

Enhancing Engineering Students' Flexible Communication Skills through Digital Learning Environments to Support International Cooperation

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ABSTRACT

Communication skills are a key component of the flexible skills required for future engineering professionals, supporting effective interaction with colleagues, clients, and international partners. This study investigates the effectiveness of a specially designed digital English-language course in cross-cultural communication for developing engineering students' flexible communication skills at Kharkiv National Automobile and Highway University. A pedagogical experiment conducted during the 2024–2025 academic year involved an experimental group ($n = 65$) and a control group ($n = 63$). The experimental group was taught using innovative digital methods, whereas the control group followed conventional instruction. The findings revealed statistically significant improvements in the experimental group, confirming the effectiveness of the proposed instructional approach.

Keywords: business etiquette, communicative tolerance, digital course, engineering students, English (Second Language), flexible skills, intercultural communication

INTRODUCTION

In today's competitive environment, higher education institutions are making significant efforts to develop and enhance the all-around competencies of prospective professionals. An essential role in developing these competencies is given to the so-called "soft" or "flexible" skills, which hold a special place in a professional's training. These terms refer to all competencies that are not directly related to a specific task (Cimatti, 2016). The most well-known and straightforward definition of flexible skills was given by Heckman and Kautz (2012): they determine success in life. Besides, from a purely practical point of view, they provide career development in the context of earning money and recognition (Chaudhari, 2022).

Flexible skills influence human activity, although they cannot directly relate to any profession. They help a professional adapt to changing conditions, communicate with others, work in a team, think critically, learn new things, approach problem-solving creatively, and take responsibility for the results of their actions. Therefore, to ensure the life success of its graduates, any university should strive to develop flexible skills by all available means within the framework of formal and informal education.

LITERATURE REVIEW

The researchers offer several synonyms for flexible skills. These skills are called life skills, transversal skills, cross competencies, generic competencies, critical competencies for a successful life and a well-functioning society, essential competencies for lifelong learning, 21st-century skills, transferable skills, future work skills, skills for talent, skills for social progress (Cinque, 2016); employability skills, core skills, necessary skills, workplace know-how skills, essential skills (Škuškovnika, 2022). In some ways, all these terms reflect the practical focus of flexible skills and emphasise their importance for professional growth and employability (Martínez-Gómez & Nicolalde, 2025). There are also numerous classifications of flexible skills. One of the earliest examples is the model of Canney and Byrne (2006), which includes basic communication, interaction, emotional and cognitive skills.

As Polonska (2021) noted, while in the recent past, the most desired were such skills as solving complex problems, critical thinking, creativity, people management, interaction with others, emotional intelligence, evaluation and decision making, now this list is supplemented by such skills as analytical thinking and innovativeness, active learning, originality and initiative, technology creation and programming, endurance, stress resistance and flexibility, logical reasoning and generation of ideas.

When investigating various classifications of flexible skills, we consider it expedient to focus on models suitable for all specialties. For example, Smahina and Shunevych (2019) highlight the following flexible skills that should be inherent for any professional: communication skills that mean the ability to listen, argue, convince, create connections, conduct negotiations, make presentations and public speeches, interact in a team; self-regulation skills that help manage one's own emotions and self-development; skills of practical thinking that include creative, logical, and strategic thinking; skills of management that help motivate, mentor and control task implementation. Araújo et al. (2025) particularly emphasize the role of emotional intelligence and communication skills in engineering teams, as modern technological activities involve complex team interactions that require conflict resolution and stress management. Whatever the classification of flexible skills is, they necessarily include communication skills as an opportunity to build and expand personal and business relationships.

Beagon et al. (2025) emphasise the critical importance of effective communication skills in complex, interdisciplinary engineering projects, where engineers must clearly articulate ideas, coordinate solutions, and convey technical information to diverse audiences. However, the researchers believe that despite their importance, communication skills are often undervalued in engineering curricula and viewed as secondary to students' technical training.

Flexible communication skills can be approached from different angles. For instance, Chaudhari (2022) defines them as practical skills such as verbal competence, behavioural skills, etiquette, respect for other cultures, conversational and public speaking, time management, media activity, leadership, and self-presentation skills. They also include skills for maintaining a positive attitude, developing volitional skills to master new skills, and fostering teamwork.

Vasanthakumari (2019) provides a comprehensive categorisation of communication skills into two groups: verbal communication skills, which primarily include linguistic competencies, and non-verbal communication skills, with an emphasis on behavioural aspects.

Verbal communication skills include knowledge of the language, adequate speech rate, the ability to coordinate social interaction, and the timeliness and accuracy of implementing the communicative act. In contrast, non-verbal communication skills include knowledge of body language, the ability to create written messages, and the ability to present work results.

Pidbutska (2016) analyses the communicative component in the skills of an engineering professional and emphasises the need to communicate with colleagues, the ability to search and obtain new scientific and technical information, the ability to correctly understand colleagues and partners in engineering activities, the ability to do competent scientific and technical presentations, make reports, and give lectures to technical specialists; tactfulness towards partners on communication, and the ability to empathise. The author cites the key skills employers seek and the skills included in training programs for obtaining CPRE (Certified Professional for Requirements Engineering) certification. Among them are communicative skills, such as the ability to effectively communicate with others, including those of a higher status; written literacy, knowledge of other languages; oratory skills; the ability to work in a team to solve problems, adaptability and flexibility, which are necessary for communication with representatives of various companies from different regions and countries.

Collins and Spoelstra (2025) emphasise the role of interdisciplinary interaction and global communication in shaping the communication skills of future technical university graduates and highlight the need to integrate communication modules into engineering programs.

Directly acquiring international experience, both academically and professionally, is invaluable as it fosters the development of global citizenship in engineering students (Cisneros-Reyes et al., 2026). Even short-term academic stays in another country enhance students' cultural engagement, increase their tolerance for uncertainty, expand their knowledge of the host country, and cultivate empathy and acceptance (Chieffo et al., 2026).

In general, as the authors (Brown & Wettstein, 2025) believe, to more effectively prepare technical students for professional functions, it is necessary to create an engineering environment within the educational process that stimulates the development of teamwork, problem-solving, and communication skills. Rahman et al. (2025) underscore the significance of extracurricular activities in fostering students' respect for social rights, compassion, empathy, and leadership skills. Such attention to communication skills **accentuates** their importance and the need to improve them. The *objectives* of this research were:

- 1) to study methods for improving the communication skills of students in technical specialities using interactive and specially developed digital technologies;
- 2) to conduct a pedagogical experiment to evaluate the effectiveness of the proposed methods.

RESEARCH METHOD

According to the concept of this research, the content of flexible communication skills of the prospective engineering professional consists of: skills of verbal and non-verbal interaction and communication; communicative creativity; the ability to resolve conflicts; teamwork skills; self-presentation, public speaking and oratorical skills; writing and speaking skills (expressiveness of speech, skills of maintaining correspondence and storytelling); the ability to negotiate and persuade; intercultural interaction and communication skills.

Verbal and non-verbal communication skills are understood as a set of communicative abilities that enable effective professional activity in interaction with colleagues, partners, and clients. At the highest level, verbal and non-verbal communication skills are represented by communicative creativity, defined as the ability to improvise in people's communicative and creative interactions. Communicative creativity is a divergent ability to produce a large number of options for behaviour and reactions in interpersonal communication, to use different methods, strategies, and tactics of behaviour, to put forward new, unusual ideas, and to show a non-standard attitude to communicative situations and their solutions (Antoshkiv & Kolisnyk, 2022).

Conflict-resolution skills are operationalised in this study through dialogicity in communication. Dialogic is a term we use to describe equal parity in communication and cooperation, joint creativity, mutual understanding, and mutual assistance, which are crucial to cooperation.

Team building, a vital flexible skill in today's business environment, is directly linked to organisational success. By creating team structures that promote improvements in productivity, profitability, and service quality, organisations can thrive (Driskell, 2018).

We combine *self-presentation, public speaking and oratorical skills* into one group of communicative flexible skills since their operationalisation in psychological discourse is reduced to common categories that reveal ease, balance, accuracy, sufficient completeness, flexibility, and speed in expressing thoughts publicly, in front of the audience, which demonstrate a professional's business strengths.

The skills of *storytelling* are important because stories have been used by humanity to transmit wisdom, knowledge, and culture, as well as to strengthen social bonds, since the earliest times of their existence. People often identify with the characters in a story. If the views and values of these characters resonate with their own, they help people make informed decisions about certain issues in their own lives and can cause them to act or change their beliefs and behaviour (Joubert et al., 2019).

The ability to *negotiate* is an essential flexible communication skill. Among other types, distributive negotiations, based on the maximisation of one's profit,

and integrative negotiations, which result from cooperation and involve the joint solution of problems and the increase of joint benefits, are distinguished (Stoshikj, 2014). The ability to conduct integrative negotiations is the desired outcome of developing communication skills.

Skills of *intercultural communication* include knowledge of foreign languages and cultures, respect for their bearers, understanding of the psychological state of communicants, tolerance for differences in other people's opinions and cultural characteristics, mastery of one's emotional state, observance of etiquette, and tact in communication.

While the importance of the previously mentioned skill groups is acknowledged, this research focuses specifically on the development of intercultural communication skills. These skills are vital for facilitating successful interactions between cultures. We have defined intercultural communication skills based on two key criteria: 1) communicative tolerance: this refers to the ability to accept and respect individuals who may hold different attitudes and values, as they represent a different culture; 2) awareness of international business etiquette: this involves recognising the necessity of adhering to appropriate behavioural norms expected by representatives of various cultures.

The intercultural communication skills of technical university students were intentionally developed during the process of learning a foreign language, particularly English. English serves as a crucial means of communication across various spheres of modern society, including scientific, technical, political, business, and educational fields.

In the first stage of the empirical research, a psychodiagnostic complex was developed to assess a prospective professional's flexible communicative skills, which included interviews, questionnaires, and testing. To conduct the pedagogical experiment at Kharkiv National Automobile and Highway University, an experimental group (EG; $N = 65$) and a control group (CG; $N = 63$) were formed. Students in the experimental group were instructed using innovative, specially designed pedagogical technologies, whereas students in the control group received instruction through traditional teaching methods.

The study was conducted in accordance with ethical research standards. Participation was voluntary and anonymous. No personally identifiable information was collected, and all data were analysed in an aggregated and anonymised form.

In the second stage, a program to develop flexible communication skills during foreign language learning and participation in extracurricular activities was implemented for the students of the EG.

In the third stage, indicators of flexible communication skills development for participants in the EG and CG were compared by analysing results from a longitudinal study conducted during the 2024-2025 academic year.

Communicative tolerance, the relevance of which in the pedagogical studies is highlighted by several scientists (Muharib & Pennington, 2019; Sumter et al, 2020) involves patience, kindness, benevolence, wisdom, balance, empathy, tolerant attitudes in communication, ability to flexibility, mobility, skills to adapt their behaviour and communication to the circumstances that arise in the process of communication and interaction.

Tolerance has garnered increased scientific interest in recent years. The modern multicultural environment presents significant opportunities for promoting inclusion and intercultural interaction. However, it also poses new social and communicative challenges, highlighting the need to foster tolerance. The social and cultural capital that students gain during their education is a critical factor influencing the development of personal attitudes such as acceptance, empathy, and respect for cultural diversity (Mustafida et al., 2025).

Based on levels of communicative tolerance, students were divided into three groups: high, average, and low levels of development of this quality. Students with a high tolerance level are predictable in their attitude towards a partner; they are pleasant to deal with; they avoid situations that cause differences with others and aim for good relationships with interlocutors showing respect for their opinions. Students at an average level have quite developed communicative qualities, as evidenced by restraint, tact, and benevolence in relationships; however, students in this group occasionally show negative emotions towards others. This can be explained by the fact that some people may possess communicative knowledge but are not always situationally able to transfer it into practical activity.

A low level of communicative tolerance is characteristic of individuals who show a hostile attitude towards their partners; they are unable to restrain their dissatisfaction with interlocutors, are unwilling to forgive their mistakes, and are intolerant of others' physical or mental defects. They cannot hide their unpleasant feelings toward inconvenient partners, creating a negative emotional backdrop to communication.

Communicative tolerance was measured using the adapted Boyko's Communicative Tolerance Diagnostic Method (Boyko, 1996). A questionnaire-based instrument was designed to assess an individual's ability to accept, understand, and interact effectively with communication partners who differ in personal characteristics, emotional states, values, and behavioural patterns.

The questionnaire consists of 22 statements grouped into diagnostic scales, each reflecting a specific manifestation of communicative intolerance: rigidity of judgment, rejection of individuality, dominance of one's own perspective, and intolerance toward emotional discomfort in others. Respondents rate each statement on the degree to which it reflects their typical communicative behaviour.

The total communicative tolerance score was calculated by summing respondents' answers across all questionnaire items. Based on the overall score, three levels of communicative tolerance were identified. Scores ranging from 22

to 60 indicate a low level of tolerance, reflecting a high degree of intolerance and pronounced attitudes toward others and the surrounding social environment. Scores between 61 and 99 indicate an average level of tolerance, characteristic of respondents who exhibit a combination of tolerant and intolerant traits; such individuals tend to behave tolerantly in some social situations while intolerant in others. Scores from 100 to 132 indicate a high level of communicative tolerance and a well-developed tolerant personality, with stable prosocial and respectful attitudes in interpersonal communication.

Awareness of international business etiquette governs many aspects of relationships in professional activity and intercultural communication, including business correspondence, information exchange, and forms of greetings and tributes to colleagues at work. The ability to follow etiquette rules can be sufficiently developed if a person consistently observes the accepted norms of politeness, courtesy, tolerance, and speech culture. Skills are not sufficiently developed if the specified norms and regulations are followed only in specific situations.

To determine the degree of awareness of communication rules with an interlocutor who is a representative of another culture, a questionnaire was designed with items rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

The questionnaire's internal consistency was assessed using Cronbach's alpha and item–total correlations. The scale's overall reliability was high (Cronbach's $\alpha = 0.85$), indicating strong internal consistency. Pearson's r indicates the item–total correlation for each item with the total questionnaire score. The correlations ranged from 0.74 to 0.95, exceeding the recommended threshold of 0.30 and demonstrating that all items were positively and substantially related to the overall construct. Although several items showed very high correlations with the total score, they were retained for their conceptual significance and theoretical relevance in capturing key dimensions of international business etiquette awareness. The values of Cronbach's alpha when an item was deleted remained stable (0.85–0.86), suggesting that removing any single item would not substantially improve the scale's internal consistency (Table 1).

To prepare students for intercultural communication, we used our own digital culture-related English language course. Digital learning has fundamentally transformed educational methods, particularly in higher education institutions. Research indicates that incorporating digital learning principles into the educational process can foster creativity, self-confidence, collaboration, and self-directed learning (Álvarez Ariza & Hernández Hernández, 2026). The authors emphasize the increasing popularity of online platforms in engineering education, which fosters effective teamwork and collaboration (O'Connor et al., 2026).

Table 1: Item–Total Correlations and Internal Consistency of the Questionnaire “Awareness of International Business Etiquette”

Item	Statement	r (Item–Total)	α if Item Deleted
1	For effective communication with others, I consider the interlocutor's ethnic background.	.745	.852
2	For effective communication with others, I consider the interlocutor's social status and cultural background.	.944	.852
3	For effective communication with others, I consider a business partner's educational and professional status when working with someone from another country.	.844	.852
4	For effective communication with others, I consider a partner's age and country of origin.	.832	.853
5	For effective communication with others, I consider the gender of the partner from another country.	.855	.852
6	I consider regional communication norms and practices typical of the interlocutor's country.	.952	.851
7	For effective communication with others, I consider the interlocutor's religious affiliation.	.923	.852
8	For effective communication with others, I consider the professional status of a partner from another country.	.899	.851
9	I am tolerant of the interlocutor even if I do not share their values, beliefs, or behaviour patterns stemming from belonging to another culture.	.901	.851
10	I am tolerant of the interlocutor even if I do not share their cultural traditions.	.903	.852

Note. r = item–total correlation; α = Cronbach’s alpha.

The digital course was developed with audiovisual translation and posted on YouTube (English from 0 to B2, n.d.), coupled with a traditional cross-cultural communication course implemented in a paper format.

The course contains a large amount of cultural information (over 200 videos) for teaching English and getting acquainted with world culture. Porter et al. (2022) suggest including as many materials rich in cultural artifacts as possible in the target language to encourage students' emotional engagement and intrinsic motivation.

In developing our videos, we employed the audiovisual translation method, which is considered one of the most modern trends in language teaching (Talaván et al., 2024). We used parallel translation alongside the speaker's voice, allowing students to repeat vocabulary and phrases during pauses. Despite some criticisms of monotony, this method proved to be effective when applied correctly. It helps students concentrate on accurate pronunciation, provides intensive practice in both listening and speaking the educational material, facilitates a comfortable environment for language production, and promotes the memorisation and automation of speech patterns and phrases. Students could engage with the clips at their own pace and listen to them as many times as necessary to build their confidence. During the lessons, they completed tasks based on the material they had independently studied and were prepared to discuss various applied and evaluative issues.

To choose the video content, we utilised a well-known three-dimensional model of cultural space from cultural studies. This model consists of three subsystems: technological culture, social culture, and spiritual culture. We compiled a comprehensive list of cultural components that contain substantial cultural knowledge that can be effectively conveyed to students in a foreign language.

A relatively recent survey of 614 language teachers in the UK indicated that the two main objectives of language teaching are to develop learners' intercultural understanding and their ability to communicate in the language (Woore et al., 2020). However, a study of popular teaching materials used worldwide (Keles & Yazan, 2023) indicates an imbalance in favour of Western cultures over non-European cultures, resulting in limited global cultural awareness among language learners. Contemporary textbooks predominantly portray an Anglo-American cultural image, offer only a cursory look at non-English-speaking cultures, and ignore the history and politics of other cultural communities.

Therefore, researchers call on teaching material developers to reconsider training content in favour of discursive constructions that shape diverse cultures and communities and will serve as "windows to the world" (Risager, 2021). We have attempted to develop such courses and continue to work in this direction to familiarise students with the world's culture in its broadest sense.

The digital course was supplemented by a course-book on cross-cultural communication (Saienko & Monev, in press) to enhance the development of intercultural communication skills, which acquainted students with the essential features of different cultures and taught them to overcome obstacles when establishing contact with their representatives. By completing the interactive tasks, students experienced emotions that might arise in real intercultural communication situations and analysed their own behaviour and that of their partners. Such intercultural training practice prepared prospective engineering professionals to establish and maintain contacts with their future foreign counterparts.

This course systematically addresses key issues and topics in intercultural communication, focusing on developing cultural sensitivity and enhancing the ability to interpret diverse communicative behaviours across cultures. It aims to cultivate practical skills for effective communication with individuals from various cultural backgrounds. The course is divided into theoretical and practical components. The theoretical portion introduces students to the nuances of intercultural communication, while the practical section explores the characteristics of cultures from different regions around the world. Course materials cover a wide range of topics pertinent to intercultural communication, including types of communication, examples of intercultural differences, strategies for improving intercultural interactions, specifics of business negotiations, conflict resolution in multicultural settings, and the concept of ethnicity within the framework of intercultural relations. The course includes a variety of assignments that are reproductive, discussion-based, and creative. Additionally, the practical section focuses on comparing cultures from different countries, addressing complex issues, and conducting case studies.

The program for developing flexible communication skills also included in-class dialogue and game-based methods, both of which are important for developing an individual's social abilities and talents.

The leading structural-logical method in our research was the case method or the method of situational exercises, which is interactive and brings the learning process closer to actual, practical, professional activity. The case method aims to develop ingenuity, the ability to solve problems, and the ability to analyse and diagnose creative problems (Takahashi & Araujo, 2020).

One of the methods used was art therapy as a form of social skills development (Cheng et al., 2023); in particular, its variant, fairy-tale therapy, is aimed at making sense of life experiences and actualising life resources. Initially, fairy tales, legends, and myths were used to instil moral values and rules of conduct in people's minds, helping resolve interpersonal conflicts and overcome life's difficulties. We applied the art therapy method in teaching English: a selection of parables of the world's peoples with problematic tasks was created, which solved moral problems and issues of intercultural coexistence and helped find humane ways to resolve interpersonal conflicts.

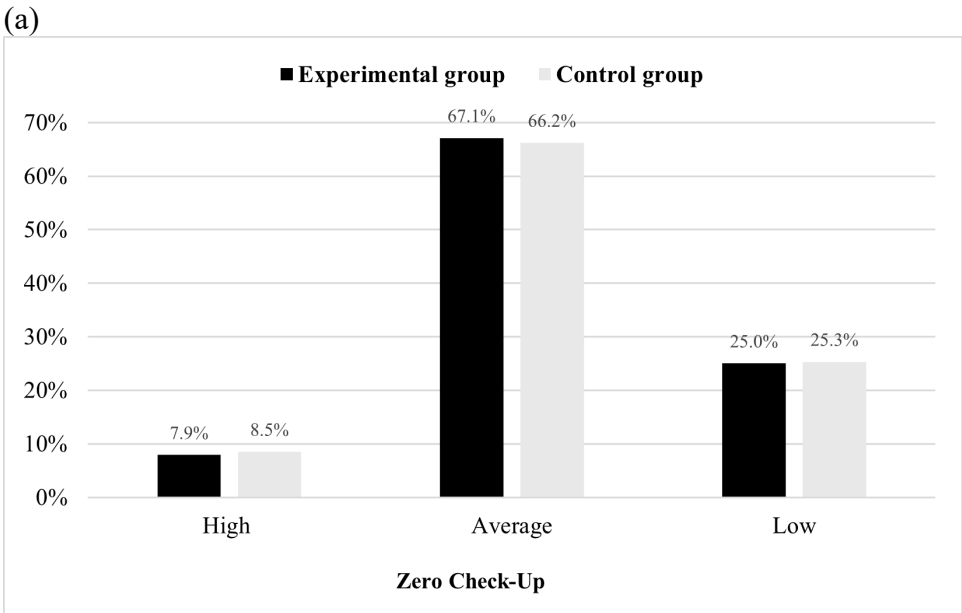
A set of psychological exercises was used to correct destructive communicative strategies, overcome communicative barriers for social interaction, remove emotional, socio-intellectual and behavioral rigidity, get over communicative and moral egocentrism, in particular, "Greetings without words", "Island", "First Meeting", "Living Pyramid", "Molecules", "Negotiations", "Siamese twins", "Suitcase", "Puppet", "Discussion", "Tower of Babel", "Understand feelings", "Intonation", "I know your dreams", "Rosebush", "Reincarnation", "Healing", "Interpretation technique", "Guess who is listening", "Persuasive speech" (Savrasov, 2021).

The implementation of a structured set of psychological exercises resulted in a statistically and practically significant improvement in students' communicative tolerance and interactional flexibility. Participants demonstrated reduced emotional, socio-intellectual, and behavioural rigidity, alongside a noticeable decrease in communicative and moral egocentrism. The intervention facilitated the overcoming of key communicative barriers in social interaction, contributing to more adaptive, empathetic, and cooperative communication patterns. As a result, students showed enhanced ability to interpret others' emotions and intentions, to regulate expressive behaviour, and to engage in constructive dialogue, including negotiation and persuasive communication. Overall, the intervention promoted the development of integrative communicative competencies, including flexible (soft) skills such as interpersonal sensitivity, emotional awareness, and collaborative problem-solving.

RESULTS

The research findings indicate substantial differences in students' achievements between the EG and CG, and significant positive shifts in the studied phenomena due to the use of the proposed methods for developing flexible communication skills.

The selected diagnostic tool enabled the assessment of communicative tolerance as a measurable manifestation of flexible communication skills within the proposed theoretical framework (Figure 1).



(b)

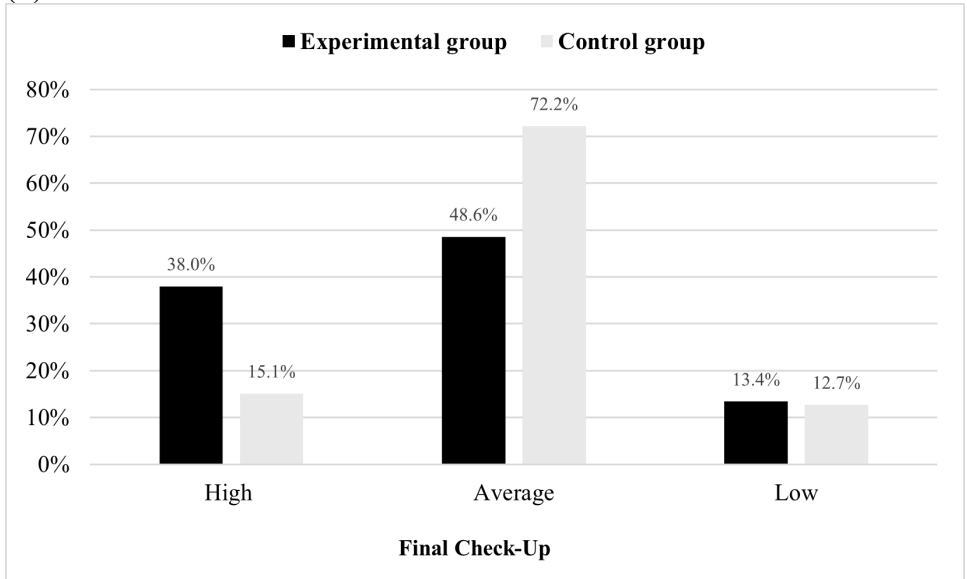


Figure 1: Changes in Communicative Tolerance Levels

The results demonstrate a significant increase in the proportion of students with a high level of communicative tolerance in the EG (from 7.9 % to 38.0 %). In comparison, the control group showed only moderate improvement (from 8.5 % to 15.1 %).

A chi-square test of independence showed a statistically significant difference between the experimental and control groups in communicative tolerance levels after the intervention, $\chi^2(2, N = 128) = 8.62, p = .013$, indicating the effectiveness of the experimental instructional approach. A similar pattern was observed in the development of students' ability to follow business etiquette rules (Table 2).

Table 2: Dynamics of Business Etiquette Compliance in Experimental and Control Groups

Criterion / indicator	EG (n = 65)		CG (n = 63)	
	Pre-test	Post-test	Pre-test	Post-test
<i>Ability to follow the rules of business etiquette</i>				
Regular compliance with the rules of decency, courtesy, tolerance, and speech culture accepted in society	45.1	76.2	45.2	51.3
Situational compliance with the specified rules	54.9	23.8	54.8	48.7

Note. Values represent percentages of respondents. EG = experimental group; CG = control group.

The analysis of students' ability to follow business etiquette rules demonstrated statistically significant positive changes in the EG. In this group, the proportion of students demonstrating regular compliance with the rules of decency, courtesy, tolerance, and speech culture increased markedly from 45.1 % to 76.2 %, while situational compliance decreased from 54.9 % to 23.8 %. These changes were statistically significant, $\chi^2(1) = 12.94, p < .001$.

In the control group, only minor changes were detected, with regular compliance increasing from 45.2 % to 51.3 %. However, the chi-square test indicated that these differences were not statistically significant, $\chi^2(1) = 0.62, p = .43$.

The post-test comparison between the experimental and control groups demonstrated statistically significant differences in students' ability to follow the rules of business etiquette, $\chi^2(1) = 10.87, p = .001$, with a medium-to-large effect size (Cramér's $V = 0.29$), indicating a meaningful practical impact of the experimental intervention.

The findings of the present study provide empirical support for interdisciplinary models of flexible skills development that integrate pedagogical, psychological, and sociocultural perspectives. Communicative tolerance, as a key indicator of flexible communication skills, reflects not only cognitive awareness but also affective dispositions and behavioural readiness for interaction across diverse educational and professional contexts.

The significant increase in the proportion of students demonstrating a high level of communicative tolerance in the experimental group confirms the theoretical assumption that flexible skills are developed most effectively through pedagogical approaches that combine experiential learning, social interaction, and reflective practices. From an interdisciplinary standpoint, these results align with educational psychology theories underscoring the role of emotional regulation and empathy, as well as with sociocultural theories that view communication as a socially constructed process shaped by dialogue and collaboration.

In contrast, the relatively modest changes observed in the control group suggest that traditional instructional methods predominantly support cognitive learning outcomes and are less effective at fostering the affective and behavioural components of communication. This distinction highlights the importance of integrating pedagogical innovations that transcend disciplinary boundaries and address communication as a holistic competence.

The statistically significant differences identified through the chi-square analysis further indicate that the development of communicative tolerance is contingent upon intentional educational design rather than incidental learning. This finding reinforces contemporary interdisciplinary frameworks that conceptualise flexible skills as dynamic and context-dependent, requiring purposeful instructional strategies.

At the same time, preparing for intercultural communication at a technical university comes with specific challenges. These include a lack of emphasis on practical language application, an imbalance between language skills and cultural knowledge, insufficient authentic experiences, and difficulties in integrating intercultural communication into technical disciplines. The main challenges involve developing the affective components (such as tolerance and empathy), the cognitive components (knowledge of cultural characteristics), and the procedural components (behavioural strategies) of competence. These aspects require specific approaches that are not always part of traditional technical education. Foreign language instruction often prioritises grammar and vocabulary over cultural contexts. As a result, students may struggle to understand how cultural competence is relevant to their specialised technical tasks. Additionally, fostering affective components can be challenging, as developing empathy, tolerance, and openness to other cultures demands time and effort – factors that are hard to fit into the busy schedules of technical courses.

We would identify potential solutions to these challenges by incorporating intercultural communication modules into specialised technical courses, such as “Intercultural Communication in IT Teams” and “Managing International Engineering Projects.” Additionally, we advocate completing practice-oriented assignments, including case studies, simulations of real-life work scenarios, and collaborative projects within international groups. Further, it is essential to focus on developing “soft skills,” particularly empathy, critical thinking, and conflict-resolution skills. Engaging industry experts, such as inviting engineers from international companies to share their insights, can also greatly enhance the learning experience.

CONCLUSIONS

A prerequisite for the life success of modern professionals is their having developed flexible skills, which include solving complex problems, critical thinking, creativity, people and self-management, interaction with others, emotional intelligence, evaluation and decision making, innovativeness, autonomous learning, originality and initiative, technology creation and programming, endurance, stress resistance, logical reasoning, and generation of ideas.

Communication skills are crucial in today’s world, as the professional activity of a technical university graduate is directly related to globalisation and requires the ability to establish mutually beneficial connections with colleagues from other countries. For these connections to be profound, versatile and fruitful, a professional must be able to communicate in everyday situations, maintain personal contacts, discuss professional issues, have a broad outlook and express their opinion on various aspects of socio-cultural life. It is necessary to form their

skills of verbal and non-verbal interaction and communication; communicative creativity; the ability to resolve conflicts; teamwork skills; self-presentation, public speaking and oratorical skills; writing and speaking skills (expressiveness of speech, skills of maintaining correspondence and storytelling); the ability to negotiate and persuade; intercultural interaction and communication skills.

Universities face the challenge of developing their graduates' communication skills so they can become full participants in scientific cooperation and intercultural communication.

A key responsibility of teachers is to create educational programs that not only prepare students for careers in specific fields but also help them develop essential skills such as persuasion, evidence-building, information acquisition, processing, and transfer. Furthermore, these programs should teach students how to establish interpersonal relationships and select the most effective communication styles for various everyday and business situations. A tolerant attitude toward partners and adherence to communication etiquette are crucial for successful international collaboration. By preparing students for intercultural communication through a specially designed program that utilises modern digital tools and a variety of interactive resources from both formal and informal education, we can significantly enhance the flexibility of future engineering professionals' communication skills. This, in turn, will enable them to become valuable contributors to the global scientific and technical community.

Overall, the research findings provide convergent evidence that the experimental pedagogical intervention had a statistically significant and practically meaningful effect on students' development of flexible communication skills. Significant improvements were observed in both communicative tolerance and adherence to business etiquette rules in the experimental group, while the control group showed no comparable positive dynamics. The results contribute to the growing body of interdisciplinary research in education by enhancing students' readiness for effective professional, intercultural, and collaborative engagement.

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