Communication Attitudes of First-year Engineering Students: Insight and Implications

Krisztina Csiba[1*], Barbara Török[2], Imre Kocsis[3], Gábor Gyarmati[4]

[1] University of Debrecen Faculty of Engineering, Ótemető 2-4., 4028 Debrecen, Hungary
csiba.krisztina@eng.unideb.hu
[2] University of Debrecen, Faculty of Economics and Business, Institute of Marketing and Trade, Non-independent Department of Marketing, Böszörményi 138., 4032 Debrecen, Hungary
torok.barbara@econ.unideb.hu
[3] University of Debrecen Faculty of Engineering Department of Basic Technical Studies, Ótemető 2-4., 4028 Debrecen, Hungary
kocsisi@eng.unideb.hu
[4] University of Debrecen, Faculty of Economics and Business, Institute of Marketing and Trade, Non-independent Department of Marketing, Böszörményi 138., 4032 Debrecen, Hungary
gyarmati.gabor@econ.unideb.hu

Abstract. The complexity of engineering work and the engineers' technical and social responsibility requires multifaceted preparation. Communication skills play a prominent role in this, determining both the efficiency of transferring information when dealing with complex systems and the success of dialogue with society, as well as the representation of professional values and interests. This study provides insight into the preparedness of first-year engineering students in this area, as well as their attitudes towards the communication expectations of the engineering profession.

Keywords: Engineering Education, Soft Skills, Communication.

1 Introduction

New challenges regarding communication skills have recently emerged in engineering education (EE) that require solutions. Two such challenges are the demand for transdisciplinarity and collaboration with LLM-driven "AI" tools. Transdisciplinary education goes beyond multidisciplinarity and is based on the active exchange of ideas among stakeholders. Soft skills, including communication skills, play a prominent role in this process. To organize transdisciplinary education and effectively utilize the latest digital technologies, including generative AI, students must consciously use basic communication skills. Agentic AI is becoming increasingly present in the field of engineering, functioning as 'colleagues' rather than tools. Such changes in the field expand the scope of communication processes for all. In this case, in situations where human-to-human

© The Author(s) 2026
S. Árvai-Homolya et al. (eds.), *Proceedings of the 2nd Innovation in Engineering Education Conference (IEE 2026)*, Atlantis Highlights in Social Sciences, Education and Humanities 58,
https://doi.org/10.2991/978-94-6239-823-8_6

communication was previously the norm, human-to-machine and machine-to-machine channels are playing an increasingly important role in transmitting information. Consequently, the question arises: How does communication change when an AI agent is involved?

To support students in preparing for successful careers in engineering, we need to understand their attitudes, problems, and expectations regarding communication and situations where this communication takes place. It is also important to understand the extent to which they are aware of the challenges that engineers face and their ability to overcome them. This can be investigated through questionnaires, interviews, and creating situations in which students must actively use their communication skills. In this paper, we present the results of a survey in which we aimed to learn students' self-evaluation in this field and clarify their attitudes towards communication situations by addressing the following research questions: (RQ1) whether they are aware of the requirements related to their future engineering work; what is the extent to which they think they meet these requirements; (RQ2) how they address their deficiencies; whether they know how to address these deficiencies with help or self-training; (RQ3) how they perceive the impact of the virtual environment surrounding them, which is dominated by communication based on very simplified, short text messages; and what they think the impact of generative AI on their interpersonal and professional communication. This research did not intend to test and evaluate students' communication skills.

2 A Brief Literature Review

Training the next generation of engineers requires a shift away from the traditional educational approach, one that focuses on transferring specific knowledge. Young engineers must adapt to the evolving nature of engineering work and take on greater responsibility for improving people's lives. In [1], six extensively researched domains in the EE literature are identified (Fig. 1).

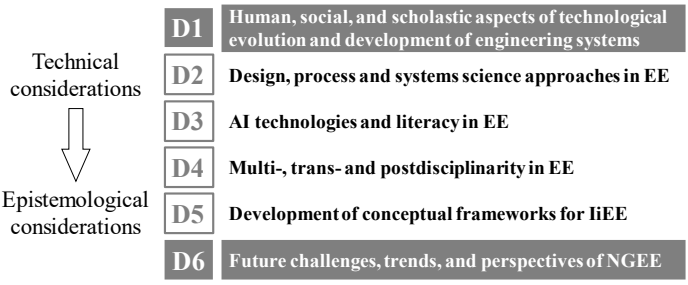


Fig. 1. Some domains of research in the field of EE. (NGEE=Next-generation EE) Source: [1]

The interaction between human needs, societal challenges and educational pathways creates a dynamic environment that drives the evolution of technology and engineering systems. When studying EE in this environment, it is essential to focus on the interplay

between human factors, societal impacts, and educational influences in this evolution. (Fig. 2).

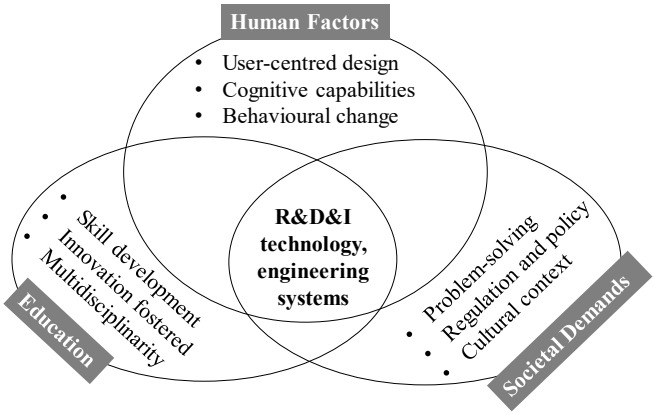


Fig. 2. Three factors of EE. Source: [1]

As increasingly complex tasks, including decision-making and reasoning, are taken over by smart "machines", the role of humans in industry becomes uncertain. Future engineers will be expected to perform higher-level tasks such as analysis, assessment and control. These responsibilities require a broader range of literacy skills. A holistic educational approach is proposed in [2] to help engineers develop the right attitude towards an ever-changing world. To promote their ideas effectively, engineers must understand the social aspects of their work, including social trends and needs, as well as political and economic factors. Engineering students must be aware of the important and far-reaching effects of their work on their community and society in general. [3] illustrates how the relationship between engineering and its broader social, intellectual, and economic contexts evolves over time.

Reference [4] introduces a model that demonstrates how knowledge and skills from the social sciences and humanities can be applied to engineering in relation to people. The authors call on educators to recognize the human aspect of EE as an integral part of the curriculum. Engineers should be trained to address large-scale socio-technological issues and complex situations with integrity. Growing levels of intellectualization, socialization, and personalization can place systems in completely different social and educational contexts [5]. It states that the transformative power of engineers relies on their ability to interpret complex problems holistically and interact with the various profiles present in multidisciplinary teams.

The EE's input largely depends on social conditions. Pre-university sociodemographic and academic data can predict EE performance [6]. Students' general intelligence, attitude, motivation, and professional preparedness determine the effectiveness of their education, particularly during the initial training period. Typically, young people starting EE are assumed to have the following skills: (i) understanding the processes of the real world around them, (ii) recognizing and understanding basic laws, (iii)

knowing the basic concepts and laws of the natural sciences, (iv) having realistic judgment and common sense, (v) having critical thinking and reasoning skills, (vi) recognizing and creatively applying the possibilities of modern technology (including ICT), and (vii) having communication skills as a receiver and sender.

Traditional approaches in EE were primarily knowledge-based, whereas more recent trends have been linked to outcome-based strategies. Current challenges require multidisciplinary teams to communicate effectively and respect different opinions and cultures. Employers seek creative, entrepreneurial engineers with leadership skills who can collaborate with others and apply interdisciplinary knowledge to their work. Engineering educators should respond by developing and continuously updating their own skills, as well as preparing their students [7]. Traditionally organized school subjects have been criticized for their inability to incorporate 21st-century skills and for being disconnected from contemporary, cross-disciplinary, creative modes of knowledge production. Conversely, post-disciplinary curricula may underestimate the importance of intergenerational, specialized conversations about knowledge in schools [8].

The Soft Skills Development Method (SSDM), introduced in [9], focuses on personality development by simulating the personal interactions engineers encounter in their everyday work. These interactions include giving and receiving instructions, collaborating, communicating, and providing objective and subjective assessments and criticism of each other's work. Students are encouraged to step outside their comfort zones by completing unexpected tasks and undergoing unconventional assessments. Examples include working with a somewhat provocative and seemingly subjective teacher ("boss") and relying on peer ("colleague" or "client") assessments. According to their learning objectives, SSDM assignments (including documentation, presentations, teamwork, and reports) fall into one of three categories: (i) learning and applying specific course material, (ii) recalling (or relearning) aspects of general engineering knowledge, and (iii) developing soft skills.

Today, AI tools are available to everyone. However, the quality of AI usage reflects a user's general and professional intelligence, depending on their skill sets, cultural attitudes, and policy frameworks. The emergence of significant new technologies, tools, or methods has always reorganized human, economic, and social relations. Those who adapt quickly gain a competitive advantage, while those who do not fall further behind. Significant technological advances have also occurred at the social level, bringing tangible changes to people's quality of life, social relationships, and economic relations.

Education has always embraced new knowledge, and it will continue to do so. Information and communication technology tends to progress independently of the education system among young people, who then bring this knowledge and these tools with them into the classroom. For several reasons, education must respond to the rapid spread of AI-based applications, which are fundamentally changing our relationship with knowledge, learning, knowledge management, and communication. [10] explores the application of AI in teaching and research tasks within academic institutions. Two objectives are emphasized: (1) identifying and describing current and prospective AI systems in higher education, and (2) characterizing the opportunities and risks of integrating AI into academic environments. Based on interviews, seven distinct clusters of

attitudes were identified: Optimists, Moderates, Dreamers, Cautious Skeptics, Expansionists, Knowledgeables, and Strategists.

3 Results

We conducted a quantitative survey using a structured questionnaire administered to first-year engineering students at the Faculty of Engineering of the University of Debrecen. It was completed by 224 Hungarian students (58% of all Hungarian first-year engineering students) and 50 international students (28.4% of all foreign first-year engineering students). The instrument consisted of 49 closed-ended questions and 8 open-ended questions. Most closed-ended items employed a six-point Likert scale (1 = not at all, 6 = exceptionally/highly), while some questions used multiple-choice or dichotomous (yes/no) response formats. The questionnaire was organized into four thematic sections: (1) Communication Self-Assessment and Attitudes, (2) Communication and Artificial Intelligence, (3) Self-Awareness and Development Needs, and (4) Awareness, Trust, and Professional Responsibility. The survey aimed to explore students' communication-related self-perceptions, attitudes toward AI-assisted communication, development needs, and broader views on communication responsibility and trust in digital environments.

To complement the quantitative data, eight open-ended questions allowed respondents to elaborate on their opinions and experiences. These qualitative responses were analyzed through inductive thematic coding, whereby recurring ideas and patterns were identified, grouped into thematic categories, and subsequently summarized. This mixed-methods approach provided both statistically analyzable data and richer contextual insights into students' perceptions and experiences.

Regardless of nationality, both groups considered communication skills to be important in engineering work (Mean_Hungarian = 5.09, Mean_International = 5.2; with standard deviation remaining below 1 in both cases on a scale of one to seven).

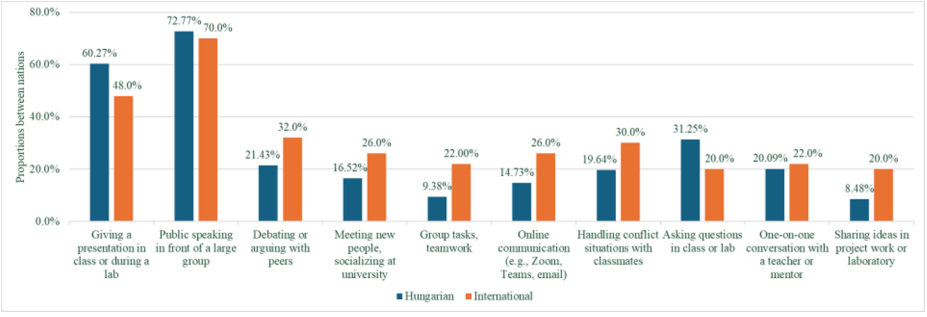


Fig. 3. Respondents' main challenges in communication, Source: Author's own editing, 2026

As part of the analysis, we compared the communication challenges faced by the respondents. Due to the differing number of respondents, proportions were compared, and participants were allowed to select multiple response options. Results are shown in

Fig. 3. As shown in the figure, regardless of nationality, the greatest challenge for students is speaking in front of a large audience, while sharing ideas during project work or laboratory is what they find most comfortable (RQ1).

We also asked whether respondents consciously work on improving their communication skills (RQ2). Of the 274 students, 176 (64.2%) answered no, while 98 (35.8%) answered yes. Those who responded affirmatively were asked, via an open-ended question, what methods they use for self-improvement. The responses were subsequently categorized and presented in a frequency table; these results are shown in Table 1.

Table 1. Main communication improving methods used by respondents, Source: Author's own editing, 2026

Communication method	Number of answers
Reading	29
Communicating	27
Practicing	17
Watching videos	13
Listening to podcasts	11
Giving/practicing presentations	4
Observing others' communication	4
Practicing communication situations at home	3
Participating in debates	3
With psychologist's help	2
Developing articulation	2
Using AI tools	1
Developing confidence	1
Learning out loud	1

It is evident that respondents most commonly develop their communication skills through reading and by deliberately placing themselves in real-life communication situations. Other frequently mentioned responses included practicing at home and watching or listening to videos and podcasts. Additionally, some respondents mentioned the role of self-confidence and the assistance of a psychologist, suggesting that there are students for whom communication poses a particular challenge in everyday life.

In the following open-ended question, we also asked students to what extent they believe that time spent in virtual spaces (e.g., gaming) can distort communication and the perception of situations. Opinions varied considerably, and the approaches taken to the question were similarly diverse. The results are summarized in Table 2.

Table 2. Respondents' answers regarding the communication-distorting effects of time spent in virtual spaces. Source: Author's own editing, 2026

Category	Number of answers	Examples of answers given by the respondents
Yes, to a fairly large extent	120	„It can distort to such an extent that it can confuse you if you are talking or playing with a real person or AI." „Quite a bit, because it is easier to misunderstand other people's reactions online, and the lack of nonverbal signals can distort communication." „Real situations are more difficult to judge, after a while, for example, they compare real situations to game situations."
Not at all	49	„There are also internal communications within the games, and I don't think it distorts much." „In my opinion, it doesn't distort it, because when we play in a team, we have to communicate and use tactics with other team members." „I don't think it distorts it, because there are many games where you have to understand a task and complete it, or where you have to communicate with other players in order to successfully complete a given task."
Depends on the time spent in the virtual space	23	„I think the more one spends time in virtual spaces, the more they are detached from reality. It can distort their communication and judgement severely as they would tend to relate everything to virtual reality." „I think that people who spend more time in virtual spaces tend to become less aware of what happens in their surroundings, and their communication skills are not as effective." „Spending a lot of time in virtual spaces can distort communication and judgment because online environments often encourage quick, impulsive responses, reduce real social cues like tone and body language, and create their own norms that don't always match real-life behavior."
No, it helps a little	23	„My communication has improved through cooperation with strangers in the digital space." „Not at all, I think it improves it because we talk to people we might never meet in real life." „I think video games help communication to a small extent."
Depends on the personality /attitude of the person playing	20	„Despite I play games, I can control myself. In my thoughts, it fully depends on people and how their mindsets work." „I think it can influence judgment to some extent, especially when people spend long hours in virtual environments, but the effect varies from person to person."

		„It depends on the person whether it can be very distorting if they are really immersed in the game and it is their life, or it can be unnoticeably distorted if someone just uses it as a pastime.”
Yes, to a small extent	19	„It sometimes makes you insensitive.” „It can affect the communication skills in multiple ways, which might be good or bad.” „Sometimes quite a bit because it does not reflect reality.”
Depends on the type of game	15	„This can depend on a lot of things, games, because I think there are games where you have to recognize the situation, you have to communicate something.” „It really depends on the given game and the time spent in it. Certain games can worsen the sense of reality, while others can even positively influence teamwork or thinking skills.” „It depends on the game, there are some that can improve it, but of course, it is rarer than those that can worsen it. The “toxic” games are the ones that worsen it the most, for example, competitive games, but they can partly strengthen teamwork.”

Respondents expressed both positive and negative views regarding virtual environments and online gaming. It is apparent that there is no consensus among first-year engineering students; however, a larger proportion of respondents confirmed the negative influence of these platforms.

The study also paid particular attention to students' use of artificial intelligence (AI). Our analysis revealed that the most frequently used AI tool among respondents was ChatGPT, followed by Gemini, Perplexity, Claude, and Grok.

Table 3. The most frequently used AI tools among respondents.

AI tool	mean	median	mode	std
ChatGPT	2.96	3.00	3	0.840
Google Gemini	2.07	2.00	1	1.032
Perplexity	1.17	1.00	1	0.538
Claude	1.15	1.00	1	0.448
Grok	1.15	1.00	1	0.464

This difference may be linked to the varying social media ecosystems students are embedded in prior to entering higher education. Grok, developed by xAI, is deeply integrated into the X (formerly Twitter) platform, meaning its reach is closely tied to the user base and penetration of that platform. According to global surveys, ChatGPT remains by far the most widely adopted AI tool among university students, while Grok has not emerged as a mainstream academic tool [11]; however, it should be noted that dedicated worldwide empirical research on the comparative adoption of specific AI tools among student populations remains limited to date. By performing cross-tabulation analysis, a significant correlation was found between Grok usage and nationality

($p < 0.05$). Although first-year engineering students generally do not use Grok frequently, Hungarian respondents are more likely to report that they never use it (83.5%), whereas international students are more likely to indicate that they use it, albeit rarely (39.1%). This pattern aligns with the observation that the input of engineering education depends largely on social conditions, and that pre-university sociodemographic and academic backgrounds shape students' technological preparedness and habits [6]. Supporting this, platform-level data indicates that X usage for any purpose remains exceptionally low in Hungary (12%), suggesting that Hungarian students have had limited prior exposure to the ecosystem through which Grok primarily reaches its users [12].

Regardless of nationality, students who completed the questionnaire considered the interpretation of responses generated by the aforementioned AI tools to not pose a significant challenge (Mean_Hungarian = 2.27, Mean_International = 2.3, with standard deviation ranging between 1.033 and 1.266 on a scale of one to seven).

In response to the question "Have you ever shared AI-generated content as your own?", 12.5% of Hungarian respondents and 20% of international students answered yes. Cross-tabulation analysis revealed no significant differences between the two nationality groups in terms of sharing AI-generated content as their own.

Finally, respondents were asked whose opinion influences their views on AI the most (RQ3). Figure 2 presents the number of votes among first-year engineering students by nation. The y-axis shows the distribution of nations, while the number shown in the bar charts indicates how many respondents marked the given answer per nation.

As shown in Fig. 4, while Hungarian respondents are most influenced by their acquaintances and friends, international respondents identified IT professionals as the primary source of influence. For both nationality groups, social media platforms emerged as a significant influencing factor at a high proportion ($p < 0.01$). This difference may reflect the distinct pre-university social and professional environments the two groups come from, as sociodemographic background has been shown to shape students' academic and technological preparedness prior to entering higher education [6]. Consequently, students embedded in networks where IT professionals are prominent - as appears more characteristic of the international respondents in this sample - may develop more professionally anchored perspectives on AI, while those whose primary social circle consists of peers and acquaintances tend to form their views through informal, experience-based channels. This is consistent with findings suggesting that attitudes toward AI in academic contexts are not uniform but reflect a spectrum of orientations shaped by individuals' broader social and informational environments [10].

We also asked students in an open-ended question about their opinions on the advantages and disadvantages of using AI, such as ChatGPT. The results are shown in Table 4.

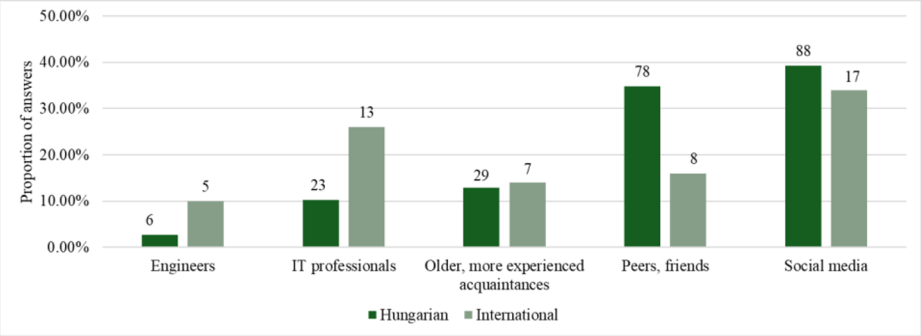


Fig. 4. The factors that most influence respondents' attitudes toward AI by nationality Source: Author's own editing, 2026

Table 4. Opinions on the advantages and disadvantages of using AI.

Advantages	Number of answers	Disadvantages	Number of answers
Speed/time saving	91	Erodes communication skills	71
Helps with development/learning, explains things, answers everything	79	Misinformation and hallucinations	57
Helps with writing	48	Loss of autonomy and critical thinking	55
Gives ideas	16	Generic output, lacks the "human touch"	37
Helps with translation	6	Cognitive laziness and complacency	18
Have someone to communicate with	3	Stagnation of personal growth	15
Enthuses	2	Stifling of creativity	11
		Impairment of cognitive abilities	9

It is evident that students identified a wide range of both advantages and disadvantages regarding the use of AI tools. The primary benefits were perceived to be the speed of task execution, support in learning and personal development, and assistance with writing and composition. Conversely, the most significant drawbacks cited were the detrimental impact on communication skills, the risk of misinformation, and the loss of autonomy and original thought resulting from over-dependence. To provide a comprehensive overview of student perspectives, several verbatim responses from the survey are quoted below:

- „AI is not the best choice for communication tasks, a person can convey what he or she is saying with more emotions and can formulate these in a "more human" way. AI is useful for information gathering, but I don't think it's suitable for human communication.”
- „It helps quickly write emails, checking grammar, 24/7 availability to help. But lack of critical thinking and personal understanding if you rely on it a lot.’
- „The advantage is that we get a quick answer, but the disadvantage is that it's not necessarily good, and people don't think anymore, they just write something to the AI, and it's done.”
- „The advantage is that I don't have to bother the teacher with certain professional questions in some subjects, I simply get an answer quickly. The disadvantage, however, is that it doesn't necessarily state accurate things.”
- „Advantage - developed communication skill, disadvantage- makes you lonely”
- „It makes the student's life much easier, if you don't understand something, you can ask him for an explanation, but you have to be careful with it because it doesn't necessarily give the right answer and it can make you lazy.”

The list indicates that, beyond the factors presented in the table above, AI usage is also influenced by other elements, such as social anxiety („I don’t have to bother the teacher”) or the lack of social interaction („It makes you lonely”). These responses suggest that students are not only aware of the practical benefits of AI tools, but also recognize and articulate their potential risks — both in terms of learning outcomes, such as reduced critical thinking and over-reliance, and in terms of social consequences, including increased isolation and diminished interpersonal communication. This nuanced self-awareness indicates that first-year engineering students approach AI with a degree of reflective understanding that goes beyond mere tool adoption, acknowledging the broader implications of its integration into academic and everyday life.

4 Conclusions

Advances in high-capacity technological tools are reshaping the role of engineers, shifting their work toward (i) analysis and control, (ii) research, development, and innovation (R&D&I), and (iii) the effective use of AI-driven tools. These activities demand a higher level of professional expertise, creativity, and a broad range of soft skills, particularly communication. At the same time, the lifestyle of younger generations—characterized by the dominance of electronic games, artificial visual environments, and increasing social isolation in virtual spaces—makes it more challenging to acquire even basic interpersonal skills.

Deficiencies in communication skills can render an engineering career more stressful and potentially less successful. As widely emphasized in the literature, engineering education bears a clear responsibility to highlight the importance of communication and to develop structured programs that enhance these competencies. Designing effective communication training requires a thorough understanding of students’ attitudes, motivations, expectations, and self-perceptions.

In this study, posing three research questions, we explored first-year engineering students' self-assessment of their communication skills and their attitudes toward various communication contexts. We also examined their perceptions of how generative AI is influencing communication among younger generations. Rather than directly assessing students' abilities, we focused on their experiences—both personal and observed—regarding communication with peers and instructors. Specifically, we investigated their experience and confidence in communication situations, their perceived personal barriers, and their level of satisfaction with the communication practices of those around them. Understanding these factors is essential for those who design communication development programs.

Both the questionnaire and our educational experience show that most students are aware of the general expectations within the industry. However, many overestimate their soft skills and are uncertain about the impact of AI on communication (RQ3). As AI—particularly generative AI—continues to permeate everyday and professional life, and it is fundamentally reshaping the role of human contribution. Developing a personal strategy to navigate this evolving landscape is becoming essential, especially in preparation for engineering careers. Our findings suggest that many students lack clear perspectives on this challenge and often hold unrealistic expectations regarding future problem-solving processes and human–machine collaboration.

Historically, advanced technologies were accessible only to a limited group of trained individuals and were typically introduced in higher education contexts. Today, however, powerful technological tools are widely available—even to children—often without the foundational knowledge required to use them effectively. This shift is transforming how younger generations perceive learning, problem-solving, and knowledge itself. Consequently, engineering education must adapt by equipping students with practical strategies for the age of AI while fostering critical awareness of its opportunities and risks.

The results show that communication skills are a core competence for students, but the increasing use of AI is fundamentally affecting how these skills are practiced. AI serves both as support and as a challenge in everyday academic work, reshaping the way students approach communication tasks.

While AI use increases efficiency, our key finding is that students engage with AI outputs at different critical levels. Some rigorously evaluate AI-suggested content, while others accept it with minimal scrutiny. Frequent AI users primarily see it as an enabling tool, not a replacement for communicative effort. However, not all students apply the same level of scrutiny to AI-generated content. This uneven AI literacy directly affects the development of critical thinking and self-reliance, posing a central challenge for adapting communication skills to an AI-influenced academic and professional landscape.

As AI becomes integrated into communication, it actively shapes communication skills rather than merely serving as a separate tool. Therefore, engineering education must intentionally help students use AI to enhance, rather than replace, their critical thinking and communication abilities.

Future engineers must navigate in hybrid communicative environments where human judgment and AI-generated assistance coexist, making critical awareness an essential competence. By aligning pedagogical approaches with this transformation, higher education institutions can better prepare future engineers to communicate effectively, think critically, and collaborate responsibly in an AI-augmented world.

Our experience and the relevant literature show that the most effective way to develop soft skills, including communication skills and AI-supported communication techniques, is to integrate these activities into professional courses. This integration is evident in project-based, modular educational systems, where the educational goal is to facilitate multifaceted discussions on problem areas within modules, in line with the project-based approach commonly used in industry. In traditional, course-centered educational systems, special soft skills development methods are required, as discussed e.g. in [13].

Disclosure of Interests. The authors have no competing interests to declare that are relevant to the content of this article.

References

1. Kocsis, I.: Extended Editorial: Design, Process, and System Science Triggered Innovations in Engineering Education. Journal of Integrated Design and Process Science, Online first, https://doi.org/10.1177/10920617261430871 (2026)
2. Trbušić, H. Holistic education: the social reality of engineering. The Journal of Education, Culture, and Society, 4(2), 227-238. (2013)
3. Cheville, A.: Defining engineering education, 121st ASEE Annual Conference & Exposition, Indianapolis, Paper ID 9586 (2024)
4. Hynes, M., Swenson, J.: The humanistic side of engineering: Considering social science and humanities dimensions of engineering in education and research. Journal of Pre-College Engineering Education Research, 3(2), 31–42. https://doi.org/10.7771/2157-9288.1070 (2013)
5. Lantada, A. D.: Engineering education 5.0: Continuously evolving engineering education. International journal of engineering education, 36(6), 1814-1832. (2020).
6. Santiago-Muñoz, F., Larrañaga, M., Elorriaga, J. A., Arruarte, A.: Identification of patterns to prevent the failure of engineering students. International Journal of Artificial Intelligence in Education, 35(4), 3356–3405. https://doi.org/10.1007/s40593-025-00502-9 (2025)
7. Fomunyam, K. G.: Education and the fourth industrial revolution: Challenges and possibilities for engineering education, International Journal of Mechanical Engineering and Technology, 10(8), 271-284. (2019)
8. Dussel, I.: The shifting boundaries of school subjects in contemporary curriculum reforms. Towards a post-disciplinary curriculum?. Zeitschrift für Pädagogik, 66(5), 666-689. (2020)
9. Burján-Mosoni, B., Balajti, I., Kocsis, I.: Expanding Soft Skills Development Across Undergraduate Engineering Education. Journal of Integrated Design and Process Science, Online first, https://doi.org/10.1177/10920617251409518 (2026)
10. Verboom, A. D., Pais, L., Zijlstra, F. R., Oswald, F. L., Santos, N. R.: Perceptions of artificial intelligence in academic teaching and research: a qualitative study from AI experts and professors' perspectives. International Journal of Educational Technology in Higher Education, 22(1), 46. (2025)

11. Digital Education Council. Global AI Student Survey 2024. https://www.digitaleducationcouncil.com/resource-library-items/digital-education-council-global-ai-student-survey-2024 (2024)
12. Statista. Share of X (formerly Twitter) users in Europe who used the service for any purpose and for news in the last week as of February 2023. https://www.statista.com/statistics/1428365/x-twitter-use-in-europe-news/ (2023)
13. Burján-Mosoni, B., Balajti, I., Kocsis, I.: Expanding soft skills development across undergraduate engineering education. Journal of Integrated Design and Process Science (2026), online first, https://doi.org/10.1177/10920617251409518

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (http://creativecommons.org/licenses/by-nc/4.0/), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

