2.12

Cultivating Feedback Literacy in Engineering Education and Professional Practice

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Feedback literacy, critical for engineering, is the ability to effectively seek, interpret, use, and provide feedback across complex and diverse stakeholder environments. This chapter explores feedback literacy as a foundational skill that enhances engineering performance across technical and interpersonal domains, examining theoretical foundations and recent developments in feedback literacy theory. While frameworks to evaluate feedback literacy in engineering contexts are in active development, this chapter provides practical implementation strategies for developing these skills through authentic and experiential learning environments, engineering studios, and self-reflection methods. Additionally, we explore how innovations in generative artificial intelligence (AI) tools impact learners' and educators' ability to develop feedback literacy skills through improved feedback quality and personalised support. Through systematic curriculum integration that moves beyond simply delivering feedback to students towards approaches that empower students to seek, interpret, and act upon feedback, educators can prepare them for the lifelong learning and adaptability required in modern engineering careers.

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1 Definition

Engineering practice demands more than technical expertise — it requires the ability to navigate complex design processes, iterate on solutions, and collaborate effectively across multidisciplinary teams (Le et al., 2010; Specht & Crowston, 2022). Engineers must continuously process inputs from multiple stakeholders to create solutions that meet complex, often conflicting requirements (De Weck et al., 2011). At the heart of developing these competencies lies feedback literacy, i.e., the ability to actively seek, critically interpret, selectively implement, and effectively provide feedback across diverse stakeholder contexts. While Chapter 2.11 establishes foundational principles of effective feedback, this chapter examines how to develop feedback literacy as a distinct professional competency.

1.1 Theoretical foundations: feedback literacy as active engagement

Feedback literacy emerged from a critical insight: not all feedback improves performance, because its effectiveness depends on how students engage with it (Hattie & Timperley, 2007; Kluger & DeNisi, 1996). As can be seen from the foundational frameworks discussed in Chapter 2.11, research now treats feedback as a dialogue between educators and learners rather than one-way information transfer. Feedback literacy builds on this idea, focusing on learners' ability to engage effectively in these feedback exchanges (Daumiller & Meyer, 2026; Hattie & Timperley, 2007; Panadero & Lipnevich, 2022; Winstone et al., 2017).

Sutton (2012) established a foundational definition of feedback literacy: understanding what feedback means and why it matters, recognizing one's agency in feedback processes, and knowing how to act on feedback. Modern frameworks build on this foundation. Carless and Boud's (2018) influential model identifies four interconnected components. *Appreciating feedback* involves understanding the purpose and value of feedback, while acknowledging the recipient's active role. This includes recognizing that feedback appears in various forms from diverse sources — peers, instructors, stakeholders, or self-assessment (Tenenbaum et al., 2020). *Making judgements* means developing the ability to critically evaluate both one's own and peers' work against established criteria through comparison and self-reflection (Nicol, 2021). *Managing affect* requires emotional regulation skills to maintain balance when receiving critical input, recognizing that feedback is inherently relational when provided by another human. Lastly, *taking action* involves acquiring strategies for translating insights into concrete improvements.

Molloy et al. (2020) then expanded this to seven groupings with 31 specific capabilities. These include:

1. *Committing to feedback as improvement* by embracing continuous development and viewing expertise as evolving rather than fixed;
2. *Appreciating feedback as an active process* that requires learner agency and understanding of standards;
3. *Finding information to improve learning* by actively seeking feedback from different people and sources;

4. *Acknowledging and working with emotions* by managing difficult feelings and building trust with those giving feedback;
5. *Acknowledging feedback as a reciprocal process* by recognizing dual roles as both provider and receiver of feedback;
6. *Processing feedback information* by making sense of what is said, comparing it to examples and standards, and thoughtfully deciding what to use;
7. *Enacting outcomes* through goal setting, planning, and monitoring progress.

This framework shows that students have more agency in feedback processes than previously recognized and provides a foundation for curriculum design and development of feedback literacy.

1.2 Engineering specific considerations

These frameworks are particularly important for engineers, who must regularly navigate feedback from diverse sources, translate input into technical improvements, and manage emotional challenges of critique in high-stakes contexts. For educators, this means feedback literacy instruction must go beyond teaching students to 'accept criticism gracefully'. It requires helping students develop sophisticated skills for managing competing inputs and making strategic decisions about implementation.

Moreover, feedback literacy varies significantly across disciplines. Recent scholarship recognises a plurality of feedback literacies, as practices are shaped by different learning environments, disciplinary specialisations, and professional demands (Gravett, 2022). Engineering feedback processes are shaped by disciplinary values and norms, pedagogical approaches, technical complexity, safety implications, and professional standards. For instance, feedback on a thermodynamics problem set, with clear solutions and single-source input, requires different processing strategies than feedback on a capstone design project involving multiple stakeholders, competing priorities, and regulatory considerations. Generic feedback literacy training will not prepare students for these varied contexts. Feedback literacy should be taught within the specific contexts where students will apply it, using authentic engineering scenarios that mirror the complexity they will face in practice.

Cultural and institutional contexts also influence how feedback is delivered, received, and implemented, as educational traditions, hierarchical structures, and professional communication norms vary across engineering programmes (Winstone et al., 2022). Engineering programmes are also shaped by accreditation and professional expectations that emphasise reflection, communication, and continual improvement. Making this link explicit helps students see feedback literacy as part of professional identity and lifelong professional development.

For you, as engineering educators, developing learners' feedback literacy means embedding it within authentic disciplinary practices rather than teaching it as a generic skill. This requires cultivating students' competency in two interconnected areas: feedback reception skills (i.e., actively seeking, interpreting, and selectively implementing guidance from diverse stakeholders) and feedback provision skills (i.e., evaluating technical work against professional standards and providing constructive guidance to others). This dual focus is crucial because engineering students continuously exchange feedback through team projects, design reviews, and stakeholder interactions. Engaging with real engineering problems and experiencing the consequences of incorporating or ignoring input prepares them for the lifelong learning required in modern engineering careers. Developing these competencies requires integrating three domains: disciplinary expertise for technical evaluation, interpersonal competence for collaborative feedback exchange, and the ability to navigate technology-mediated feedback from digital tools and AI systems. Together, these create unique opportunities for developing feedback literacy, but each of these domains requires intentional pedagogical approaches (Fig. 2.12.1).

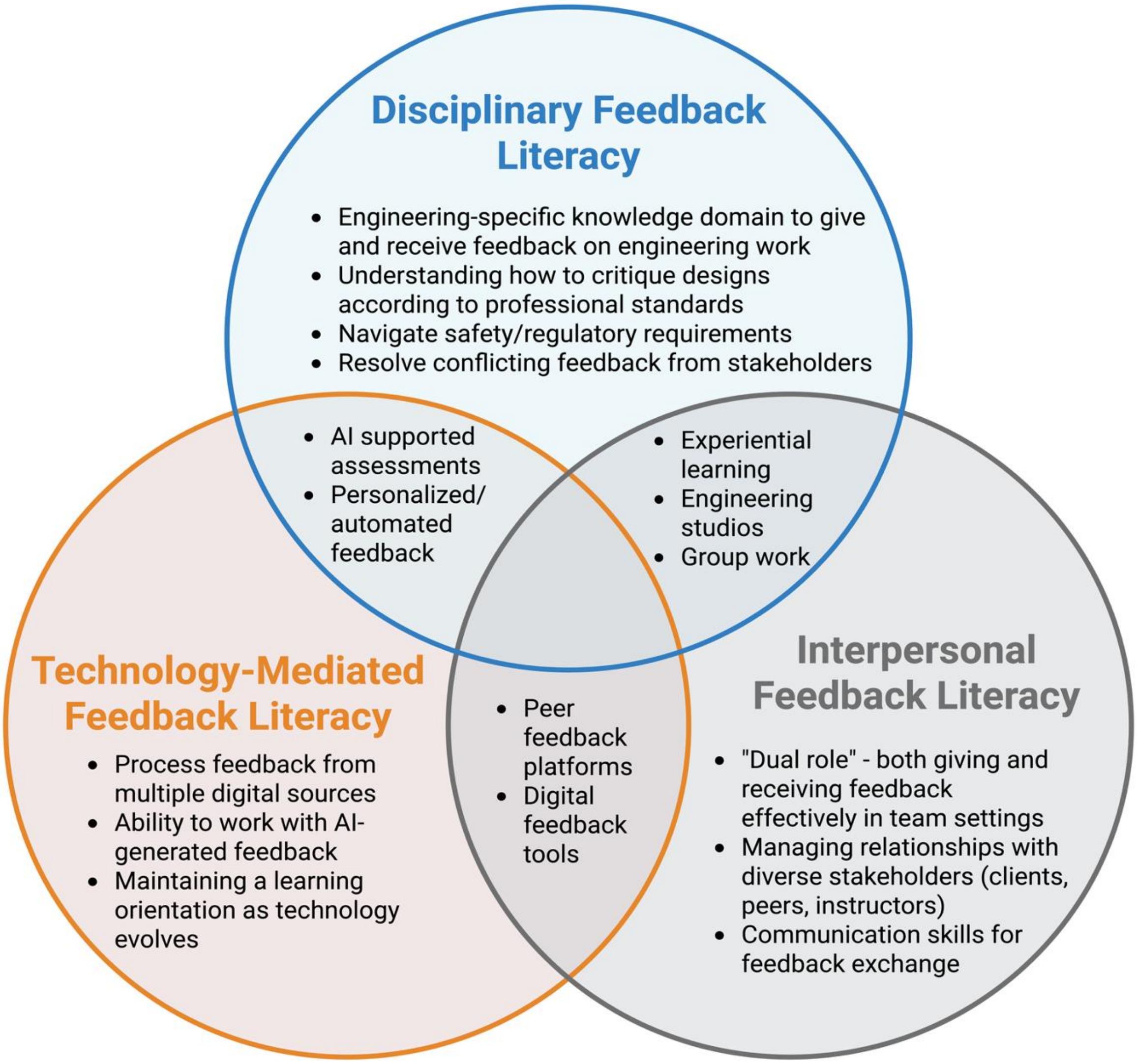

Figure 2.12.1: Engineering-specific feedback literacy framework. Feedback literacy in engineering requires integrating disciplinary expertise, interpersonal competence, and facility with AI-enhanced digital tools. Own work by Fuchs, Meyer, Butcher, and Werth (2026).

2 Why teach feedback literacy?

2.1 Why feedback literacy matters for engineering practice

Engineering is fundamentally iterative, requiring continuous refinement of solutions based on testing, analysis, and stakeholder input (Brunhaver et al., 2017). Engineers must process feedback from multiple sources to create solutions that meet complex, often conflicting requirements (De Weck et al., 2011). Engineers with strong feedback literacy can proactively solicit critiques on design proposals, interpret complex technical review comments accurately (Åström & Murray, 2021), apply insights to refine prototypes (Mohedas et al., 2020), offer constructive input to team members, and effectively manage the emotional responses often associated with critical evaluation (Nieminen & Carless, 2023).

In professional settings, feedback literacy shows up in design reviews, code reviews, safety audits, stakeholder conversations, and post-project retrospectives. Engineers who can ask for the right input, interpret conflicting perspectives, and turn comments into concrete revision plans can move faster and avoid repeat mistakes.

More importantly, developing feedback literacy becomes critical not only for improving engagement but also for enabling learners to be strategic and selective about implementation. This selectivity proves particularly vital in engineering contexts, where students must navigate feedback from multiple sources, including team members, instructors, industry partners, and increasingly, generative AI tools, while making informed decisions about which recommendations to prioritise and integrate. Without such preparation, students enter engineering practice lacking the sophisticated feedback literacy skills required for navigating complex stakeholder ecosystems.

2.2 Why feedback literacy matters for engineering education

For engineering students, feedback literacy encompasses dual roles as both feedback receivers and providers, making it a crucial catalyst for developing self-regulated learning and metacognitive skills needed for complex engineering problems and projects. Research reveals consistent gaps between perceived and actual feedback engagement in educational contexts: in settings focused on written assessment, students often fail to sufficiently engage with the feedback they receive (Meyer et al., 2025; Wang et al., 2020). This pattern extends beyond writing instruction. While design students reported that stakeholder interactions significantly shaped their design outcomes, analysis of their design reports revealed minimal actual incorporation of stakeholder feedback (Sugar, 2001). The gap between perceived and actual engagement highlights the need for explicit instruction in how to seek critical information from stakeholders and build constructive designer-stakeholder relationships (Dieter & Schmidt, 2012).

As feedback receivers, students must develop skills in analysing tasks, setting goals, planning activities, monitoring progress, and evaluating learning processes, which are core components of metacognitive development (Zimmerman, 2008). Simultaneously, their role as feedback providers proves equally valuable: research demonstrates that training students to give feedback to others significantly improves both the quality of their future work and their capacity for self-regulated learning (Andrade, 2010; Donaldson et al., 2023).

This creates a reciprocal relationship where active engagement in both roles strengthens individual learning capabilities and professional competencies. When engineering students learn to objectively evaluate their peers' work against technical criteria, they simultaneously refine their own understanding of quality standards and develop enhanced capacity for self-assessing their designs and problem-solving approaches (Drinkwater et al., 2025). The benefits multiply when feedback modifies students' thought processes rather than merely correcting surface-level errors. Moreover, research confirms that effective engagement in both feedback roles helps students develop self-assessment abilities while improving team dynamics, fostering self-regulation behaviours, and supporting broader professional skill development (Nicol et al., 2014).

For you as educators, this dual role has practical implications. Rather than treating peer feedback as an occasional assessment activity, design learning experiences where students regularly practise both giving and receiving feedback. This means building structured opportunities for students to evaluate others' work, provide constructive critique, and then apply similar critical thinking to their own designs. The goal is not just to distribute the workload of providing feedback, but to develop students' professional competencies in both directions simultaneously.

2.3 Assessment challenges and emerging solutions

Despite the established importance of feedback literacy, assessing these competencies in engineering remains underdeveloped. The need for engineering-specific tools becomes clear when examining recent work on peer feedback quality: Drinkwater Gregg et al. (2025) found that in first-year engineering students' peer feedback comments, over 60% failed to identify performance gaps, approximately 70% provided no actionable recommendations, and fewer than 3% achieved overall high-quality status. These findings suggest that while students recognise positive contributions, they struggle with identifying improvement areas and providing actionable guidance, skills particularly critical in engineering's iterative design processes. This means that simply asking students to review each other's work without scaffolding will produce superficial comments that do not support learning. Students need explicit instruction in what good feedback looks like, supported by models, rubrics, and progressively complex feedback tasks (see Section 3 for implementation approaches).

A further challenge is that much of the feedback exchange in engineering education and practice occurs through informal oral conversation rather than structured written forms, including during capstone design projects, co-op experiences, and active learning classrooms. This spontaneous feedback often carries substantial learning value but is difficult to capture and assess systematically (Nikolic et al., 2018), making this an important gap for both researchers and practitioners to address.

Several instruments now exist with evidence of validity for measuring feedback literacy in higher education contexts, though none were developed specifically for engineering. They vary meaningfully in what they measure and how. Some focus on attitudes and dispositions toward feedback (Yıldız et al., 2022; Zhan, 2022), while others capture observable behaviours, i.e., what students actually do when engaging with feedback (Dawson et al., 2024). Instruments also differ in the feedback modes they cover: some address only written or peer feedback (Dong et al., 2023; Yu et al., 2022), while others measure oral, written, rubric-based, peer, and self-assessment modes within a single scale (Liao, 2021). Since none of these instruments have yet been adapted and validated for engineering contexts, we encourage you to examine what each measures and how, consider which modes and behaviours are most relevant to your specific module or programme, and treat any instrument you choose as a starting point to iterate on.

3 Forms of implementation

While theoretical frameworks for feedback literacy continue to evolve, translating these concepts into specific, evidence-based practices for engineering education requires moving beyond existing systems to address the dynamic, collaborative nature of engineering practice. In this section, we examine four complementary approaches for implementing feedback literacy development within the unique characteristics of engineering education: peer feedback structures that naturally create opportunities for students to practise both giving and receiving critique; engineering studios that provide systematic frameworks for authentic, iterative feedback exchange; self-reflection methods that support both the development and assessment of feedback literacy skills; and emerging generative AI technologies that offer scalable solutions for both fostering and measuring feedback literacy in complex engineering contexts.

3.1 Peer feedback for engineering students

Experiential learning approaches, including problem-based learning (PBL), capstone design modules, first-year engineering experiences, and laboratory modules, emphasise higher-order thinking skills by engaging students in real-world problem-solving scenarios (Tembrevilla et al., 2024). These approaches simultaneously develop essential professional skills (Borrego et al., 2010), including communication (Beagon et al., 2019), conflict management (Ryan et al., 2023), and collaboration with diverse team members (Zhang & Ma, 2023), making them ideal environments for feedback literacy development.

Within these structures, students naturally alternate between feedback roles as they evaluate teammates and receive input from peers and instructors (Kokotsaki et al., 2016). This dual engagement serves multiple purposes: it informs you about team dynamics, helps teams improve their performance, and, critically, provides authentic opportunities for students to practise both giving and receiving feedback (Mentzer et al., 2015). Research shows peer feedback can be as effective as instructor feedback when properly implemented, because giving feedback forces students to think deeper about design quality, including in their own work (Ekoniak & Paretti, 2018; Rukmono

& Chaudron, 2022). When implemented with training and reflection components, peer feedback serves as a powerful tool for developing both feedback literacy and engineering design understanding (Mattucci et al., 2018).

The quality of peer feedback also depends heavily on proper training. Trained peer reviewers provided feedback that better matched effective practices—more coaching/readerly comments, more content focus, and a more positive tone— than untrained instructors, highlighting the importance of structured preparation (Ekoniak & Paretti, 2018). Moreover, as students participate in peer feedback activities, they become more discerning evaluators as their work quality improves, aligning assessments with instructor ratings when given comparative benchmarks (Revilla-Cuesta et al., 2024). However, challenges remain in both roles: as providers, first-year engineering students often lack training in writing effective feedback, resulting in short phrases or comments that are not actionable (Drinkwater Gregg et al., 2025); as receivers, student motivation significantly affects their willingness to incorporate suggestions (Berry et al., 2022).

Commonly used peer evaluation platforms such as CATME, ITP Metrics, and TEAMMATES facilitate peer feedback interactions but provide minimal instruction for either giving or receiving feedback, leading to considerable variation in both feedback quality and utilisation (Burgess et al., 2021; Sajadi et al., 2024). These challenges are compounded when feedback serves summative assessment purposes, as students avoid providing honest critiques that might negatively impact teammates' grades (Sridharan et al., 2019). Regardless of the platform you use, explicit instruction in both giving and receiving feedback is essential for developing true feedback literacy.

Structured peer and external feedback in senior design

The advisory board model developed by Werth et al. (2026) illustrates how peer and external feedback structures can be embedded systematically across a senior design module. Rather than treating feedback as a single review event, this model distributes critique across the design cycle and requires students not only to receive comments, but also to generate, interpret, and act on them through documented module artefacts.

One component is a student advisory board system in which current students from other design teams serve in defined review roles mirroring common professional perspectives, including technical, clinical, regulatory, intellectual property, and business roles. Boards meet at multiple points across the project lifecycle, creating iterative opportunities for critique as teams refine problem definitions, design choices, and implementation plans. Each advisor submits an individual report identifying strengths, risks, and actionable recommendations, and the instructional team evaluates report quality to maintain norms for specificity and actionability, while preserving the peer-centred nature of the exchange (Nicol et al., 2014) as shown in Example 1.

Example 1. Individual advisory board report assignment

As an advisory board member, your job is to independently evaluate the team's progress and provide helpful, constructive feedback from the perspective of your assigned advisory role. Your report should identify strengths, point out risks or gaps, and suggest practical next steps. This assignment is meant to help you practice technical evaluation, professional communication, and strategic thinking.

Each report should be one to two pages and include the following sections:

- *Executive summary: a brief overview of the team's progress, major strengths, and main areas for improvement.*
- *Achievements: what has the team done well so far? Highlight important accomplishments, strong ideas, or notable progress toward their goals.*
- *Risks: describe current challenges or concerns, such as technical issues, logistical barriers, or team-related problems. Use specific examples when possible.*
- *Recommendations: provide three to four specific, actionable suggestions to help the team improve. These may include next steps, ways to address challenges, possible collaborations with other teams, or useful stakeholder* connections.

In addition to the report, include your meeting notes as an appendix. These do not need to be formal; bullet points are fine. Your notes should summarize the advisory board discussion and capture useful feedback on both the substance of the project and the quality of the presentation.

The second component is a sequence of individual stakeholder interviews in which students solicit perspectives from relevant external stakeholders and document what was learned through short written analyses. In combination with the advisory board structure, these interviews broaden the range of evaluative input students must navigate and create repeated opportunities to connect feedback to design criteria and constraints.

A key feature of this model is that feedback uptake is made visible. After each advisory board round, teams produce a response-to-advice that triages recommendations, justifies which suggestions will be accepted, modified, or deferred, and records resulting changes. Teams also complete a recap synthesising lessons from other groups' reviews, moving feedback from simple receipt toward selective use and enactment.

3.2 Using engineering studios to make critique routine and visible

Recent work by Fuchs et al. (2026) demonstrates how studio-based pedagogy can systematically address feedback literacy development. Unlike conventional approaches that isolate feedback to discrete evaluation moments, their studio model creates structured opportunities for students to transition between providing and receiving feedback throughout the design process. Three key feedback modalities are incorporated: real-time informal consultations during problem solving, where instructors circulate to visit student teams at their workstations (desk visits); structured pin-up critiques where teams present in-progress work for class examination, enabling both intra- and inter-team idea sharing; and final reviews, where students present their finished work products to the class for review and critique, integrating engineering analysis with design thinking (Fig. 2.12.2).

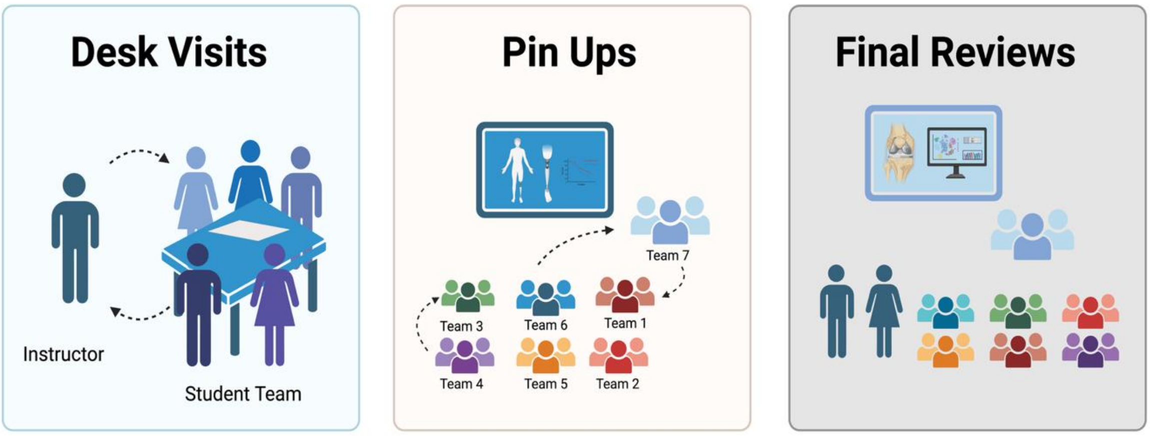

Figure 2.12.2: Three-tiered feedback framework in engineering design studios (Fuchs et al., 2026), spanning real-time desk consultations, structured pin-up critiques of work-in-progress, and final reviews integrating engineering analysis with design thinking. Own Work by Fuchs, Meyer, Butcher, and Werth (2026).

Studios scaffold feedback literacy through the studio's structured, multi-step process, which directs students to focus on specific aspects when giving feedback, such as whether all constraints were identified, if the system model is accurate, or if proposed solutions are feasible. Through repeated practice with giving feedback, students develop both technical standards and professional communication skills. While direct measurements of feedback literacy improvements have not yet been conducted, this framework establishes a solid foundation for treating feedback as fundamental to engineering practice rather than an add-on evaluation exercise.

For educators considering studio approaches, you do not need three-hour sessions or a complete curriculum redesign to adopt studio principles. The key elements, including regular informal feedback during work time, structured peer critique sessions, and scaffolded frameworks that guide what to look for, can be integrated into existing modules. Consider starting with structured peer reviews using specific prompts that focus students' attention on technical criteria, then gradually building in more frequent, informal feedback opportunities during class time.

3.3 Developing feedback literacy through self-reflection

Self-reflection has emerged as both a catalyst for feedback literacy development and a valuable tool for tracking students' progress. Coppens et al. (2023, 2025) developed an approach using reflective logs, i.e., structured written records in which students describe and analyse a meaningful feedback experience, capturing actual behaviour rather than stated intentions. Longitudinal analysis revealed significant growth in both reflection quality and feedback literacy across the undergraduate programme: students demonstrating advanced feedback literacy characteristics increased from 14% in Year 1, semester 2 to 75% in Year 3, semester 2 (Coppens et al., 2024). Initially, 63% of reflective logs remained at the understanding level, one of four reflection levels used in the study alongside non-reflection, reflection, and critical reflection. At this level, students recognise the relevance of feedback and may explain how it could be applied, but do not yet clearly commit to using it again in future work. This is unsurprising, as engineering students often struggle with reflection since it differs significantly from typical engineering assignments (Coppens et al., 2023). However, sustained implementation throughout undergraduate years led to significant improvements, helping students move beyond understanding toward fuller reflection, where they connect feedback to personal experience, explain why it matters, and identify implications for future learning. This suggests that consistent exposure to reflective practices can develop both reflective capacity and feedback literacy over time.

For educators implementing reflection, expect initial resistance as engineering students may view reflection as irrelevant compared to technical work. Start with structured prompts that connect directly to engineering practice, such as *'How did you use feedback from your design review to improve your prototype?'* rather than open-ended questions like *'Reflect on your learning.'* Build reflection into existing portfolio systems rather than creating additional assessment burdens and be patient as improvement takes consistent practice over multiple terms.

3.3 Scaling feedback literacy development

One promising application of generative AI for supporting self-reflection is adaptive question generation. Mburu et al. (2025) developed an AI-driven survey tool that generates contextually relevant questions in response to individual student answers in real time, meaning a student who writes a superficial reflection receives follow-up questions that probe more deeply, while a student demonstrating sophisticated thinking receives questions that extend their analysis further. This addresses a core challenge in engineering education: prompting students unfamiliar with reflective practice to engage more meaningfully, without requiring an instructor to respond to every submission individually.

This potential represents part of a broader trend in GenAI applications for educational feedback. GenAI offers promising solutions for personalised feedback assistance (Zhan et al., 2025), and emerging findings suggest that AI-generated feedback can improve student performance and is often rated highly by experts for accuracy and clarity

(Meyer et al., 2024; Steiss et al., 2024). For example, Meyer et al. (2024) found that students receiving feedback generated by a large language model improved their revision performance and reported higher motivation, more positive emotions, and greater perceived usefulness than students given only a general revision instruction, though the study did not compare AI feedback with teacher feedback. In a follow-up study, Meyer et al. (2026) compared AI-generated feedback with teacher feedback showing that the immediately provided AI feedback when compared to the delayed AI and teacher feedback had motivational benefits and was perceived as more useful. Unlike human feedback sources, generative AI is readily available without scheduling conflicts and creates a less intimidating environment for students who might hesitate to seek feedback due to social anxieties (Zhan et al., 2025). In first-year problem-based learning modules, large language models significantly improved peer feedback quality by making comments more constructive and actionable and providing meaningful comparisons between students' self-evaluations and peer assessment (Sajadi et al., 2024). While preliminary evidence from other disciplines suggests similar potential for AI-supported peer feedback systems (Guo et al., 2025), more research is needed to establish their effectiveness specifically within engineering contexts.

Table 2.12.1: Observational feedback tool (Fuchs et al., 2024). When observing a feedback interaction, select one descriptor from each column to categorise the context, the feedback given, and the student response to feedback.

Context		*Feedback given*		*Response to feedback*	
Prompted by	**Feedback was**	**Nature**	**Focus level**	**Cognitive**	**Emotional**
Group	Directive	Gaps in status	Task	Increased efforts	Positive
Instructors	Facilitative	Provides information	Process	Lower expecta-tions or standards	Neutral
Students outside group		Reduces misconcep-tions	Self- and/or group regulation	Reject the feedback,	Negative
		Other	Self/group	Abandon efforts to achieve the goal	

For educators considering AI tools, be aware that these tools are not equally effective for all students. Students with stronger feedback literacy tend to engage more productively with AI-generated feedback, while those with weaker feedback literacy may find complex feedback overwhelming (Weidlich et al., 2025a, 2025b). This suggests that students' existing feedback literacy likely shapes how much they benefit from these tools. This highlights the importance of personalised feedback design, particularly in engineering contexts given the complexity of collaborative tasks. A practical starting point is to help students develop habits of critical engagement with AI-generated suggestions. Encourage students to evaluate and question feedback rather than accept it uncritically. It may also be worth introducing these tools gradually, beginning with lower-stakes or more straightforward assignment types such as written reports or reflections, to allow both you and your students to build familiarity before expanding to more complex engineering tasks.

Using AI to analyse feedback interactions in your classroom

Emerging research shows how generative AI can also serve as an analytical tool for understanding feedback interaction dynamics. Fuchs et al. (2024) developed an observational framework that categorises feedback interactions across multiple dimensions: context and timing, feedback nature (directive versus facilitative), focus level (task, process, self-regulation, or self and group), and the immediate emotional and cognitive responses these interactions elicit from students (Table 2.12.1). Their protocol captures feedback modalities ranging from planned instructor desk visits to spontaneous peer interactions, enabling real-time documentation of how different approaches impact student engagement (see Example 2).

Example 2. Observing a desk visit during a studio session

Scenario: *during a modelling activity, an instructor visits a team struggling with their system equations. The instructor asks: "Walk me through how you derived this equation. What assumptions did you make about flow rate?" The students explain their thinking, and the instructor responds: "Good start. What happens to your equation if the flow isn't constant? Think about how that affects your boundary conditions." One student looks at the equation and says, "Oh! So, we'd need a time-dependent term here..." Another student adds excitedly, "Wait, that's why our simulation kept crashing — we were treating it as steady-state!" The team immediately starts redrawing their diagrams and revising their equations. We can use the framework to categorise this interaction as shown in Table 12.2.2.*

Table 12.2.2: Desk visit example of use of framework

Context		*Feedback given*		*Response to feedback*	
Prompted by	**Feedback was**	**Nature**	**Focus level**	**Cognitive**	**Emotional**
Instructor	*Facilitative*	*Reduces misconceptions*	*Process*	*Increased*	*Positive*

Why these classifications?

- *Facilitative: used questions to guide students to their own insights rather than giving direct answers.*

- *Reduces misconceptions: corrected their assumption about constant flow.*
- *Process level: focused on how they approach deriving equations, not just the final answer.*

This systematic categorisation revealed critical insights. For example, conflicting guidance between multiple instructors dramatically reduced student engagement and created learning-disrupting frustration, while validating feedback during class-wide discussions maintained high engagement levels (Fuchs et al., 2024). These findings show that how and when you provide feedback matters as much as what you say, something that can be difficult to notice in the moment while teaching. The framework addresses this by categorising feedback interactions in real time and tracking student responses, revealing how identical feedback types produce different reactions depending on timing, context, and consistency with previous guidance.

Augmented by AI-generated synthetic data for training natural language processing models, the framework enables instructors to identify patterns in their feedback delivery that may not be apparent during sessions (Fuchs et al., 2025). However, you can apply the underlying principle without AI: record studio sessions or desk consultations and review them later, or have a colleague observe and categorise your feedback using the framework (Table 2.12.1). The key is systematic observation, whether AI-aided or manual, to make your feedback patterns visible and actionable.

4 Recommendations for implementation

Engineering-specific evidence is still emerging, so the recommendations below combine established feedback literacy theory with implementation patterns that fit common engineering learning environments. We recommend using these as a starting point: pilot one or two, gather information about student uptake, and iterate as needed. These recommendations on developing feedback literacy complement the broader feedback strategies discussed in Chapter 2.11; use both chapters together to create comprehensive feedback environments that both deliver effective feedback and develop students' capacity to use it.

Adapt and validate for your context. Interventions and assessment tools developed for general educational contexts require careful adaptation within engineering-specific settings. Several validated feedback literacy instruments exist, each measuring different modes and behaviours. Examine what each measures, consider which aspects are most relevant to your module or programme, and treat any instrument you adopt as a starting point rather than a fixed tool. AI technologies offer promising pathways for accelerating engineering-specific feedback literacy research in the coming years.

Leverage engineering's collaborative nature to develop dual competency. Engineering projects naturally position students as both evaluators and recipients. Capitalise on this by explicitly training students in both roles rather than treating peer feedback as an afterthought to instructor assessment. Integrate feedback literacy development within existing activities — studios, capstone modules, problem-based learning — and enhance these structures with explicit scaffolding rather than adding separate training modules that may seem disconnected from core engineering practice.

Use AI thoughtfully to scale support, not replace instruction. Generative AI offers promising solutions for scaling feedback literacy development through enhanced peer feedback quality, personalised support, and analytical tools for understanding feedback patterns. However, its effectiveness depends significantly on students' existing feedback literacy levels, highlighting the need for thoughtful integration rather than wholesale replacement of human feedback processes. Move beyond simple rating systems towards platforms that scaffold both feedback provision and reception skills.

Implement systematic reflection across the curriculum. Self-reflection serves dual purposes: it develops feedback literacy and provides a tool for tracking progress. Whilst engineering students often struggle with reflection initially, sustained implementation throughout undergraduate programmes can develop both capacities simultaneously. Embed reflective logs across multiple terms using structured but non-directive prompts, such as *"How did you contribute to obtaining or processing the feedback?"* and *"How does the feedback help you to better assess your own work and that of others?"* Focus on dual assessment frameworks that evaluate both reflection quality and feedback literacy. Address initial resistance by recognising that engineering students may demonstrate limited reflection levels initially but can develop these skills over time when reflection is embedded within existing portfolio systems or module requirements rather than creating additional assessment burdens.

We encourage practitioners to stay engaged with emerging feedback literacy research and share insights from your implementations, helping build the engineering-specific evidence this field needs. Reflect systematically on your own feedback practices, just as you ask students to do, and use those observations to refine your approaches over time. Should you wish to further deepen your knowledge on feedback literacy, we recommend Carless (2022), Lee and Moore (2024) and Little et al. (2023).

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AI statement

During the preparation of this work, the authors used ChatGPT5 in order to improve language and readability. After using this tool, the authors reviewed, edited, and made the content their own as needed. They take full responsibility for the content of the publication.

Contributor statement

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