was demonstrated that lecturers' digital attitudes and the conditions of the educational environment determine the intensity of ICT use and the development of students' digital skills. The interpretation indicates a dependence on pedagogical readiness for digital change. The research results showed that digital educational communications are more effective when synchronous and asynchronous learning formats are combined. This is evidenced by the 78% level of student engagement in LMSs and the increase in the proportion of EU online learning users from 21.4% to 34.8%. The patterns identified regarding lecturers' readiness for digital change were consistent with the findings of J. Castaño Muñoz *et al.* (2021), who demonstrated that collaboration among lecturers fosters students' digital competence development. It was also found that institutional self-assessment tools support the development of the digital environment, which is consistent with the conclusions regarding the role of collective pedagogical interaction. This is consistent with the findings of C. Chang *et al.* (2023), who considered digital literacy to be a key factor in the effective use of AR, VR, and MR technologies for learning purposes. This enabled this study to conclude that multimedia technologies significantly alter the structure of educational communication.

The results of the study were consistent with the conclusions of M. de Obeso *et al.* (2023), who found that students' perception of lecturers' digital competence influences the level of trust and interaction. The importance of lecturers' digital authority in facilitating effective communication was confirmed. The obtained data were consistent with the results of V. Díaz-García *et al.* (2023) in direction. The digital transformation of educational institutions was considered a complex managerial process influencing the introduction of new learning interactions. It was found that organisational support determines the pace of digital communication. Observed trends corresponded with the findings of W. Jeong *et al.* (2024), who found that the digital capital of participants

in the educational process affects academic achievement. This allows inequality in access to digital resources to be viewed as a factor in the asymmetry of educational communication. This asymmetry manifests as differences in engagement with digital platforms, access to educational materials, and interaction opportunities between participants in the educational process. This coincided with the conclusions of A. Josué *et al.* (2023), who regard digital platforms as a key tool for organising the learning process. Educational technologies increase student engagement by providing interactive learning mechanisms. This is evident in students' increased activity when completing assignments and their enhanced participation in the communicative processes of the learning environment. The identified patterns were consistent with the results of J. Kim (2023), who considered interaction between lecturers and artificial intelligence to be a new form of pedagogical cooperation. Integrating artificial intelligence into the educational process changes the roles of participants and the nature of their communication. It also contributes to the emergence of new formats that support learning activities and automate certain pedagogical functions. These new formats include intelligent tutoring, personalised learning recommendations, adaptive assessment, automated feedback, virtual assistants, chatbots for student consultations, systems for predicting learning outcomes, and tools for automatically generating educational content. The automation of pedagogical functions includes checking assignments, monitoring learning activities, analysing students' progress, and preparing personalised learning plans.

AI has transformed the role of lecturers by changing communicative functions and reorienting pedagogical activity towards interaction with digital systems. These results are consistent with the conclusions of S. Mhlongo *et al.* (2023), who found that barriers to implementing digital technologies include insufficient resources and low digital skills, which limit the full integration of innovative tools into the learning process. This results in uneven development of digital educational practices across different institutions. The obtained data corresponded to the results of S. Muammar *et al.* (2022). The quality of the learning process is determined by lecturers' digital competence. This confirms the importance of pedagogical digital training for effective communication. The results were also consistent with the conclusions of A. Ou *et al.* (2024), who considered artificial intelligence to be a factor that alters the nature of academic discourse and the organisation of educational interaction in higher education. Communication processes become mixed, combining human and technological participation in the transmission and processing of educational content. This is consistent with V. Ratten (2023) study, which described the transition to digital teaching methods following the pandemic. This made it possible to explain the dominance of digital interaction formats. The identified trends corresponded to the conclusions of A. Purwanto *et al.* (2023), who considered social networks to be a tool for educational communication. This confirmed the expansion of channels of interaction between

lecturers and students. The results obtained coincided with Y. Shi (2023) data, which considered mobile platforms to be an effective learning tool. It was established that the portability of technology strengthens communication continuity. Interactive synchronous platforms were found to be the most effective, providing immediate feedback and explanations of complex educational material. Asynchronous environments, meanwhile, contributed to students' development of independence. Combining individual and group work formats in digital environments improved the quality of knowledge acquisition and expanded the possibilities for collaborative learning. The obtained data correlated with the results of Z. Wang & Z. Chu (2023), which found that lecturers' self-assessment of digital competence influences the effectiveness of the educational process. Additionally, the authors emphasised that developing teachers' digital skills increases student engagement and improves the quality of learning interactions. Y. Xie *et al.* (2022) found that structured interaction scenarios are required for online communication to improve learning effectiveness. The researchers noted in particular that organised communication protocols reduce students' cognitive load and contribute to better assimilation of educational material. They also established that planning the stages of interaction between participants in the educational process increases engagement, improves feedback quality, and facilitates the more effective completion of individual and group tasks in a digital environment. Overall, the study's findings indicated a transformation in educational communication under the influence of digital technologies, particularly artificial intelligence and mobile platforms. It was established that the effectiveness of the learning process depends to a significant extent on the level of lecturers' digital competence, the quality of the organisation of online interaction and the structured nature of communication scenarios. The obtained results confirmed that the digitalisation of educational communications contributes to increasing the effectiveness of the learning process, expanding opportunities for interaction between its participants and developing students' learning autonomy. The combination of digital platforms, pedagogical approaches and artificial intelligence technologies forms a flexible educational environment capable of adapting to the needs of education.

CONCLUSIONS

In the digital society, educational communications function as an integrated system of interaction between lecturers and students. Combining digital platforms and synchronous and asynchronous learning forms, they contribute to the development of learning autonomy, cooperation and digital competence, as well as improving the effectiveness of the educational process. Student-centred, collaborative and connectivist approaches ensure active student participation in knowledge creation, expand feedback possibilities and form a flexible, adaptive learning environment. Generalisation of the results shows that digital educational communications are highly effective when combining

synchronous and asynchronous formats. At the same time, 78% of students are engaged with LMSs, and the share of online learning users in the EU has increased from 21.4% to 34.8%, confirming a stable trend in the digital transformation of education. The most productive formats are interactive, synchronous platforms for explaining complex material and providing immediate feedback. Asynchronous environments, on the other hand, ensure deeper engagement with content and increase learning autonomy. Combining group and individual work formats on digital platforms expands opportunities for cooperation and improves the quality of knowledge acquisition. This is confirmed by the steady growth of digital activity among students and lecturers.

Platforms enable automated and individual assessment of learning achievements, provide feedback on completed assignments and dynamically monitor students' progress, thereby increasing the accuracy and promptness of pedagogical control and correction in learning activities. An important feature is the support for group work, implemented through collaborative projects, discussions, and the coordination of learning activities. This ensures the development of communication and teamwork skills. Additionally, digital platforms integrate multimedia content, expanding the possibilities for presenting educational material and increasing the level of assimilation through visualisation and interactivity. Taken together, these features create a multifunctional educational environment that facilitates effective communication between lecturers and students, thereby improving the quality of online education, as evidenced by the results of systems analysis of digital educational platforms in pedagogical practice.

Digital educational communication can be classified into three formats: synchronous, asynchronous, and integrated tools of interaction. These formats perform different pedagogical functions in the educational process. Video-conferencing enables direct contact between lecturers and students, providing immediate feedback. Chats and forums facilitate rapid communication and in-depth discussion of educational topics, while interactive whiteboards support the collaborative creation and visualisation of knowledge. Learning Management Systems combine all these formats to organise the learning process and assess and monitor students' progress. This increases the effectiveness of pedagogical interaction in the digital environment. Further research could focus on the effectiveness of specific digital platforms in different educational contexts, particularly in face-to-face, blended and distance learning settings, and in institutions offering general, higher and postgraduate education.

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Олена Дудар

Кандидат психологічних наук, доцент
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0000-0003-0541-5646>

Ярослав Щоголев

Старший викладач
Університет Григорія Сковороди в Переяславі
08401, вул. Сухомлинського, 30, м. Переяслав, Україна
<https://orcid.org/0009-0007-7814-638>

Освітні комунікації в цифровому суспільстві: нові формати взаємодії між викладачем і студентом

Анотація. Метою дослідження було з'ясування впливу цифрових технологій на зміну характеру та організацію взаємодії між викладачем і студентом у сучасному освітньому процесі. Методологія дослідження включала теоретичний аналіз наукових джерел, метод порівняння, метод системного аналізу, метод систематизації та узагальнення. Було з'ясовано, що результати свідчать про стабільне зростання ефективності цифрових освітніх комунікацій, що підтверджується підвищенням рівня участі в онлайн-навчанні з 21,4 % до 34,8 % у Європейському Союзі та високою інтеграцією Learning Management System, якими регулярно користуються близько 78 % студентів. Було визначено, що синхронні формати забезпечують найвищу ефективність у ситуаціях пояснення складного матеріалу та оперативного зворотного зв'язку, тоді як асинхронні середовища та комбіновані платформи демонструють кращі результати у розвитку автономності студентів, глибокому опрацюванні навчального контенту та організації групової взаємодії. Студентоцентризований, колаборативний і конективістський підходи сприяють розвитку самостійності студентів і активізації їхньої взаємодії. Було визначено, що вони дозволяють поєднувати індивідуальне навчання з командною діяльністю та створюють умови для гнучкого освітнього процесу. Визначено, що цифрові платформи забезпечують автоматизоване та індивідуальне оцінювання навчальних досягнень студентів. Вони дають змогу надавати оперативний зворотний зв'язок і відстежувати прогрес у динаміці. Також вони підтримують організацію групової роботи через спільні проекти та обговорення. У сукупності це підвищує якість освітньої взаємодії. Виокремлено, що класифікація форматів цифрової освітньої комунікації охоплює синхронні та асинхронні інструменти взаємодії. Відеоконференції забезпечують безпосередній контакт між учасниками навчання та оперативний зворотний зв'язок. Результати дослідження можуть бути використані викладачами, адміністрацією закладів вищої освіти та розробниками освітніх програм для вдосконалення організації цифрової освітньої комунікації та підвищення ефективності взаємодії між викладачем і студентом

Ключові слова: поширення інформації; педагогічна функція; мультимедійний контент; форумні обговорення; передача знань