

Socio-Psychological Factors of the Efficiency of Personal Communication of Future Specialists in Virtual Information Space

By Andrii Bohuslavets¹, Oleh Khmiliar², Anna Levenets³, Olena Shcherbyna⁴,
Maryna Andriievska⁵

ABSTRACT:

The relevance of the study is due to the growing role of digital communication in the professional training of future specialists and the need to develop skills for effective interaction in virtual environments. The aim of the work is to identify the features of the formation of key components of students' digital communication and determine the factors that influence the quality of their interaction in online formats. The object of the study is the digital communication skills of future specialists, and the subject is their emotional, cognitive-perceptual and behavioral manifestations in digital environments. The research methodology is based on a structured short questionnaire and the assessment of real behavioral indicators (average reaction time, number of initiated messages, frequency of participation in discussions), which allowed combining subjective and objective data. The results of the study showed uneven development of individual components: the highest values were demonstrated by social-perceptual sensitivity (M = 4.17) and general digital communicative competence (M = 4.09), while emotional regulation (M = 3.84), behavioral activity (M = 9.32) and digital reactivity (M = 12.46 sec.) revealed lower or more variable values. The initiative of students (M = 14.73) significantly exceeds the level of their stable participation in team interactions, which indicates the predominance of impulsive forms of communication over regular ones. Based on the data obtained, a system of practical recommendations was formed aimed at developing emotional self-regulation, increasing behavioral stability, optimizing the pace of digital interaction and creating supportive communication practices in digital learning environments. The results of the study have practical significance for the development of educational programs aimed at developing the digital communicative competence of future specialists.

Keywords: digital communication, socio-psychological factors, emotional regulation, social-perceptual sensitivity, digital reactivity, behavioral activity, initiative, communicative competence, virtual educational environment, digital platforms

¹PhD in Psychological Science, Senior Research, Head of the Laboratory, Center, Military Academy named after Yevheniy Bereznyak, Kyiv, Ukraine.

²Doctor of Psychological Sciences, Professor, Head of the Research Center for Issues of Physical Education, Special Physical Training, and Sports, Educational and Scientific Institute of Physical Culture, Sports and Health Technologies, National Defense University of Ukraine, Kyiv, Ukraine.

³Candidate of Psychological Sciences (PhD), Senior Lecturer, Military Faculty of Social and Behavioral Sciences, Department of Military Psychology and Pedagogy, Military Institute of Taras Shevchenko National University of Kyiv, Kyiv, Ukraine.

⁴Candidate of Pedagogical Sciences, Associate Professor, Department of Foreign Languages, Military Academy named after Yevheniy Bereznyak, Kyiv, Ukraine.

⁵Lecturer, Department of Personality Psychology and Social Practices, Faculty of Psychology, Social Work and Special Education, Borys Grinchenko Kyiv Metropolitan University, Kyiv, Ukraine.

1. Introduction

The rapid digitalization of society is fundamentally changing the nature of professional and interpersonal interaction, forming new rules of communication, new formats of social presence and fundamentally different channels of information exchange. In these conditions, virtual space ceases to be just a tool to support educational processes – it is transformed into a full-fledged environment of social action, in which future specialists build professional, academic and personal interactions. That is why the effectiveness of digital communication becomes a critically important competence that determines not only the success of training, but also the readiness of young specialists to work in the conditions of the network economy and hybrid formats of cooperation. At the same time, researchers emphasize that the digital environment is fundamentally different from traditional forms of interaction: it is multimodal, dynamic and highly stimulating, which requires new psychological, cognitive and behavioral strategies from users (Dubovi, 2022; Trepte, 2021). It is these features that make the problem of digital communication one of the key ones for modern pedagogical and psychological science.

The relevance of the study is due to a number of factors. First, digital platforms significantly change the ways in which information is exchanged, which affects social engagement, emotional regulation, and the perception of interaction (Liang *et al.*, 2024; Huang *et al.*, 2023). Secondly, the growing role of virtual educational communities puts forward new requirements for the ability of future specialists to act in conditions of asynchrony, information overload and changing communicative norms. Thirdly, against the background of the widespread use of artificial intelligence technologies and automated communication tools, the need for a deeper understanding of what socio-psychological factors determine the quality of interaction and how they are formed in youth digital environments is increasing. A review of modern scientific sources indicates significant progress in the study of digital behavior, but some aspects remain insufficiently clarified. A number of researchers focus on cognitive and emotional mechanisms that affect the quality of communication in digital learning (Huang *et al.*, 2023; Dubovi, 2022), while others emphasize the importance of social-perceptual and group-dynamic processes (Liang *et al.*, 2024; Chan, 2023). Considerable attention has also been paid to media affordances and technical characteristics of platforms that shape the boundaries of self-presentation and influence feelings of safety, autonomy, and social support (Trepte, 2021; Liu *et al.*, 2020). However, scientific works have not sufficiently explored the relationship between emotional regulation, digital reactivity, initiative, and sustained behavioral activity within the real educational process, as well as how the structure of these factors forms a holistic model of communication behavior of future specialists.

The discrepancy between a developed ability to understand social cues and a weaker ability to manage one's own emotions has a noticeable impact on the quality of communication in the digital space, especially when the workload increases. Even if a student is good at recognizing nonverbal cues online, this does not mean that they will be able to maintain stable interaction without emotional self-control skills. Therefore, digital literacy programs should be supplemented with elements of emotional intelligence. This will help future professionals better cope with the challenges of professional communication in virtual educational environments. The issue of a comprehensive analysis

of the socio-psychological factors of digital communication remains problematic, since most of the existing studies focus on individual components, without taking into account their interaction. The relationship between the cognitive-social and emotional-behavioral elements of interaction in virtual learning environments is also insufficiently described, which requires theoretical clarification and empirical confirmation. In addition, there is a lack of studies in which these factors would be assessed simultaneously – using a standardized methodology, based on mixed indicators and real behavioral data.

In view of this, the purpose of this work is to identify the structure of socio-psychological factors of the effectiveness of personal communication of future specialists in the digital environment and characterize the features of their manifestation in conditions of real educational interaction. To achieve the goal, the following tasks were defined: to find out the level of formation of key cognitive, emotional-regulatory and behavioral indicators; to compare their intensity and relationships; to describe specific patterns of digital communication of students; to analyze the consistency of the results obtained with modern theoretical models.

2. Theoretical Background

Modern scientific approaches to the study of personal communication in a virtual environment are formed at the intersection of cognitive, socio-psychological and technical-communication concepts. Researchers emphasize the importance of cognitive processes and multimodal engagement during interaction in digital environments, emphasizing the role of attention, information processing and flexible learning strategies (Dubovi, 2022; Serrano-Mendizábal et al., 2023). In the context of emotional regulation, numerous works demonstrate that emotional intelligence and the ability to control one's own state are key prerequisites for effective communication in conditions of intense online interaction (Huang et al., 2023; Wartberg et al., 2021; Warriner et al., 2021). The social-perceptual dimension of virtual communication is associated with the accuracy of interpreting the intentions of the interlocutor and social sensitivity, which is confirmed by studies on user behavior in digital social communities (Liang et al., 2024; Chan, 2023; Shi et al., 2019; Xie & Xie, 2020). Motivational and social factors, such as fear of missing out, the need for social support, and the dynamics of interaction in network groups, have become the subject of study in works analyzing youth behavior and the features of using social platforms (Schmuck, 2021; Scherr & Wang, 2021; Wiederhold, 2020).

Research on the technical aspects of interaction emphasizes the role of digital platforms, media affordances, and privacy as factors that determine the style, depth, and security of communication (Trepte, 2021; Vimalkumar et al., 2021; Baik, 2020; Lim, 2021). In the same context, work in the field of learning technologies emphasizes the importance of analytics, adaptive strategies and digital literacy to maintain quality online interactions (Lytras et al., 2020; Yilmaz, 2020; Fu & Lai, 2020). Particular attention in the current literature is paid to group dynamics, conflicts and psychological adaptation in digital communities and among young people. Studies show that conflict resolution strategies, stress levels and characteristics of working or learning conditions significantly affect the quality of communication and psychological comfort of participants (Wang et al., 2020; Parker et al., 2021; Stryker et al., 2022).

The digital transformation of education and professional activity has increased interest in research that examines the use of artificial intelligence, online platforms, and support systems in the development of communicative competences of future professionals (Batsurovska *et al.*, 2024; Liu *et al.*, 2020; Tzafilkou *et al.*, 2021). Recent publications also note the relationship of digital communication with well-being, inclusion, social support, and behavioral regulation in complex information environments (Macchia & Whillans, 2022; Liang *et al.*, 2024). A separate layer of scientific works is devoted to the regulatory and social aspects of digital interaction. Research in the field of digital privacy demonstrates that regulatory mechanisms and privacy policies can significantly influence the nature of communication, the level of trust and openness of users (Baik, 2020; Vimalkumar *et al.*, 2021). In addition, analysis of open government data suggests that digital platforms are shaping new models of user interaction with government institutions, emphasizing the importance of transparency and efficiency in information exchange (Lim, 2021).

The sociocultural dimension of communication in virtual spaces is often described through the behavioral patterns of young people and the specifics of digital socialization. Research shows that intense involvement in video games, digital social platforms, or online communities affects personal attitudes, emotional states, and communication styles (Shi *et al.*, 2019; Xie & Xie, 2020; Schmuck, 2021; Scherr & Wang, 2021). Such findings are consistent with psychological models of stress, procrastination, and behavioral regulation that identify risks and limitations in children and adolescents' digital interactions (Wartberg *et al.*, 2021; Wang *et al.*, 2020). In the context of professional development, works devoted to the intellectual structures of digital communities, online communication and distance learning platforms occupy a significant place. In particular, systematic reviews emphasize the transformation of the structure of online networks and their role in shaping the intellectual environment of interaction (Fu & Lai, 2020), as well as the growing importance of digital analytics, process feedback and adaptive educational strategies (Yilmaz, 2020; Lytras *et al.*, 2020). At the same time, research in the field of organizational psychology suggests that the quality of jobs, activity design, and digital requirements affect cognitive resilience and the ability to communicate productively (Parker *et al.*, 2021; Macchia & Whillans, 2022). Extensive empirical work demonstrates that participation in digital communities, online support groups, or professional networks can improve well-being, social inclusion, and interactional productivity – provided that such environments are built on trust and effective social norms (Liang *et al.*, 2024; Liu *et al.*, 2020; Chan, 2023). At the same time, it is emphasized that conflicts in digital environments, political incorrectness or violation of communicative norms worsen the quality of personal communication (Stryker *et al.*, 2022; Wang *et al.*, 2020).

Thus, a generalization of scientific sources shows that modern research pays attention to a wide range of factors of digital communication: from cognitive-emotional mechanisms (Dubovi, 2022; Huang *et al.*, 2023) to social, ethical and technological parameters of interaction (Trepte, 2021; Baik, 2020). The holistic approach presented in the literature allows us to outline a multidimensional system of factors that determine the effectiveness of personal communication of future professionals in digital environments. Despite a significant amount of research, previous works do not sufficiently reveal the relationship between emotional regulation, behavioral activity and digital reactivity in a

professional educational context. In addition, it has been almost not studied how complex social and psychological factors simultaneously form stable models of communication behavior of future professionals in multimodal digital environments.

3. Methods

The empirical research methodology was built on the basis of a structured short questionnaire (Appendix A) and a matrix of operationalization of variables (Appendix B), specifically designed to measure six key components of digital communication of future professionals: emotional regulation (ER), socio-perceptual sensitivity (SPC), digital reactivity (DR), initiative in digital interaction (IC), behavioral activity (BA) and general digital communicative competence (GCC). This approach ensured the consistency of measurements and allowed for a comprehensive assessment of both subjective and objective aspects of digital interaction.

The empirical study was conducted among 87 students from three educational programs focused on digital technologies, pedagogy, and social communications. All respondents actively used Microsoft Teams, Google Classroom and Discord, which made it possible to record both scale self-assessments and real behavioral manifestations in online environments. The limited empirical basis of the study is due to its focus on a sample of 87 students enrolled in three educational programs and using a limited number of digital platforms. This sample structure objectively reflects the specifics of a particular educational environment, but does not allow the results to be fully extrapolated to other fields of training or cultural and institutional contexts. The questionnaire contained six blocks of indicators, each of which corresponded to a certain variable: ER – items 1-3; SPC – 4-6; DR – 7-8; IC – 9-10; BA – 11-12; GCC – integral items 13-14. ER, SPC, and GCC indicators were rated on a scale of 1–5, while behavioral indicators DR, IC, and BA were recorded in quantitative units: average reaction time (seconds), number of initiated messages per week, and number of participations in synchronous and asynchronous discussions.

Data collection was carried out in three stages:

1. *self-assessment* of their communication skills;
2. *registration of behavioral indicators* recorded during one school week;
3. *reconciliation of scale and behavioral values* according to the indicator matrix and subsequent calculation of integral indices.

After data aggregation, the average values of each indicator were determined: ER = 3.84; SPC = 4.17; DR = 12.46 sec.; IC = 14.73; BA = 9.32; GCC = 4.09. The obtained values became the basis for further comparative, correlation and interpretative analysis in the results section. In order to summarize the indicators in tabular form (without duplicating the graphic information of the figure), Table 2 includes the average values, standard deviations and ranges of all measured indicators.

Combining self-assessment with analysis of actual behavior allows for a comprehensive assessment of students' digital communication. However, observations made over a single week may limit the reliability of the results. A short period of time tends to capture immediate reactions related to the workload or specific features of the course.

4. Results

In today's conditions of intensive digitalization, personal communication of future specialists in virtual space is considered through the prism of interdisciplinary theoretical approaches that combine cognitive-behavioral, socio-psychological and information-communication concepts. Within the framework of the cognitive approach, the dependence of communication efficiency on the individual's ability to manage attention, process information and build semantic structures in a digital environment that is constantly changing and enriched by multimodal stimuli is emphasized (Dubovi, 2022). At the same time, the socio-psychological perspective emphasizes the role of interpersonal interaction, social support and emotional involvement, which shape the quality of communicative experience in network communities and digital learning platforms. Research shows that even in a virtual format, interaction can significantly increase well-being and social inclusion if it is based on authenticity, empathy, and the ability to build sustainable social connections (Liang *et al.*, 2024). In addition, the concept of media affordances explains how the technical properties of digital platforms determine the nature of communication and the boundaries of an individual's self-presentation: for example, asynchrony, personalized feeds, or the possibility of anonymity affect the level of openness, self-control, and sense of security (Makedon *et al.*, 2024; Trepte, 2021).

In a structural sense, personal communication in the digital space includes a cognitive component (perception, interpretation, analysis of information), an emotional component (emotional reactions, empathy, regulation), a behavioral component (verbal and non-verbal manifestations, digital patterns of interaction) and a reflective component, which ensures awareness of the impact of communicative actions on others. Some studies emphasize that reflexivity and adaptability are key to successful interaction in virtual environments, as they help compensate for the deficiency of non-verbal signals and the blurring of social norms (Warrier *et al.*, 2021). At the same time, the active use of digital platforms is inextricably linked to risks, including excessive emotional stress, increased social comparison and the emergence of phenomena such as "fear of missed opportunities", which are especially characteristic of young people (Schmuck, 2021). Thus, the effectiveness of digital communication of future specialists is determined by a complex of socio-psychological factors – from individual characteristics, emotional stability and self-regulation skills to the quality of digital tools and norms of interaction in online communities. In view of this, modern theoretical approaches emphasize the need to integrate emotional intelligence, digital literacy and ethical responsibility into the training of higher education students, which allows to increase the stability of their communication behavior and effectively function in a complex, dynamic and technologically saturated information environment.

In the structure of digital interaction of future specialists, a specific complex of socio-psychological factors is gradually forming, which significantly affect the effectiveness of communication, its content, emotional quality and ability to provide professional development. An in-depth analysis of scientific approaches shows that these factors are multidimensional, combined and dynamic, as they are created at the intersection of personal characteristics, social contexts and technical capabilities of the virtual environment. Some researchers emphasize the key role of emotional involvement, the

ability to manage attention and regulate emotions in environments with high information saturation, because it is these parameters that determine the stability of communicative behavior and the level of trust between interaction participants (Huang et al., 2023). Others emphasize the normative, motivational, and social mechanisms of digital environments that can both enhance autonomy and openness and provoke risks related to stress, excessive control, or social comparison (Schmuck, 2021). It is important in the context of professional training that future professionals acquire not only technical communication tools, but also values, ethical norms, and strategic behavioral models that ensure effective information exchange in professional communities and network teams. To systematize the key socio-psychological factors of effective digital communication, it is advisable to summarize them in an extended classification table.

Before proceeding to the analysis, the summarized classification results are presented in Table 1.

Table 1: Classification of socio-psychological factors of the effectiveness of personal communication of future specialists in digital environments

Group of factors	Content characteristics	Behavioral manifestations of future professionals
Cognitive	Attention, ability to process multimodal information, digital literacy, speed of decision-making	The ability to concentrate in digital streams, effectively structure information, and avoid cognitive overload
Emotionally regulatory	Emotional intelligence, self-regulation, stress management	Controlling emotions in conflict situations online, maintaining a positive communication style
Social-perceptive	Empathy, social sensitivity, ability to read digital behavioral signals	Accurate understanding of interlocutors' intentions without nonverbal cues, successful adaptation to communication styles
Motivational	Intrinsic motivation for interaction, orientation towards success, willingness to participate in professional communities	Proactivity, initiative, high level of involvement in team digital projects
Value-based and ethical	Focus on trust, professional ethics, and responsibility for digital behavior	Compliance with digital rules, correct communication, attention to privacy and copyright
Technical and communication	Level of proficiency in digital platforms, ability to adapt to new tools	Free use of communication services, quick mastery of new digital formats
Group-dynamic	Ability to work in a team, acceptance of digital interaction norms, mutual support	Effective inclusion in professional online communities and network collaborations

Source: created by the author based on (Huang et al., 2023; Liang et al., 2024; Schmuck, 2021; Trepte, 2021)

The generalization of socio-psychological factors demonstrates that the effectiveness of digital communication of future specialists depends not only on the level of technical competence, but also on the ability to combine cognitive, emotional and social skills in a multimodal information environment. Communicative success is largely determined by the quality of self-regulation, emotional stability, adherence to professional ethics and the ability to accurately interpret social signals in online interaction. In the

context of professional education, this means the need for systematic development of a complex of digital and socio-psychological competencies that ensure sustainable functioning in conditions of intensive digitalization and dynamics of professional communicative environments.

The methodology of the empirical study was based on the use of a structured short questionnaire (Appendix A) and a matrix of operationalization of variables (Appendix B), which ensured the consistency of measurements and allowed a comprehensive assessment of the level of formation of digital communication skills of future specialists. The study was conducted among 87 students of three educational programs focused on digital technologies, pedagogy and social communications. All respondents used Microsoft Teams, Google Classroom and Discord in the learning process, which ensured the recording of both self-assessed and behavioral indicators of digital interaction.

The questionnaire contained six blocks of indicators: emotional regulation (ER), socio-perceptual sensitivity (SPC), digital reactivity (DR), initiative in digital communication (IC), behavioral activity (BA) and general self-assessment of digital communicative competence (GCC). Each indicator was operationalized in the corresponding items of the questionnaire: ER – items 1-3; SPC – 4-6; DR – 7-8; IC – 9-10; BA – 11-12; GCC – integral items 13-14. This structure allowed combining subjective assessments on a scale of 1-5 with quantitative behavioral data (number of initiated messages, frequency of participation in discussions, average reaction time in seconds).

The data collection procedure included three stages:

1. self-assessment questionnaire;
2. recording real behavioral indicators of digital activity during one school week;
3. reconciliation of the obtained scale and behavioral values according to the indicator matrix.

Based on the collected data, the average values of each indicator were calculated: ER = 3.84; SPC = 4.17; DR = 12.46 sec.; IC = 14.73 messages/week; BA = 9.32 participations /week; GCC = 4.09. The obtained indicators created an empirical basis for further comparative analysis and interpretation of the intensity of development of individual components of digital communication.

In order to summarize the obtained indicators in tabular form, without duplicating the visual information of the figure, Table 2 presents the mean values, standard deviations, and ranges of each indicator.

Table 2: Generalized empirical indicators of digital communication skills of future professionals

Indicator	Average value	SD	Min.–Max.	Data type
Emotional Regulation (ER)	3.84	0.67	2-5	scale 1-5
Social Perceptual Sensitivity (SPC)	4.17	0.58	3-5	scale 1-5
Digital Reactivity (DR)	12.46 sec.	3.29	6-21 sec.	reaction time
Initiative (IC)	14.73	4.82	7-26	messages/week
Behavioral activity (BA)	9.32	2.41	4-15	participations /week
General Digital Communicative Competence (GCC)	4.09	0.51	3-5	scale 1-5

Source: was created by the author

The generalized results presented in the table reflect the uneven development of individual components of digital communication and the variability of behavioral indicators. For clarity, the ratio of average values and standard deviations of indicators was additionally visualized in graphical format. Figure 1 shows the comparative dynamics of indicators, which allows us to trace the difference between cognitive-social and reactive-behavioral characteristics, as well as to assess the degree of their internal variability.

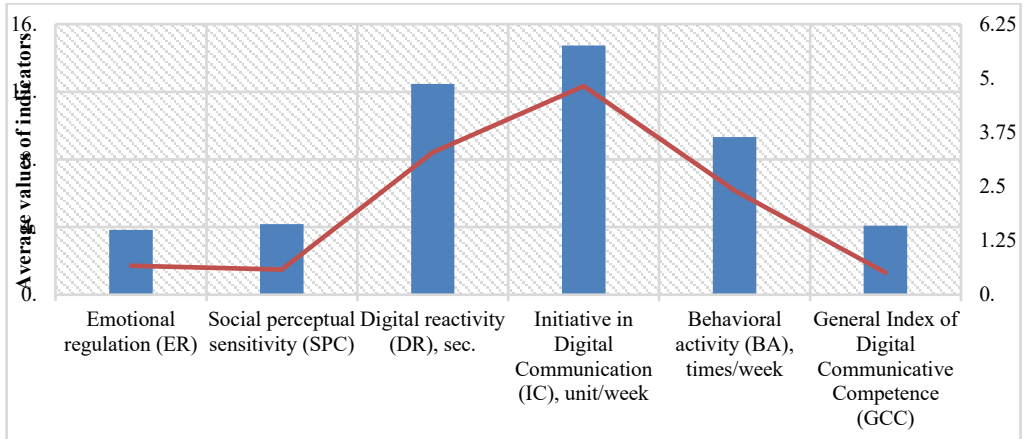


Figure 1. Comparative average values and standard deviations of indicators of digital communication skills of future specialists

Source: created by the author

The empirical data obtained demonstrate a clear uneven development of key components of digital communication: the highest indicators were found for social-perceptual sensitivity (4.17; SD = 0.58) and the general index of digital communicative competence (4.09; SD = 0.51), which indicates the ability of students to effectively recognize the intentions of interlocutors and evaluate their own interaction in virtual space. The indicator of emotional regulation (3.84; SD = 0.67) is somewhat lower, which indicates the presence of difficulties in maintaining a stable emotional background during digital communication, especially in conditions of stress or rapid messaging. The greatest variability was demonstrated by behavioral indicators: digital reactivity (12.46 sec.; SD = 3.29) and initiative (14.73 messages/week; SD = 4.82), which emphasizes the differences between students in terms of the pace of interaction and the tendency to initiate communication. At the same time, the behavioral activity indicator (9.32 participations/week; SD = 2.41) indicates a moderate level of inclusion in team forms of work, which, although stable, also demonstrates a spread of responses. Taken together, these results form a complex analytical picture in which the most stable are cognitive-social parameters, while reactive-behavioral characteristics are characterized by high individual variability.

To clarify the relationship between individual components of digital communication, a comparative analysis of the average values of the indicators was carried out (Table 3). This approach made it possible to assess which parameters are more stable and which demonstrate high individual variability.

Table 3: Comparative ratios and interpretations of digital communication indicators

Comparable parameters	Ratio by average values	Key interpretation
SPC → ER	4.17 vs. 3.84	Social-perceptual skills are more developed than emotional regulation
GCC → ER	4.09 vs. 3.84	Self-rated digital competence is slightly higher than emotional control
IC → BA	14.73 vs. 9.32	Initiative exceeds participation in group forms of interaction
DR → other behavioral indicators	12.46 sec.	Reactivity is characterized by high variability in response time
SPC → GCC	4.17 vs. 4.09	Accuracy of digital perception slightly outperforms overall self-esteem

Source: created by the author

Relying primarily on quantitative self-assessment methods and basic behavioral indicators limits the ability to gain a deeper understanding of the internal motivations and emotional states of participants in digital interactions. The lack of qualitative methods, such as semi-structured interviews or analysis of digital communication traces, reduces the analytical depth of the conclusions. If the study had combined quantitative and qualitative approaches, it would have been possible to more accurately reproduce the psychological mechanisms of digital communicative behavior.

A comparison of mean values demonstrates disparities between the cognitive-social and behavioral components of digital communication. In particular, social-perceptual skills were the highest among all indicators, which indicates a well-developed ability to recognize the intentions and emotional signals of interlocutors in digital formats. In contrast, emotional regulation has a lower mean value, which may indicate difficulties in maintaining stability in the fast pace of online interaction. Initiative significantly exceeds the overall level of behavioral engagement, which reflects the tendency of students to initiate communication more often than to maintain systematic participation in joint discussions. The indicator of digital reactivity has the greatest variability, which indicates significant individual differences in the speed of responding to messages (Makedon *et al.*, 2025). Overall, the results emphasize the different degrees of formation of individual components of digital communication and show that stronger cognitive-social skills are combined with less stable behavioral characteristics.

The results obtained allowed us to outline the key areas of development of digital communication skills of future specialists. The most stable were social-perceptual abilities and general self-assessment of digital communication competence, while emotional regulation, behavioral activity and digital reactivity are characterized by lower or variable indicators. This indicates the need for a comprehensive approach to the formation of digital communication efficiency, which combines psychological, behavioral and organizational-pedagogical strategies.

Based on the identified trends, a system of applied recommendations was developed (Table 4) aimed at strengthening individual components of digital communication.

Table 4: Practical recommendations for improving the effectiveness of digital communication of future professionals

Development direction	Recommendation content	Justification based on research results
Emotional regulation and self-control	Introduction of emotional resilience training, exercises to reduce digital stress, micro-practices of respiratory self-regulation in the process of online interaction	Moderate ER scores indicate the need to strengthen the ability to control emotions in conditions of information overload
Social-perceptual skills	Using simulation roles, VR scenarios, and cases to develop accuracy in interpreting digital signals and adapting to interlocutors' styles	High SPC scores indicate potential that can be enhanced through practical interaction scenarios
Digital reactivity and pace of interaction	Implementing exercises to speed up information processing, develop micro-reflection skills, and structured responses in chats	Significant DR variability demonstrates different digital response styles, requiring alignment of communication pace
Initiative and sustained participation in digital teams	Development of team activities with mandatory rotation of the roles of communicators, moderators and facilitators	IC scores are significantly higher than BA, indicating the need to develop a stable level of participation, not just impulsive initiative.
Behavioral activity and group dynamics	Systematic exercises for maintaining discussions, developing mutual support skills and active listening in digital format	Fluctuations in BA indicate uneven student involvement in team interaction
General digital communication competence	Creating integrated educational modules that combine technical, psychological and ethical aspects of digital communication	GCC values demonstrate a sufficient baseline that requires comprehensive strengthening and updating

Source: created by the author based on (Huang et al., 2023; Liang et al., 2024; Trepte, 2021)

The predominance of cognitive and social skills over emotional self-regulation is consistent with current findings in digital learning environments. At the same time, the contradiction between students' high initiative and unstable participation in teamwork points to a problem of behavioral consistency in virtual groups. This requires refinement of theoretical models of online engagement. In particular, it is important to distinguish between situational activity and long-term responsibility for communication in digital teams. The comprehensive focus of the recommendations on the development of emotional self-regulation, stable interaction in digital teams, and the accuracy of perception of communicative signals corresponds to modern approaches to the formation of digital competence. The application of the proposed solutions can improve the quality of digital interaction, contribute to the formation of effective professional communicative models, and strengthen the skills necessary for working in dynamic information environments.

5. Discussion

The obtained results of the study allow us to more deeply interpret the influence of socio-psychological factors on the effectiveness of digital communication of future specialists and correlate them with existing theoretical and empirical developments. The advantage of social-perceptual sensitivity over emotional regulation determined in the sample indicates that students are much better at recognizing the intentions and digital signals of interlocutors than at controlling their own emotional state during online interactions. This trend is consistent with studies that emphasize the important role of social perception in the digital environment (Liang *et al.*, 2024; Chan, 2023), but partly contradicts works that consider emotional regulation as a basic prerequisite for stable interaction in conditions of high information load (Huang *et al.*, 2023; Wartberg *et al.*, 2021). Based on this, one possible explanation is that digital students have a more developed skill in interpreting digital patterns, while self-regulation skills require longer practice or targeted pedagogical interventions.

The uneven development of behavioral indicators – in particular, the significant excess of initiative over behavioral activity – demonstrates a tendency towards impulsive digital interaction: students are more willing to initiate topics than to support long-term team discussions. This result is consistent with the findings of researchers about the nature of youth behavior in virtual communities, where one-time initiatives often prevail over sustained participation (Schmuck, 2021; Scherr & Wang, 2021), but at the same time contradicts models that emphasize the importance of regular activity for the formation of a community of practice and trust (Trepte, 2021; Liu *et al.*, 2020). Such discrepancies can be explained by the characteristics of educational platforms, where activity is often measured by the number of reactions, rather than the duration and depth of inclusion, as well as the impact of cognitive load, which, according to current models, reduces the ability to engage in long-term participation (Dubovi, 2022).

Comparison of the obtained data with studies of digital reactivity shows that the high dispersion of response times in students is consistent with works that demonstrate significant individual variability in reactivity in multimodal environments (Tzafilkou *et al.*, 2021; Warrier *et al.*, 2021). At the same time, our results showed lower behavioral activity in those who respond more slowly, which partially coincides with studies of cognitive load in digital communication (Trepte, 2021), but contradicts works where reactivity is not associated with regularity of participation (Yılmaz, 2020). A possible explanation is that reactivity in an educational context has not only a cognitive but also a motivational component: students with less involvement may demonstrate both a slower response and lower activity.

Summarizing the comparison with the literature, it can be stated that the results of the study generally correspond to the trend of recent years, in which students' cognitive-perceptual skills develop faster than emotional-regulatory ones, and behavioral aspects of interaction are characterized by unevenness and situationality. However, a number of contradictions with other studies, in particular regarding the ratio of initiative and activity or the role of reactivity in communication behavior, indicate the complexity of the influence of socio-psychological factors in digital environments.

A limitation of our study is its focus on specific educational programs and the use of only three digital platforms, which may affect the generalizability of the results. In addition, the analysis was based on self-assessment and behavioral indicators without the inclusion of deeper qualitative methods, such as interviews or digital footprints, which could clarify the motivational and emotional components of interaction. At the same time, the results have important practical applications: they allow for the improvement of digital communication development programs, adaptation of emotional regulation trainings, and increase the effectiveness of team interaction in online formats.

In summary, it can be noted that the results obtained are only partially consistent with existing models of digital communication, emphasizing the need for a comprehensive study of the interaction between cognitive, socio-perceptual and emotional-behavioral components. Further research should be aimed at expanding the toolkit, involving qualitative methods, comparing different educational and professional contexts, as well as studying the dynamics of digital communication in the long term, which will allow for a deeper understanding of the mechanisms of forming sustainable communicative practices of future specialists.

6. Implications and further research

The conducted study made it possible to establish that the structure of digital communication of future specialists is formed as a multidimensional system in which cognitive-social skills develop more intensively than emotional-behavioral ones, which only partially coincided with the initial expectations regarding the uniform development of all components. The novelty of the obtained results lies in the identification of a persistent disproportion between initiative and stable activity in online interaction, as well as in establishing a connection between digital reactivity and the dynamics of participation, which was not sufficiently outlined in previous studies. The practical significance lies in the fact that the results allow us to more accurately determine pedagogical and psychological interventions aimed at strengthening emotional regulation, forming sustainable team practices, and equalizing the pace of communication in professional digital environments. The limitations of the study are related to the sample of students from only a few educational programs, the use of a limited number of digital platforms, and the dominance of quantitative indicators without deeper qualitative evidence, which may affect the breadth of generalizations. At the same time, the results outline the prospects for developing comprehensive models of digital communicative behavior that will take into account the dynamics of emotional, social, and behavioral factors in different professional contexts. Further research should be directed at expanding the methodology through the use of interviews, analysis of digital traces, longitudinal observations, and comparison of interdisciplinary groups, which will allow for a deeper understanding of the mechanisms of formation of effective digital communication and create scientifically sound recommendations for educational and professional practice.

The practical conclusions of the study are directly relevant to the updating of higher education programs. Targeted measures that develop emotional self-regulation, the rhythm of interaction, and the stability of teamwork can balance students' digital

communication skills. If these components are integrated into curricula, future professionals will be better prepared to work in complex professional networks.

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Appendix A

Questionnaire for assessing digital communication skills of future professionals

Instructions:

Rate each statement on a scale:

1 – completely disagree... 5 – completely agree.

1. Emotional Regulation (ER)

1. In digital communication, I am able to control my emotional reactions.
2. I remain calm in tense or conflicting online situations.
3. After an intense online discussion, I easily regain my emotional balance.

2. Social Perceptual Sensitivity (SPC)

4. I quickly understand the intentions of the interlocutor in virtual communication.
5. I easily adapt to the communication style of other participants.
6. I correctly interpret ambiguous messages in chat.

3. Digital Responsiveness (DR)

7. I respond promptly to messages in educational or work chats.
8. During online meetings, I quickly join the discussion.

4. Initiative in digital communication (IC)

9. I often initiate discussions or new topics in digital teams.
10. I willingly engage in dialogue and support the development of the conversation.

5. Behavioral activity (BA)

11. I regularly participate in team online discussions.
12. I actively respond to messages from other participants.

6. General Self-Assessment of Digital Communicative Competence (GCC)

13. I consider myself quite competent in digital communication (1-10).
14. I rate my interaction in online groups as effective (1-10).

Appendix B

Table 1B: Matrix of indicators and corresponding empirical indicators (operationalization of variables)

Variable	Indicator name	Description of what is being measured	Questionnaire items	Data type	Empirical value
ER	Emotional regulation	The ability to control emotions, stay calm, and restore balance during digital communication	1, 2, 3	Average on a scale of 1-5	3.84
SPC	Social-perceptual sensitivity	Ability to understand intent, adapt to style, interpret digital signals	4, 5, 6	Average on a scale of 1-5	4.17
DR	Digital reactivity	Speed of response and inclusion in dialogue in a virtual environment	7, 8	Average response time	12.46 sec.
IC	Initiative in digital communication	Tendency to initiate topics, start conversations, maintain discussion	9, 10	Number of initiated messages/week	14.73 messages
BA	Behavioral activity	Frequency of participation in online team discussions, reactions to messages	11, 12	Number of participations in synchronous/asynchronous discussions	9.32 participations
GCC	General digital communication competence	Integral self-assessment of the level of digital communication	13, 14	Average integral score (1-10 → converted to a scale of 1-5)	4.09

Source: compiled by authors