2.10

Teaching Interpersonal Communication: Listening, Adaptive Communication and Interconnection Skills

Vladislav Krivoshchekov[a], Ina Peters[b], Sabine Ammon[c], and Siara Isaac[d]

[a] EPFL, Switzerland, ORCID: 0000-0003-1213-0884;
[b] Technische Universität Berlin, Germany, ORCID: 0000-0003-2399-7483;
[c] Technische Universität Berlin, Germany, ORCID: 0000-0002-0857-563X;
[d] EPFL, Switzerland ORCID: 0000-0002-1527-8510.

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This chapter helps you teach interpersonal communication skills for engineering students. It focuses on one-to-one interactions based on three skills: active listening (perceiving and interpreting verbal and non-verbal messages), adaptive communication (integrating perspectives to negotiate meaning and adjust communicative choices), and interconnection (building and sustaining constructive professional relationships over time). For each skill, we define subskills and provide implementable teaching guidance, including activities, short practice drills, and feedback and reflection prompts that support transfer into project work, stakeholder engagement, and interdisciplinary collaboration. Interpersonal communication does not succeed or fail only at the level of technique; emotion cues, competing perspectives, and identity-based dynamics shape what people notice, how they interpret it, and what feels permissible to say or do. To assist in the operationalisation of these concepts, we pair each interpersonal communication skill with a social dimension: social emotions help students identify affective cues that guide attention and inference in listening, perspective taking helps students to surface and to work with divergent framings in adaptive communication, and social identity helps students anticipate trust and status dynamics that shape interconnection. This chapter will help you teach students to predict, avoid, and repair communication breakdowns by choosing appropriate learning scaffolds, and designing activities and assessment that treat interpersonal communication skills as part of professional engineering competence.

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1 Definition

Interpersonal communication refers to the ability to exchange information, perspectives, and emotions effectively with others to achieve mutual understanding and collaboration (see Hargie, 2021). Drawing on research on transferable competencies in engineering education (Leandro Cruz & Saunders-Smits, 2022), we conceptualise this ability through three interrelated skill areas:

1. Active listening skills: attending closely to verbal and non-verbal messages to ensure accurate interpretation.
2. Adaptive communication skills: reflecting on one's own and others' perspectives to adjust communication choices to create shared meaning.
3. Interconnection skills: building trust and sustaining constructive relationships over time.

Together, these communication-specific components of broader interpersonal competency reinforce one another: listening provides the cues, adaptive communication uses them to negotiate meaning, and interconnection sustains the trust that strengthens listening and adaptation over time.

2 Why teach interpersonal communication skills?

Engineering work increasingly relies on inter- and transdisciplinary collaboration for technology development, bringing together technical, social, organisational, and lived expertise to anticipate impacts and prevent harm. This emphasis is also reflected in European accreditation: the EUR-ACE framework defines programme outcomes across learning areas that include communication and team-working skills and the capacity to make judgements that incorporate relevant social and ethical issues (ENAEE, 2021). The need for these skills is most visible in interdisciplinary project teams, stakeholder and client engagement, safety-critical handovers, and design reviews where disagreement must be handled constructively. When interpersonal communication is assumed rather than taught, concerns and uncertainty are left unsaid or are misread (listening), misunderstandings persist across disciplines, languages, and priorities (adaptive communication), and trust erodes so conflict increases or becomes personal, resulting in rising coordination difficulties (interconnection).

The need to teach these skills is further reinforced by evidence that the competencies of engineering graduates in this area often fall short of employers' expectations (Coffelt et al. 2024; Mills & Treagust 2003; Nair, et al., 2009), which has been shown to negatively impact engineering projects (Gamil & Abd Rahman, 2023; Vaghela & Kaushal, 2025; Yang et al. 2025). These skills are considered essential in establishing and maintaining human relationships (Spitzberg & Cupach, 2011) and are fundamental to well-being and ethical engineering practice. Because interpersonal communication is always embedded in broader social contexts, we link each skill to a social dimension — emotions, perspectives, and identities — to clarify how these dynamics shape communication processes and learning opportunities in engineering education.

3 Forms of implementation

Interpersonal communication involves more than exchanging words; it is shaped by emotions, beliefs, and perspectives. Developing these skills therefore requires structured opportunities to notice what is happening in an interaction, to try alternative moves, and to reflect on their effects. The skills of active listening, empathy, and social influence, all relevant to interpersonal skills, are skills that are important now and, in the future, (World Economic Forum, 2025). However, engineering education research has demonstrated that activities requiring interpersonal skills are insufficient to build competence without structure that supports skill development (Picard et al., 2022). Building on findings that interconnection and adaptive communication are common weaknesses (Leandro Cruz & Saunders-Smits, 2019), we emphasise three levers: (a) structured practice, (b) explicit conceptual models and strategies, and (c) guided reflection. The 3T PLAY framework (Fig. 2.10.1) provides a practical lens for designing and auditing learning activities (Isaac & de Lima, 2024), as modelled in sections 3 and 4 of this chapter.

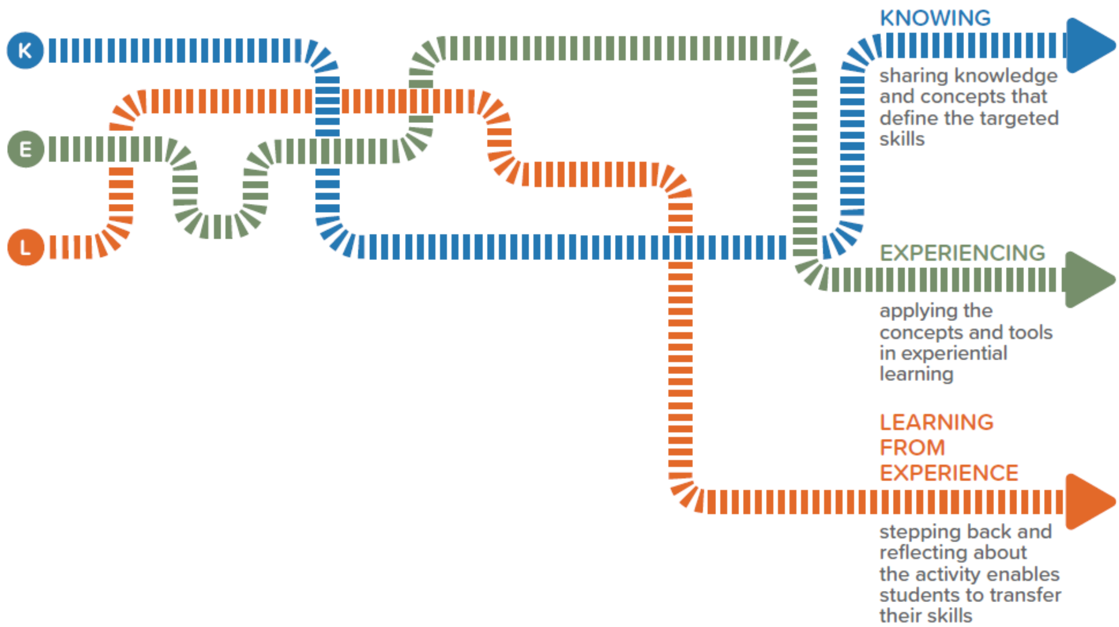

Figure 2.10.1: The 3T PLAY framework (Isaac & de Lima, 2024)

To convert opportunities into learning, you should state dual learning goals (disciplinary and interpersonal), provide a model or strategy before practice (e.g., responses to fear emotions include fight, flight, or freeze reactions), stage short drills before complex projects, and embed reflections after each interaction. Assessment and incentives should be aligned with collaboration (e.g., rubric criteria for listening, adaptation, and relational contribution) and decisions about module organisation (what is graded, time pressure during assessment tasks, team composition) should be checked for contradictions with the competence goals.

Learning does not occur in a vacuum, so the didactic setting should balance challenge with support (Peters et al. 2024). Team projects — especially when they involve several disciplines or stakeholders — create context-authentic friction, and that friction can be productive if students benefit from clear success criteria and strong communication strategies. Recognising that students' learning is impeded when they encounter too much difficulty (Kalyuga 2007; Kirschner et al. 2006) has led to some instructors seeking to reduce these difficulties (Yu & Zin, 2023). However, we argue that difficulties are valuable learning opportunities when they are scaffolded: they prompt students to apply their interpersonal communication strategies and to reflect on their experience. It may even be pedagogically beneficial to deliberately provoke moments of discomfort and irritation to create learning opportunities (Bjork & Bjork, 2023).

Crucially, insufficient preparation and support can overwhelm some students (Ellingsen et al., 2021), sometimes hardening boundaries against other perspectives (Paolini et al., 2024). You can keep conflict educational rather than corrosive by sequencing from low-stakes exercises to more complex project work, sharing explicit discussion norms and repair protocols, giving rapid formative feedback, and ensuring assessment aligns with the collaborative behaviours you are targeting (Hmelo-Silver et al., 2007). In Sections 3.1-3.3, we define teachable sub-skills for each of the three skill areas of active listening, adaptive communication, and interconnection, and illustrate how you can operationalise them through short routines and worked examples.

3.1 Listening: ability to hear and interpret another person's message, enabling a coherent response to both cognitive and emotional components

Listening skills involve capturing what another person is expressing — not only the literal meaning of their words but also what remains unspoken and the emotional messages conveyed through tone, pauses, and body language. Active listening goes beyond hearing; it also includes response strategies that signal attentiveness and help build mutual understanding.

Listening sub-skills

1a. Distinguish emotional and cognitive components in another person's communication, attending to both what is said and left unsaid.
1b. Identify emotional states and potential implications for both self and other people.
1c. Respond coherently to another person's messages, including explicit and implicit aspects.
1d. Employ active listening strategies to convey that you are listening and promote mutual understanding.

By distinguishing listening subskills, we make explicit how listening moves from detection to response: 1a) noticing cognitive and emotional content; 1b) interpreting emotions and one's own reactions; 1c) responding coherently to both layers; and 1d) using verbal and non-verbal signals that show the speaker they have been heard.

Together, these sub-skills move listening beyond content capture toward interaction-ready understanding. Example 1 presents a weekly check-in and reflection routine used in a master-level module at the École Polytechnique Fédérale de Lausanne (EPFL) that provides scaffolded support for interpersonal communication skills.

Example 1. Emotion check-in and reflection routine

This example stems from the module How people learn: Designing Learning Tools by N. Kotluk and R. Tormey

Purpose
This routine scaffolds listening skills by helping students notice and label affective cues that shape attention, inference, and turn-taking during interaction.

How to facilitate the activity with students

1. *Set the target: Remind students of the objective and name the listening focus (e.g., "today we practise noticing and labelling emotional cues that affect how we interpret each other"). Ask each student to name their current emotional state; offer vocabulary support (e.g., Plutchik emotion wheel).*
2. *Practise (embedded during activities): During class work, pause briefly to ask what students are noticing emotionally (in self and others). Normalise strong emotions as expected in inquiry work and offer a regulation script (e.g., name, normalise, navigate) so discomfort is engaged rather than avoided.*
3. *Close and transfer: End class with an individual micro-reflection where students write one sentence linking one cue to one communicative move to one action to carry into the next team meeting (e.g., "When I notice X, I will Y").*

Why it works

- *Makes the skills visible: You name the listening sub-skill and connect it to collaboration (teamwork now; stakeholder/safety culture later).*
- *Creates low-stakes rehearsal: Vocabulary support + brief check-ins operationalise detection and labelling, while the regulation script keeps discomfort within constructive limits.*
- *Fosters transfer: The closing reflection links a concrete moment to a specific next move, increasing carry-over into future interactions.*

What this shows
You can turn routine check-ins into listening practice when you name the skill, support cue-labelling, and close with a cue.

Social emotions — those arising specifically from interactions with others — signal and calibrate attention, inference, and action during talk. Micro-cues, including facial tension, tone shifts, and hesitations, convey status, social safety, and belonging, and allow listeners to use these cues to decide whether to explore, defend, or disengage (Tormey, 2021; van Kleef & Côté, 2022). Social emotions matter because they supply the input that drives detection 1a), identification 1b), responding 1c), and enactment

1d) of these interpersonal communication sub-skills. If engineering students ignore or misread these inputs, subsequent communication processes are impeded, leaving students unable to respond effectively. The implication for the development of engineering students' transferable skills is straightforward: students' capacity to capture the meaning and intention of others depends on better interpretation and use of social-emotional information.

In settings where students have had limited prior instruction in listening and where emotion talk is discouraged, some students accurately track technical content while missing or dismissing affective cues interactions. This can collapse cognitive and emotional strands into a single reading of the interaction, increasing the risk of misaligned responses. When students begin to notice the presence of emotional components, their accuracy in decoding this aspect often lags behind their perception, with the result that mislabelling of emotions is common. For instance, pride is read as arrogance, or frustration as hostility. This mislabelling undermines trust and mutual communication even when the technical message is clear (van Kleef & Côté, 2022). In engineering education, local norms that frame emotion talk as irrelevant or inappropriate exacerbate this tendency toward emotional neglect (Krivoshchekov et al., 2025), leaving students' responses hesitant and their listening signals mechanical rather than contingent on accurate interpretation.

Where academic and engineering climates are more psychologically safe, students label peers' feelings more accurately and use those appraisals to guide their responses. Video-ethnography of Nordic sustainability design teams suggests that low-intensity social emotions such as curiosity, comfort, and validation support the sharing of uncertainty and more effective knowledge distribution. Furthermore, acknowledgement and appreciation co-occur with broader participation and more flexible problem solving (Holmén & Lönngren, 2025). At this stage, detection, decoding, and integration of cognitive and emotional components become more reliable, although translating insight into timely action (e.g., reframing a task, clarifying roles, redistributing workload) may still require explicit norms or permission structures.

Expert listening adds judgement about the authenticity and relevance of both cognitive and emotional signals and converts that appraisal into appropriate action. Evidence from emotions-as-social-information theory suggests that authentic enthusiasm or compassion can elicit complementary prosocial behaviour (e.g., offering help, adjusting plans, clarifying misunderstandings), whereas surface-acted displays erode trust and limit coordination (van Kleef & Côté, 2022). Expert listeners integrate cognitive and affective layers across the four subskills: they read the room, adapt their participation, and offer precise reassurance while signalling attention. In design discussions, when vulnerability can be voiced and met with care, teams have been observed to move into deeper exploration of complex issues (Holmén & Lönngren, 2025), illustrating how interpersonal communication supports substantive engineering work.

3.2 Adaptive communication skills: ability to reactively adapt one's communication approach and language in accord with a purpose, context, and individual

Adaptive communication skills involve adjusting how you frame a problem, choose language, and respond in real time so that people can build a shared understanding between their different perspectives. These skills require engineers to recognise that communication styles and knowledge priorities vary by context, professional role, identity, and discipline, and implement their skills to deliberately shape interaction to reduce misunderstandings and to integrate diverse inputs into a workable problem definition. In engineering, this matters because the 'problem solver' identity and the expectation that problems have clear solutions can narrow what counts as relevant knowledge (Isaac & Shew, 2024).

Adaptive communication sub-skills

2a. Acknowledge the incompleteness of knowledge sets.
2b. Recognize the values, norms, and biases that are active in a communication partner and oneself.
2c. Adapt one's language and communication style to reduce misunderstandings.
2d. Explicitly integrate different knowledge sets and perspectives.

Example 2. provides a short, low-stakes activity for developing adaptive communication skills based on the 3T PLAY framework; it has been implemented in six countries, including for a first-year design module with 1000 students. The activity addresses skills for managing emotions during peer feedback, supporting listening (1a-1d) and adaptive communication (2b-2c) when feedback is difficult to give or receive.

By distinguishing adaptive communication sub-skills, we make explicit how adaptation moves from epistemic humility to integration: 2a) treating our own perspective and disciplinary knowledge as partial; 2b) noticing the assumptions and biases shaping an interaction; 2c) choosing wording and framing that builds shared meaning (e.g., defining terms, acknowledging another's perspective, checking interpretations); and 2d) integrating multiple perspectives into a broader account of the situation.

A useful lens for developing adaptive communication is the recognition that knowledge is produced within specific contexts — each with its own assumptions, rules, and priorities — which makes any single perspective inherently incomplete (Haraway, 1988). For example, engineering problem framing often prioritises feasibility, efficiency, and innovation, while other priorities (e.g., social justice) may be backgrounded (Faulkner 2007). This is why responsible technology design increasingly relies on inter- and transdisciplinary collaboration to anticipate downstream impacts and prevent harm (Grunwald, 2011). In such collaborations, misunderstandings and irritation are not only barriers; they can be diagnostic cues that reveal conceptual differences and signal where adaptation is needed (Galison 1997; Nicolescu 2002).

Example 2. Emotional self-management practice

This example on emotional self-management practice during feedback discussions, shows how to support students giving each other constructive feedback, especially when it is difficult to receive (Isaac & de Lima, 2024).

Purpose

This routine scaffolds emotional self-management by creating a challenging collaboration situation followed by a low-stakes opportunity to hold peer feedback discussions focusing on emotional skills.

How to facilitate the activity with students

1. *Set the target: Present the learning objectives related to structuring peer feedback and managing their own and others' emotions during difficult discussions. Have students briefly review their past experiences with peer feedback, focusing on barriers and accelerators including emotions.*
2. *Practise: Provide students with strategies for managing emotions and giving and receiving feedback. Then set students to work in groups designed to create collaboration difficulties while building a marble run with limited resources. Students then prepare verbal feedback for their partner. Students are encouraged to get out of their comfort zone by sharing at least one point of feedback that feels difficult to receive.*
3. *Close and transfer: Ask students to analyse what was difficult, constructive, or surprising, identifying one emotion management strategy to use in the future.*

Why it works

- *Defining the competence and why it matters now and in their future career clarifies expectations and supports students to set their personal development goals.*
- *Analysing their past experiences enables students to see value and challenges in skill development.*
- *Simple emotional regulation strategies provide a conceptual model and practical guidance for feedback discussions. Informing students that their emotions are a common, even desirable, part of collaborative work normalises feelings in engineering.*
- *Focus on skill development without pressure via short, non-technical activity avoids implication for grades or project deliverables. It also creates space to engage with discomfort and focus on learning.*
- *Considering how this feedback and emotional experience was (dis)similar to their projects assists students to transfer their developing skills to future situations.*

What this shows

You can make adaptive communication skills teachable when you 1) name the interaction risk (defensiveness, ambiguity, perceived threat); 2) provide a short *script for regulating emotion and adapting wording; and 3) give students practice opportunity followed by reflection that links one cue to one repair move.*

In settings where students have had limited experience communicating across disciplines or roles, some may treat their own framing as self-evident and interpret disagreement as error or resistance rather than conceptual difference. This can produce predictable breakdowns: key terms remain undefined, assumptions are not tested, and feedback is delivered in ways that trigger defensiveness rather than revision. In engineering cultures that reward certainty and speed, the hurdle for recognising incompleteness (2a) and surfacing assumptions (2b) can be high (Faulkner, 2007).

Where learning environments legitimise uncertainty and offer explicit interaction norms, students are more likely to treat disagreement as information and to use it to compare concepts, express uncertainty, and adapt language (2c). At this stage, students begin to translate meta-awareness into practice by reducing jargon, checking interpretations, and signalling openness — especially when cues such as hesitation, irritation, or withdrawal are treated as prompts for clarification rather than as interpersonal failure (Keestra, 2017).

Expert adaptive communication involves integrating perspectives into a shared understanding that guides action (2d). Tools such as concept mapping (Tan et al., 2021) and scenario techniques (Pößneck et al., 2024) support this integration by making assumptions visible and enabling teams to articulate how different priorities interact. Recognising that no single perspective can fully capture a complex sociotechnical situation provides a strong foundation for adaptive communication in interdisciplinary and stakeholder-facing engineering work.

3.3 Interconnection skills: ability to build and retain professional relationships

Interconnection skills involve building and sustaining working relationships that support learning, coordination, and professional growth over time. In engineering, these skills help students move from working alongside others to working with others — maintaining trust, seeking support when needed, and creating the professional relational conditions for effective collaboration across roles and disciplines.

Interconnection subskills

3a. Identify potential growth opportunities arising from interpersonal connections in professional and learning contexts.
3b. Initiate, maintain, and respond to social interaction in ways that promote openness and build connections with a range of profiles.
3c. Constructively and proactively create opportunities for increased interaction with and between people to develop networks around you.

By distinguishing interconnection subskills, we make explicit how relationship-building moves from recognition to action: 3a) noticing why a connection could matter (for learning, support, opportunity, or inclusion); 3b) using interaction moves that build trust and openness (e.g., expressing interest, following up, offering to help); and 3c) creating repeated opportunities for interaction that turns one-off contacts into durable networks. Example 3 illustrates how you can support students in developing interconnection subskills 3a-3c in an interdisciplinary, stakeholder-facing module design by acknowledging that building trust in teams requires engaging with moments of tension and discomfort rather than avoiding them. When students learn to stay in such moments and respond constructively, they develop the capacity to form deeper and more resilient professional relationships. Evaluated through student surveys, this approach strengthened communicative competence across diverse teams (Peters et al., 2024).

Example 3. Interpersonal and interconnection skills

As taught by I. Peters and S. Ammon in the Fair Mobility module, Berlin Ethics Lab, Technical University of Berlin.

Purpose
This module-level example shows how interconnection skills can be taught in interdisciplinary, stakeholder-facing projects.

How to facilitate the activity with students

1. *Establish module structure: Form student teams for diversity in discipline, gender, and background. Introduce methods (e.g., stakeholder mapping) for students to identify relevant external partners themselves (e.g., city planners, NGOs). Facilitate co-development of one shared research question.*
2. *Prepare students for emotional dynamics: Explain that interdisciplinary work may challenge assumptions and trigger emotions (frustration, uncertainty…), framing these as normal and signals of learning and relationship-building.*
3. *Practise (embedded during activities): When unpleasant feelings arise during project work, remind students that such moments are not only normal but central to learning in interdisciplinary collaboration. Encourage students to recognise and work through these emotional responses, as this is key to developing meaningful professional relationships across disciplines. Use low-stakes check points with questions (What priorities shape your view? How does that connect to last week?) and repair moves, such as clarifying roles.*
4. *Close + transfer: At the conclusion of each project phase, assign a 300-word reflection (Which of your own assumptions were challenged? How did you react emotionally? How did this affect your interaction with others? What changed in your perspective?) followed by a team debriefing.*

Why it works

- *Makes the skills visible: Students are supported to perceive and leverage growth opportunities by actively seeking developing professional relationships with diverse partners.*
- *Fosters growth culture: Normalizes emotions as success signals; students practice trust moves during worldview challenges.*

- *Fosters transfer: With repeated opportunities, discomfort is turned into networks, and relational labour is more visible.*

What this shows

You can support students to develop interconnection skills by (1) naming the interpersonal communication risk (working in parallel, exclusion from informal networks); (2) providing short scripts for initiating and maintaining connection (reach out, ask a genuine question, offer a concrete contribution, follow up); and (3) giving students repeated, real-task encounters followed by reflection that links one interaction cue (silence, hesitation, withdrawal, increased openness) to one trust building move (clarify expectations, invite input, acknowledge effort, propose another meeting).

A useful lens for developing interconnection skills is social identity: how people understand themselves and others in terms of group memberships, roles, and status. In engineering education, local values and norms can shape which kinds of relational behaviour are seen as legitimate. In many settings, norms associated with independence, competition, and emotional restraint can make relational work seem optional or non-technical (Secules, 2019). These norms can also create asymmetries: the same level of disengagement may be interpreted differently depending on who enacts it, potentially reinforcing exclusion (Cannaerts et al., 2025). Making interconnection teachable helps students see relationship-building as part of professional competence rather than as personality or extra labour.

In settings where networking and relationship-building are assumed rather than taught, some students may not recognise their value (3a) or may rely on narrow, familiar circles, leaving useful contacts invisible. Even when students recognise the value of networking, they may lack concrete interaction strategies (3b) or feel that reaching out signals weakness — especially where self-sufficiency is rewarded. In addition, some students face structural barriers to informal networks and mentorship, which can reduce access to opportunities and support (Krivoshchekov et al., 2025).

Where students are given explicit strategies and low-stakes practice, interconnection becomes more deliberate: they initiate contact, follow up, and use small relational moves (e.g., appreciation, clarification, help-seeking with specificity) to build trust. At this stage, students also begin to notice who is doing relational maintenance and whether that labour is distributed fairly. Research suggests that the relational and emotional labour that supports group cohesion can fall disproportionately on marginalised students and may remain undervalued (Kimpton & Maynard, 2025). Making this labour visible (and assessable when appropriate) helps avoid treating inclusion and cohesion as 'free' outputs of group work.

Expert interconnection involves sustaining diverse networks while enabling others to connect and collaborate. Rather than treating relationships as transactional, interconnection experts create conditions where trust can be repaired after friction and where support-seeking is normalised. This level of competence often requires openness, empathy, and a capacity to tolerate uncertainty — qualities that conflict with dominant norms in some engineering contexts (Krivoshchekov et al., 2025). When students model counter-normative practices (e.g., naming uncertainty, explicitly valuing mutual support), they help shift local cultures so that relational awareness and proactive connection are recognised as professional engineering competence.

4 Recommendations for implementation

Despite the intentions of engineering educators, students' development of interpersonal skills is often delayed by a lack of explicit instruction on and scaffolding of these skills (Isaac & de Lima, 2024). This may result in students perceiving interpersonal challenges exclusively as impediments to completing their tasks and not as learning opportunities to develop key skills.

The activities described in this section can be used as plug-in routines to introduce interpersonal communication skill development into your teaching. Identify a relevant sub-skill, then run a 10-20 minute cycle: (1) name the subskill and the interpersonal communication strategies for implementation; (2) students engage in an application activity; (3) students use a checklist or rubric to give each other one 'keep doing' and one 'try next time' feedback comment; (4) wrap up by asking students to consider what cues they noticed and what they will do next time. These steps follow the 3T PLAY framework of experiential learning by providing students with conceptual or practical knowledge to underpin the skill, followed by a low-stakes opportunity to practice their developing skills, and a conclusion that supports their ability to apply their skills in their engineering coursework. Repeat the cycle across the semester in labs, design work, or project activities to allow students to develop robust skills.

Tables 2.10.1, 2.10.2, and 2.10.3 provide exercises you can use to integrate listening, adaptive communication, and interconnection skills into existing engineering modules (labs, design reviews, teamwork, check-ins). For example, the 3T PLAY trident framework can be used to structure listening activities — give students a simple conceptual model (e.g., 'content vs emotional affect' or 'paraphrase and check'), run a short pair listening exercise, then close with a reflection on the cues they noticed and how they responded. For adaptive communication, prompt students to surface assumptions (e.g., what is taken for granted?) and practice one language move (e.g., define a term, reduce jargon, check interpretation). For interconnection, use team projects and industry or community collaborations to make relationship-building visible as part of coordination, so students can see how successful coordination depends on trust, follow-up, and timely help-seeking.

Even a small dose of structured interpersonal skill practice can improve coordination and decision making in sociotechnical work, especially when students must collaborate across disciplines and with stakeholders to anticipate impacts and prevent harm.

Table 2.10.1: Practice activities for developing listening skills

Skill	*Practice activity*	*Activity description*
Distinguish emotional and cognitive components	Dual-level listening (Rogers & Farson, 1957)	Learners listen to the same message twice, paying attention to: • cognitive components, focusing on facts and arguments by asking "what is being said?" • emotional components, observing tone of voice, word choice, and body language by asking "how is it being said?"
Identify emotional states	Reflecting feelings (Hargie, 2021)	Learners formulate the feelings they perceive from their conversation partner and reflect them back to verify their impressions
Identify potential implications	Conversation strategies guided by emotions (Egan, 1969)	Learners match emotions to Egan's conversation strategies for emotional states by acknowledging feelings explicitly and responding appropriately: • anger > de-escalate • insecurity > proceed step by step • disappointment > listen empathically • enthusiasm > use positive energy
Respond coherently to another person's messages	Paraphrasing and reflecting (Gordon, 2003)	Learners verbalise the factual content they have heard and the emotions they have perceived, using their own words and incorporating appropriate conversation strategies
Employ active listening strategies	Signalling active listening (Hoppe, 2006)	Learners show their conversation partner that they are actively listening by sending verbal and non-verbal listening signals, including paraphrasing, eye contact, and gestures of agreement

Table 2.10.2: Practice activities for developing adaptive communication skills

Skill	*Practice activity*	*Activity description*
Acknowledge the incompleteness of knowledge sets	Critical friends (Costa & Kallick, 1993)	Learners give a presentation on a problem from their disciplinary perspective. An ideally interdisciplinary audience asks critical questions from their own disciplinary perspectives, using orientation questions such as: • What seems taken for granted? • What perspectives are missing? • What alternative explanations exist? Presenters reflect on the situatedness and limitations of their disciplinary perspective
Recognize norms and biases	Discourse markers analysis (Maschler, 2008)	Learners analyse a communication (e.g. peer presentation) to identify terms that are value-laden, normative or based on specific assumptions. Examples include: • interpersonal markers: look, believe me, you know... • cognitive/epistemic markers: should, must, I think, probably ...
Adapt language and communication style	Interdisciplinary science communication (Noviello, 2021)	Learners generate a list of good practices for effective interdisciplinary communication, such as avoiding acronyms and explaining figures (Noviello, 2021)
Integrate different knowledge sets	Group concept map (Kane & Trochim, 2007)	Learners generate a shared question to guide them in collecting their ideas and perspectives on the topic in the form of keywords and sort these into clusters. The team then creates and interprets a concept map to reach a shared understanding of the research topic

Table 2.10.3: Practice activities for developing interconnection skills

Skill	*Practice activity*	*Activity description*
Identify potential growth opportunities	Stakeholder analysis (Berardo & Murphy, 2023)	Learners map their contacts by: • defining stakeholders in the context of a specific issue • identifying relevant stakeholders (e.g., individuals, groups, organizations) • analysing relationships, positions, and potential conflicts or opportunities for cooperation
Promote openness and build connections	Speed networking (Cross et al., 2010)	Learners practise conversation starters and small talk tailored to their own networking needs in short sequences (3-5 minutes) with rapidly changing conversation partners, based on a given objective
Create opportunities for increased interaction to develop networks	Action plan development (Ferrazzi & Raz, 2005)	Learners draw up an action plan for establishing and expanding their professional network. Examples include: • identifying desired contacts and opportunities to generate interaction • their own potential to support others

To allow your students to fully benefit from these activities, design the interaction environment deliberately. Set discussion rules early in the module (e.g., respectful listening that allows others finish their thoughts, ask one clarifying question before you disagree) and refer back to the rules during project work. Reduce status barriers where you can by modelling behaviours that reduce hierarchy *("I do not know that myself — yet")* and treating questions and mistakes as normal parts of engineering judgement, not as failure. Build perspective diversity into course work (e.g., heterogeneous groups, rotating roles, input from external stakeholders) and make it explicit that different priorities are a resource for responsible decisions. Prepare students for irritation and uncertainty by framing them as diagnostic signals that perspectives differ, then give them simple repair language to use in the moment (e.g., *"Can we define that term?"*, *"What assumptions are we making?"*, *"Let me check I understood you"*). Where possible, reduce hierarchies during discussions by inviting quieter voices first and separating idea evaluation from status (test the claim, not the person).

This chapter described three interpersonal communication skills for engineering students — listening, adaptive communication, and interconnection — and proposed how to teach them through structured practice, feedback, and reflection. We used social dimensions (emotions, perspectives, and identities) as lenses to explain how these skills shape what we notice, how we interpret it and what we feel able to say or do, and therefore why these skills may break down in professional interactions. We have provided example activities for scaffolding the development of these skills in engineering teaching, supporting students' interpersonal communication skills essential for engineering practice: coordinating within teams, collaborating across disciplines and with stakeholders, handling disagreement constructively, and working with the uncertainty and risk inherent to professional engineering practice.

Finally, in addition to the literature referenced in this chapter, in particular Krivoshchekov et al. (2025) and Isaac & de Lima (2024), we would also like to recommend the work of Khoo et al. (2018) on epistemological differences if you want to further deepen your knowledge.

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References

Berardo, R., & Murphy, C. (2023). Best practices for teaching socio-environmental synthesis with case studies: Using stakeholder analysis in the classroom. SESYNC.

Bjork, E. L., & Bjork, R. A. (2023). Introducing desirable difficulties into practice and instruction: Obstacles and opportunities. In C.E. Overson, C. M. Hakala, L. L. Kordonowy & V. A. Benassi (Eds.). In their own words: What scholars and teachers want you to know about why and how to apply the science of learning in your academic setting (pp. 19–30). Society for the Teaching of Psychology. https://www.researchgate.net/profile/Logan-Fiorella/publication/369588588_Learning_by_Teaching/links/64234a8ca1b72772e431adec/Learning-by-Teaching.pdf#page=26

Cannaerts, M., Craps, S., Veldman, J., Laar, C. V., Draulans, V., & Langie, G. (2025). Belonging in engineering education: A systematic literature review of its impact on recruitment and retention for female students and students from ethnic minority backgrounds. European Journal of Engineering Education, 50(3), 1–27. https://doi.org/10.1080/03043797.2024.2449212

Coffelt, T. A., Madson, K., Raju, N., & Shane, J. S. (2024). Which communication skills do I need? A multimethod study of communication needs in construction engineering. Journal of Business and Technical Communication, 38(4), 317–344. https://doi.org/10.1177/105065192412584

Costa, A. L., & Kallick, B. (1993). Through the lens of a critical friend. Educational Leadership, 51(2), 49–51. https://educandojuntos.cl/wp-content/uploads/2017/12/through_the_lens_of_a_critical_friend.pdf

Cross, R. L., Singer, J., Colella, S., Thomas, R. J., & Silverstone, Y. (2010). The organizational network fieldbook: Best practices, techniques, and exercises to drive organizational innovation and performance. Jossey-Bass.

Egan, G. (1969). The contract group: Small group approaches to interpersonal growth. [Doctoral thesis, Loyola University Chicago].

Ellingsen, P., Tonholm, T., Johansen, F. R., & Andersson, G. (2021). Learning from Problem-Based Projects in Cross-Disciplinary Student Teams. Education Sciences, 11(6), 259. https://doi.org/10.3390/educsci11060259

ENAEE. (2021). EUR-ACE Framework Standards and Guidelines. https://www.enaee.eu/wp-content/uploads/2022/03/EAFSG-04112021-English-1-1.pdf

Faulkner, W. (2007). "Nuts and bolts and people": Gender-troubled engineering identities. Social Studies of Science, 37(3), 331–356. https://doi.org/10.1177/0306312706072175

Ferrazzi, K., & Raz, T. (2005). Never eat alone: And other secrets to success, one relationship at a time. New York, NY: Crown Business.

Galison, P. (1997). Image and logic: A material culture of microphysics. University of Chicago Press.

Gamil, Y. & Abd Rahman, I. (2023). Studying the relationship between causes and effects of poor communication in construction projects using PLS-SEM approach. Journal of Facilities Management, 21(1), 102–148. https://doi.org/10.1108/JFM-04-2021-0039

Gordon, T. (2003). Teacher effectiveness training: The program proven to help teachers bring out the best in students of all ages. Three Rivers Press.

Grunwald, A. (2011). Responsible innovation: Bringing together technology assessment, applied ethics, and STS research. Enterprise and Work Innovation Studies, 7(7), 9–31.

Haraway, D. (1988). Situated knowledges: The science question in feminism and the privilege of partial perspective. Feminist Studies, 14(3), 575–599. https://doi.org/10.2307/3178066

Hargie, O. (2021). Skilled interpersonal communication: Research, theory and practice (7th ed.). Routledge. https://doi.org/10.4324/9781003182269

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark (2006). Educational Psychologist, 42(2), 99–107. https://doi.org/10.1080/00461520701263368

Holmén, J., & Lönngren, J. (2025). Expanding sustainability learning in engineering education through emotional scaffolding. European Journal of Engineering Education, 1–27. https://doi.org/10.1080/03043797.2025.2474046

Hoppe, M. (2006). Active listening: Improve your ability to listen and lead. CCL Press.

Isaac, S. & de Lima, J. (2024). Teaching transversal skills for engineering students. A practical playbook of activities with tangibles. EPFL Press. https://doi.org/10.55430/SJYVJ3TP24

Isaac, S., & Shew, A. (2024). Employing epistemic micro-practices to assess progress and barriers in engineering students' ethics development. In S. Chance, T. Børsen, D. A. Martin, R. Tormey, T. T. Lennerfors, & G. Bombaerts (Eds.), The Routledge international handbook of engineering ethics education (pp. 507–522). Routledge. http://dx.doi.org/10.4324/9781003464259-34

Kalyuga, S. (2007). Expertise reversal effect and its implications for learner-tailored instruction. Educational Psychology Review, 19(4), 509–539. https://doi.org/10.1007/s10648-007-9054-3

Kane, M., & Trochim, W. M. (2007). Concept mapping for planning and evaluation. SAGE.

Keestra, M. (2017). Metacognition and reflection by interdisciplinary experts: Insights from cognitive science and philosophy. Issues in Interdisciplinary Studies 35, 121–169.

Khoo, S.-M., Haapakoski, J., Hellstén, M., & Malone, J. (2018). Moving from interdisciplinary research to transdisciplinary educational ethics: Bridging epistemological differences in researching higher education internationalization(s). European Educational Research Journal, 18(2), 181–199. https://doi.org/10.1177/1474904118781223

Kimpton, C., & Maynard, N. (2025). Factors shaping teamwork skills development in tertiary engineering education: A systematic literature review. European Journal of Engineering Education, 50(2), 253–280. https://doi.org/10.1080/03043797.2024.2357343

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. Educational Psychologist, 41(2), 75–86. https://doi.org/10.1207/s15326985ep4102_1

Krivoshchekov, V., Kotluk, N., Favre, Y., Fiori, M., Werlen, E., & Tormey, R. (2025). "I felt there was no team to be included in": Navigating social emotions and masculinities in engineering team projects. Journal of Engineering Education, 114(4), Article e70026. https://doi.org/10.1002/jee.70026

Leandro Cruz, M., & Saunders-Smits, G. N. (2022). Using an industry instrument to trigger the improvement of the transversal competency learning outcomes of engineering graduates. European Journal of Engineering Education, 47(1), 30–49. https://doi.org/10.1080/03043797.2021.1909539

Maschler, Y. (2008). Discourse markers. In W. Donsbach (Ed.), The International encyclopedia of communication (vol. 4, pp. 1364–1366). John Wiley & Sons. https://doi.org/10.1002/9781405186407.wbiecd051

Mills, J. E., & Treagust, D. F. (2003). Engineering education — Is problem-based or project-based learning the answer? Australasian Journal of Engineering Education, 3(2), 2–16.

Nair, C. S., Patil, A., & Mertova, P. (2009). Re-engineering graduate skills. A case study. European Journal of Engineering Education, 34(2), 131–139. https://doi.org/10.1080/03043790902829281

Nicolescu, B. (2002). Manifesto of transdisciplinarity. State University of New York Press.

Noviello, J. (2021). Suggested practices for effective interdisciplinary science communication. Bulletin of the American Astronomical Society, 53(3). https://baas.aas.org/pub/2021n3i0801

Paolini, S., Gibbs, M., Sales, B., Anderson, D., & McIntyre, K. (2024). Negativity bias in intergroup contact: Meta-analytical evidence that bad is stronger than good, especially when people have the opportunity and motivation to opt out of contact. Psychological Bulletin, 150(8), 921–964. https://doi.org/10.1037/bul0000439

Peters, I., Hildebrand, T., & Ammon, S. (2024). Preparing future engineers for responsible technology development by disciplinary irritation in inter- and transdisciplinary teaching. In Proceedings of the 52nd Annual Conference of SEFI, Lausanne, Switzerland. https://doi.org/10.5281/zenodo.14254874

Picard, C., Hardebolle, C., Tormey, R., & Schiffmann, J. (2022). Which professional skills do students learn in engineering team-based projects? European Journal of Engineering Education, 47(2), 314–332. https://doi.org/10.1080/03043797.2021.1920890

Pößneck, J., Kabisch, S., Kowaltowski, D. C. C. K., van Oel, C. J., Soliman-Junior, J., Tzortzopoulos, P., & Koolwijk, J. S. J. (2024). Knowledge sharing through scenario development: Experiences of an interdisciplinary and international research project. Interdisciplinary Science Reviews, 49(5), 532–549. https://doi.org/10.1177/03080188241291828

Rogers, C. R., & Farson, R. E. (1957). Active listening. University of Chicago.

Secules, S. (2019). Making the familiar strange: An ethnographic scholarship of integration contextualizing engineering educational culture as masculine and competitive. Engineering Studies, 11(3), 196–216. https://doi.org/10.1080/19378629.2019.1663200

Spitzberg, B. H., & Cupach, W. R. (2011). Interpersonal skills. In M. L. Knapp & J. A. Daly, The SAGE handbook of interpersonal communication (pp. 481–523). SAGE.

Tan, E., de Weerd, J. G. & Stoyanov, S. (2021). Supporting interdisciplinary collaborative concept mapping with individual preparation phase. Educational Technology Research and Development 69, 607–626. https://doi.org/10.1007/s11423-021-09963-w

Tormey, R. (2021). Rethinking student-teacher relationships in higher education: A multidimensional approach. Higher Education, 82(5), 993–1011. https://doi.org/10.1007/s10734-021-00711-w

Vaghela, K., & Kaushal, U. (2025). A systematic review of research on pedagogical practices for communication skills in engineering education. Journal of Engineering Education Transformations, 37(3), 99–120. https://doi.org/10.16920/jeet/2024/v37i3/24007

van Kleef, G. A., & Côté, S. (2022). The social effects of emotions. Annual Review of Psychology, 73(1), 629–658. https://doi.org/10.1146/annurev-psych-020821-010855

World Economic Forum. (2025). Future of jobs report 2025. https://reports.weforum.org/docs/WEF_Future_of_Jobs_Report_2025.pdf

Yang, J., Jiang, Z., Cheng, K., & Wu, L. (2025). Disciplinary barriers need communication: a behavioral and fNIRS study under group decision-making paradigm shift based on cabin design. Frontiers in Neuroscience, 19, Article 1594111. https://doi.org/10.3389/fnins.2025.1594111

Yu, L., & Zin, Z. (2023). The critical thinking-oriented adaptations of problem-based learning models: A systematic review. Frontiers in Education, 8, Article 1139987. https://doi.org/10.3389/feduc.2023.1139987

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During the preparation of this work the authors did not use any AI tools.

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Conceptualisation	Siara Isaac, Vladislav Krivoshchekov, Ina Peters, Sabine Ammon, Becky Bergman, Jan Van Maele
Project administration	Siara Isaac
Writing - original draft	Vladislav Krivoshchekov, Ina Peters, Siara Isaac
Writing - reviewing and editing	Vladislav Krivoshchekov, Siara Isaac, Ina Peters, Sabine Ammon