3.1

Navigating the Complexities of Competency Assessment: An Introduction

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Engineering education increasingly emphasises the development of transferable competencies and skills alongside disciplinary knowledge yet assessing these remains challenging due to their complex, context-dependent, and often intangible nature. This chapter introduces Part 3 by positioning competency assessment as a central but complex aspect of engineering education and offering a critical examination of how underlying assumptions shape what is valued and assessed, often creating blind spots. Drawing on lenses such as constructive alignment, Habermas' knowledge interests, and the four Ps framework, the chapter explores how assessment both verifies learning and signals what *counts*, influencing student priorities and learning behaviours. It addresses key challenges, including the limits of single-point and product-focused assessment, issues of validity when using proxies for competence, and tensions between formative and summative purposes. The importance of inclusive, transparent, and context-sensitive assessment is highlighted alongside practical constraints such as workload and feasibility. Emerging developments, including generative artificial intelligence (AI), further emphasise the need to move towards more process-oriented and authentic approaches. Overall, this chapter provides you with a conceptual foundation for Part 3, preparing the ground for subsequent chapters that present concrete assessment approaches to be selected, combined, and adapted across diverse educational contexts.

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1 Introduction to Part 3

Assessing transferable competencies and skills is an essential and integral part of engineering education practice, as it ensures that students have developed the broad set of abilities required for modern professional practice as set out in guiding frameworks (see Chapters 1.3 and 1.4). These frameworks include not only technical knowledge but also communication, teamwork, ethical reasoning, leadership, and problem solving. As curricula become increasingly outcome-based, educators must be able to show that students have achieved these intended learning outcomes for the benefit of the students, accrediting bodies, and their future employers. Assessment is the central mechanism for verifying that graduates meet both institutional expectations and external accreditation standards. This aligns with Biggs' (1996) principle of constructive alignment (as introduced in Part 2), which emphasises the alignment between intended learning outcomes, teaching and learning activities, and assessment. Within this framework, assessment is not merely a tool for verification but a central component in ensuring that students engage in the kinds of learning activities that lead to the development of the desired competencies.

Despite its importance, the assessment of transferable competencies and skills presents significant challenges. Many of these competencies and skills do not have concrete, easily measurable outcomes. While factual knowledge can be tested through recall-based assessments and technical skills can be demonstrated through tangible outputs, competencies such as leadership, collaboration, or ethical judgement are more complex and context-dependent. They develop over long periods of time and often manifest in subtle, qualitative ways (see Chapter 1.2). For example, it is straightforward to describe the characteristics of an effective leader, but far more difficult to measure leadership development in a meaningful way within the typical teaching and assessment timeframes of higher education modules. This complexity ideally requires assessment approaches that are flexible, and capable of capturing growth rather than simply verifying performance at a single point in time. For this reason, assessment of transferable competencies and skills cannot be understood as a purely technical measurement problem but must be approached as a matter of educational design and professional judgement. In formal education, assessment is one of the most powerful drivers of learning (Frederiksen, 1984). What we choose to assess, students will prioritise; what we do not assess, students quickly learn to treat as peripheral (Alderson & Wall, 1993; Baartman et al., 2007). Therefore, we must ask, what informs the choices of what and how to assess?

This opening chapter provides you with a conceptual foundation for Part 3 of the handbook by examining the epistemological foundations, purposes, limitations, and design considerations of assessing transferable competencies and skills. It prepares the ground for the chapters that follow, each of which presents an assessment approach that you can select, combine, and adapt to your educational purposes and context.

2 Epistemology in assessment in engineering education

According to the Theory of Planned Behaviour (Ajzen, 1991; Bosnjak et al., 2020) human behaviour is guided by beliefs: "*beliefs about the likely consequences of the behaviour (behavioural beliefs), beliefs about the normative expectations of others (normative beliefs), and beliefs about the presence of factors that may facilitate or impede performance of the behaviour (control beliefs)"* (Bosnjak et al., 2020, p.353). Normative and control beliefs may lead to prioritising the learning content students expect to be assessed. Assessors' choices of what and how to assess are likely shaped by the normative expectations of their professional context.

Normative expectations of assessment in engineering education are influenced by the context of education in general and by the ontology and epistemology of the engineering field. Ontology is the philosophical study of being; it deals with how you view the world and the reality, taking your assumptions about the nature of the world and the reality into account (Easterby-Smith et al., 2012). Epistemology is the philosophical study of knowledge and knowing, that concerns the nature and justification of human knowledge (Hofer, 2001; Hofer & Pintrich, 1997). Epistemology is to know what knowledge is, how a person acquires it, and what a person knows (Ghazali, 2021).

Historically, the dominant epistemological tradition in engineering education is positivism, resulting in a dominance of quantitative and positivist work in engineering education research (Beddoes, 2014). Positivists believe that the world can be studied best through objective observations. Reality is believed to be consistent and independent of perception. This reflects engineering in general, where knowledge is expected to be objective, measurable, and transferable.

The ontological position underlying this paradigm is realist. In realism, it is believed that the world is real and science proceeds by examining and observing it. Realism is the belief that there is a single truth, and that facts exist and can be revealed through experiments (Easterby-Smith et al., 2012). A realist will attempt to uncover the truth and will tend to use a positivist epistemology, starting with a hypothesis and proceeding with conducting an experiment that will prove or disprove this hypothesis. Engineering education assessment often takes the form of an exam or an experiment, as these can be objectively measured. Therefore, students often prioritise this form (Ghazali et al., 2021), thus aligning with the epistemological and ontological positions within engineering.

Engineering education not only fits well within a positivistic ideology (Lederman et al., 2023) but also with a dualistic worldview where there are two, often opposing, points of view or answers to a question (Zhu et al., 2019). As noted above, objectivity is key in engineering and therefore many engineering students, and a significant number of educators, approach learning from this dualistic ideology: knowledge is right or wrong, true or false, relevant or not relevant. This might originate in the history of technical universities (Geschwind et al., 2020) and may be reinforced by the labour market, by the professional norms of engineering, and by the need for engineering lecturers to understand STEM pedagogy (Winberg et al., 2018). In the positivistic worldview, knowledge must be observable; learning must be demonstrated through visible behaviours; assessment must be objective. Anything that cannot be reliably measured risks being judged as peripheral, inferior, or unscientific. Our institutional systems, such as accreditation, quality assurance, and performance indicators, reinforce this stance by rewarding the quantifiable and often leaving the rest unacknowledged. In doing so, forms of learning of knowledge and competencies that are subjective, tacit, relational, intuitive, indigenous, ecological, embodied, or learning that is different in other ways can be sidelined. These are just as essential to becoming a responsible engineer and a whole human being, but they do not sit comfortably within our dominant engineering beliefs. As a result, they often fall out of sight. These epistemological assumptions help to explain why transferable competencies and skills are often marginalised in assessment. The following section therefore examines why, despite these challenges, it remains essential to assess them explicitly.

3 Why do we need to assess transferable competencies and skills?

3.1 Accreditation, accountability, and employability

The shift toward outcome-based education further reinforces the need for explicit assessment (Biggs, 1996). Accrediting bodies increasingly require evidence that students have developed the competencies necessary for professional practice at a required standard (Almuhaideb & Saeed, 2020; ENAEE, 2008). This cannot be demonstrated through assumptions or informal impressions; it requires systematic assessment practices that document and verify attainment. In this way, assessment serves not only pedagogical purposes but also institutional accountability. It ensures that programmes of study can substantiate their claims about graduate capabilities and maintain alignment with professional standards.

At the same time, employability and the rise of institutions committing to related graduate attributes (Spronken-Smith et al., 2013; Wong et al., 2021) further strengthen this need, as graduates are expected to demonstrate not only technical expertise but also transferable competencies and skills that enable them to function effectively in complex, inter- and transdisciplinary, and evolving professional contexts.

3.2 Assessment as a driver of development

Alongside this verification of achievement, assessment also plays several important roles within the learning process itself. It supports learning by giving students feedback on their progress and highlights areas where further development is needed. It allows students to benchmark their own achievements. It also makes the curriculum visible: across our modern education systems, what is assessed signals to students what is valued by you as an educator. When competencies are not assessed, they risk being perceived as optional. Students naturally focus on what is graded, and if transferable competencies and skills are not part of the broader assessment framework, they may receive less attention than technical content (Alderson & Wall, 1993; Baartman et al., 2007). This undermines the overarching goals of modern engineering education, which increasingly emphasise the importance of adaptability, interdisciplinary collaboration, and responsible decision making. By integrating transferable competencies and skills into assessment, you as an educator signal their importance and ensure that they are embedded within students' learning strategies.

At the same time, assessment provides the structure that meaningful competency development requires. Students cannot improve in areas such as teamwork or communication unless they understand what these competencies involve, what is expected of them, and how their performance will be evaluated. Clear learning objectives and explicit assessment criteria give students direction, while feedback helps them identify strengths and weaknesses and pathways to improvement. Assessment transforms broad, abstract competencies into concrete learning outcomes that students can work toward. Without this structure, competency development can become inconsistent and dependent on chance rather than on intentional educational design.

Assessment therefore also plays a developmental role that extends beyond measurement (Biggs, 1996). Through formative feedback, reflective activities, and opportunities for iterative improvement, assessment helps students internalise the habits and mindsets associated with professional competence. It makes learning visible, both to you as an educator and to students themselves, enabling students to recognise their progress and take ownership of their development.

This is particularly important in engineering, where graduates must be prepared to navigate complex, rapidly changing environments (SEFI, 2025). Transferable competencies and skills enable engineers to develop throughout their careers, work effectively in diverse teams, communicate with stakeholders, and make informed ethical decisions. Assessment supports the cultivation of these abilities by encouraging students to reflect on their performance, recognise areas for growth, and take deliberate steps toward improvement and lifelong learning.

By assessing transferable competencies and skills, you create a learning environment in which expectations are clear, feedback is meaningful, and students understand the relevance of their development beyond individual modules. This combination of clarity, accountability, and developmental support makes competency assessment indispensable for preparing future-ready engineers who can thrive in complex professional contexts.

4 Blind spots in engineering assessment

Building on the epistemological assumptions outlined above, and the challenges of holistically and meaningfully assessing transferable competencies and skills, the focus on objective assessment at the expense of other types of learning and development leaves important gaps within engineering education assessment.

Habermas' theory of knowledge interests (1971, 1973) offers a helpful lens to indicate what is being excluded. The doctrine of interest is a theory in which Habermas suggests that humans construct knowledge according to three fundamental interests. In these terms, interest means a fundamental orientation of human thinking by which humans develop means and methods for promoting life. These interests are technical (control and prediction), practical (understanding through interaction) and emancipatory (reflection, autonomy, and transformation). Engineering education overwhelmingly prioritises the technical interest. Denton (2011, p. 847) explains this further: "*The technical interest represents the fundamental human desire to control the environment through principles of positivism* (Habermas, 1971). *Because of its positivistic nature, the technical interest requires careful definitions, set criteria, and verification. Moreover, the overall purpose of these methods is to produce predictable outcomes. An accompanying dynamic associated with predicting outcomes is the careful monitoring of input and output mechanisms*".

Denton and Habermas do not imply that there is something wrong with the technical interest, but that an overemphasis on the technical interest is problematic in educational practice (Ellis 2005).

Specifically for engineering education, Dias de Figueiredo (2008, p. 94) echoes Ellis (2005) and states what it means to be an engineer and gain engineering knowledge: the engineer should be "*a sociologist, scientist, designer and doer*". This means that engineers not only need technical skills and knowledge, but also transferable and social skills such as social interaction, ethical reasoning, intuition, and self-reflection. When these competencies and skills appear in curricula, we need to be mindful of the approach, as the dominance of positivistic epistemology creates two major blind spots.

Firstly, we mistake a subset of knowledge for the whole. Technical, analytical, and procedural knowledge becomes the centre of the curriculum, not because it is the entirety of what engineers need, but because it is easiest to define, teach, and assess and it is what educators are most comfortable with and can account for easily.

Secondly, when we do engage with subjects and forms of learning that lie outside this subset, such as the development of competencies and skills related to collaboration, reflection, integrity, empathy, or professional identity, we tend to force them into our existing frame and view in order to, as discussed in Section 3.2, ensure that their value is made clear. We attempt to make them measurable; we produce rubrics to evaluate them; we make systems that define and organise them; and we assign grades. In doing so, we risk distorting the very thing we intend to cultivate.

We can illustrate the second point by looking closer at the role of constructive alignment. Constructive alignment (Biggs, 1996) is widely celebrated as a gold standard (Claassen, 2005) in the assessment of engineering education. In curriculum design principles, it enhances coherence: learning outcomes, teaching activities, and assessments should all point in the same direction. However, constructive alignment, when uniformly and uncritically implemented in curricula with a positivist epistemology, can become a constraint.

It pressures us to write precise, measurable outcomes for learning processes that cannot, and arguably should not, be pinned down. If we declare that learners must '*demonstrate empathy*' or '*show reflective depth*', we are compelled to create assessments for these outcomes. Furthermore, because our system demands objectivity, we create metrics or rubrics for what is fundamentally unmeasurable (Veen et al., 2020). The result is a curriculum designed around what can be measured, not what is valuable.

Our call to action is simple, though not necessarily easy: pause, notice, and reflect. We need to make our blind spots visible. We need an honest dialogue about how our epistemological assumptions shape our practice, about how our assessment regimes reinforce those assumptions, and about what and whom we are excluding in the process. This is not a call to abandon rigour or objectivity. It is a call to recognise that they are not the whole story.

5 What counts as evidence? Proxies for competency

These challenges raise a fundamental question: what counts as valid evidence of competence. Fawns et al. (2026) dive deeper in constructive alignment and the validity of assessment. They argue that while constructive alignment is often used in higher education to support assessment validity, in practice test validity is often verified through peer review or mapping exercises, resulting in little more than face validity (whether a task appears to measure what it is intended to measure) or content validity (whether a task adequately covers the intended content). Fawns et al. (2026) present the four Ps framework as a useful tool for educators who are not assessment specialists to move beyond surface level checks. The four Ps stand for 'four proxies'; a proxy is a form of evidence that stands in for broader, less visible capabilities.

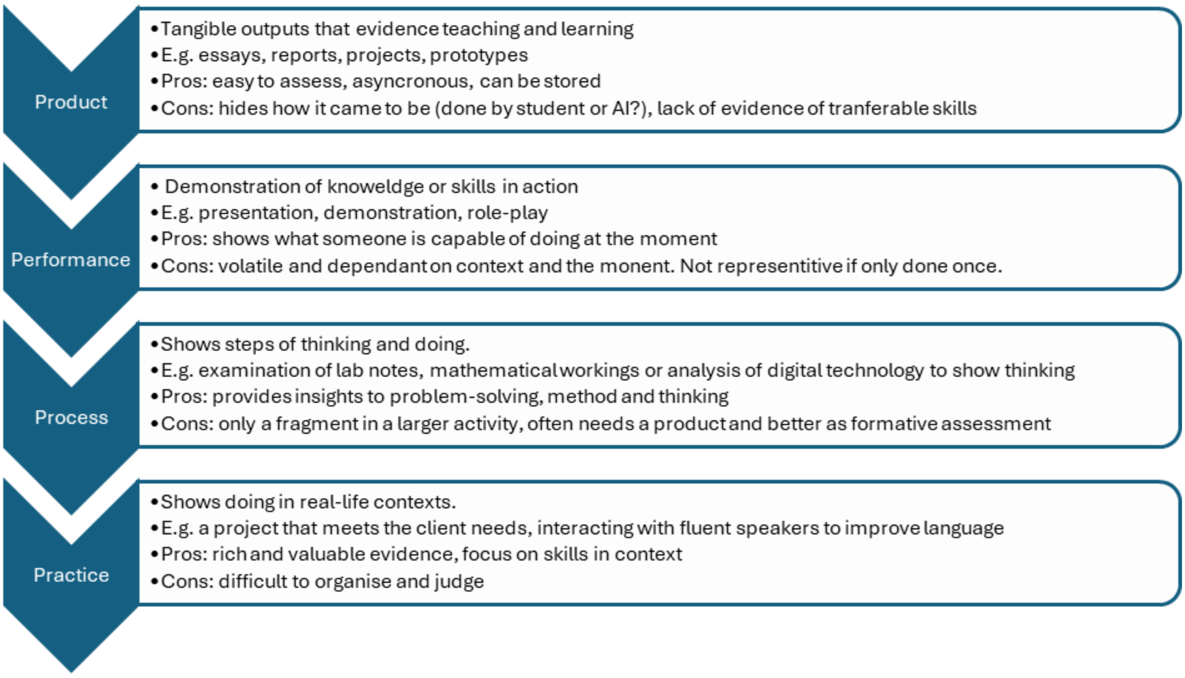

Figure 3.1.1: Steps within the four Ps framework
(Own Work based on Fawns et al., 2026)

The four Ps framework encourages you to critically consider whether the evidence generated by assessment tasks genuinely proves graduates' capabilities or whether assessments should be modified to strengthen the connection between evidence interpretation and the stated learning outcomes.

Fig. 3.1.1 shows the proxies that Fawns et al. (2026) use to describe the assessment of learning. Each of the proxies explains what they are, lists examples of each as well as some general pros and cons. However, when a proxy is used, it needs to be appropriate for the assessment. The risk arises of misalignment with the original assessment intentions, resulting in an assessment that does not truly assess the intended learning outcomes. Fawns et al. (2026) go on to describe five ways of misalignment with what you want to assess (Fig. 3.1.2).

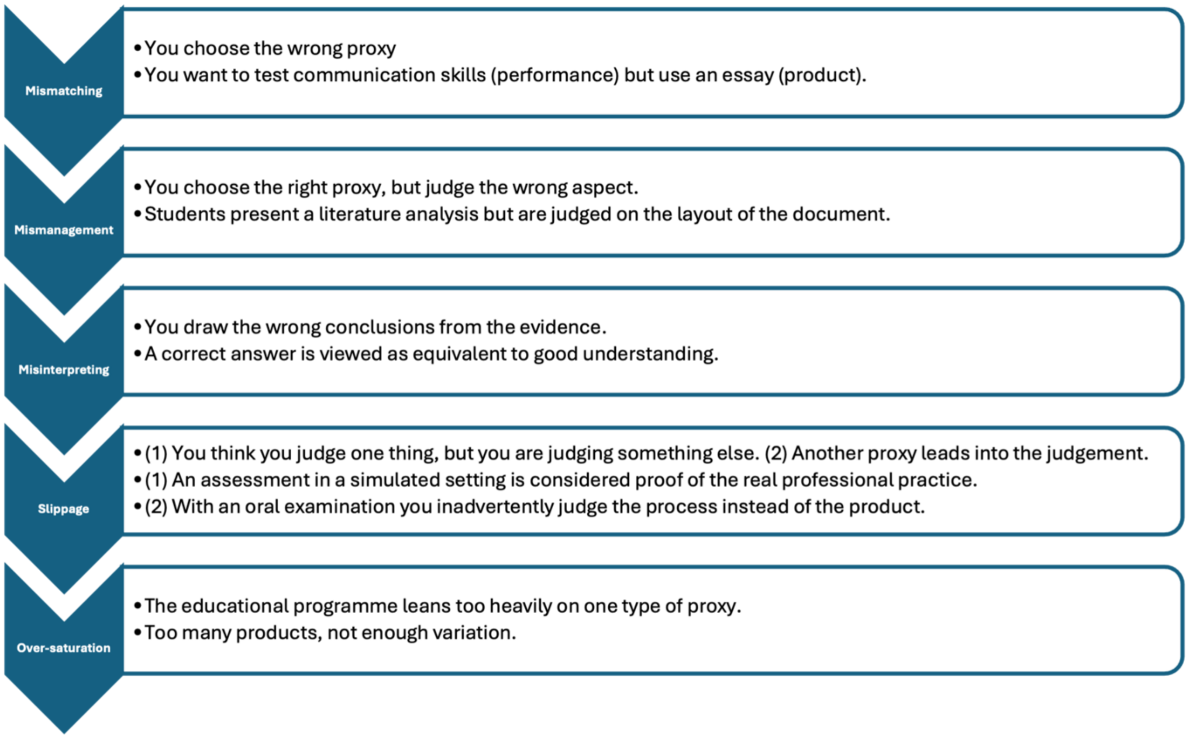

Figure 3.1.2: Summary of misalignment of proxies (Own Work based on Fawns et al., 2026)

To try to solve the misalignment issues shown in Fig. 3.1.2, Fawns et al. (2026) discuss synthesising assessment through aggregation (for example adding or averaging grades), triangulation (comparing different proxies for coherence), and holistic assessment. The four Ps framework offers a useful way for us to evaluate our assessment practices and discuss how assessment can generate credible inferences about what students know, understand, and can do.

6 Context, development, and the limits of assessment

6.1 Context

When deciding on assessment, several factors are involved, including context. Context plays an important role, as it involves the participants of the assessment (their needs, expectations, backgrounds, barriers), the educational situation (education level, location etc.) and the culture (of the students, university, and place of study). Each of these areas within context is key and must be considered, and adjustments to assessments need to be made in order to make them relevant for all stakeholders.

As Boud (2000) discusses, assessment carries implicit power and indicates implicit values. Therefore, it must be designed with transparency, fairness, and inclusivity at its core. Transparent assessment ensures that students clearly understand expectations, criteria, and the rationale behind evaluating particular competencies. Fairness requires that assessments provide equitable opportunities for all students to demonstrate their abilities, without privileging those who are already familiar with certain cultural or educational norms. Inclusive practice is especially critical in engineering education, where traditional curricula and assessment practices can unintentionally disadvantage students from diverse linguistic, cultural, or educational backgrounds or those with undisclosed disabilities. Competency-based tasks that rely heavily on implicitly accepted communication styles, culturally specific teamwork norms, or prior exposure to professional or certain social environments may obscure rather than reveal students' true capabilities (Tai et al, 2021). Inclusive assessment is therefore both an ethical responsibility and an educational necessity. Poorly designed assessments may unintentionally privilege students who are already familiar with dominant cultural or educational norms. It is therefore important to consider this when designing assessment. See Chapter 3.7 on inclusive assessment for further details.

Inclusive approaches such as offering clear instructions, alternative formats, and culturally sensitive contexts promote equity and accessibility, reduce anxiety, and foster a sense of belonging. In this way, you support assessments that measure intended learning outcomes rather than unrelated variables such as prior privilege or access to resources. Ultimately, designing assessments with inclusivity in mind not only supports individual success but also prepares graduates for diverse professional environments while maintaining the true validity of assessment. Only when all students can meaningfully engage with an assessment can it accurately reflect their capabilities. Therefore, Holmes (2004) suggests an open-minded approach with greater cultural understanding.

In terms of competencies and skills development, culture can influence the importance of some skills over others, as well as beliefs regarding those skills. For example, Courtney and Du (2015) developed a framework for Chinese learners where academic skills such as plagiarism and academic misconduct are addressed first under the competency '*being a responsible learner*', while critical thinking is addressed later. This shows that beliefs about learners influence the order in which competencies and skills are presented.

Thus, assessment of transferable competencies and skills should be designed for the specific needs of students, in addition to programmes or disciplines, because then individual differences can be better supported, leading to greater student success and achievement of learning outcomes.

6.2 Development

Assessing transferable competencies and skills presents a range of persistent and interconnected challenges for educators and institutions. Unlike discrete knowledge acquisition, competency development requires practice, is often non-linear, and most often unfolds over long periods of time, making it difficult to pinpoint when a competency has genuinely been acquired. A student's acquisition cannot be easily linked to a specific learning activity nor a single point in time. As a result, assessment systems must be flexible enough to capture development that is gradual, uneven, and deeply contextual.

Assessment in higher education is most commonly criterion- and standards-based and is rarely a direct measurement of learning gain or an individual's personalised improvement. However, for some students, the learning gain from the beginning of a programme to the point of assessment may be far smaller than for others, often depending on prior experiences and social capital. Alongside this, the development of professional competencies is often incremental or qualitative in nature. Competencies such as collaboration, critical thinking, or ethical reasoning rarely show dramatic, easily measurable leaps; instead, they evolve through subtle shifts in behaviour, mindset, and performance. Traditional assessment tools often struggle to detect these small changes, and even well-designed rubrics can fail to reflect the richness of students' developmental journeys. This raises questions about the validity and sensitivity of the instruments used to measure progress and underscores the potential value of incorporating more process-oriented and reflective forms of evidence.

6.3 Limits of assessment

Professional competencies are, by definition, transferable across contexts, so evaluating them in isolation risks fragmenting what should be a holistic picture of student development. Programmatic assessment offers a more integrated perspective, but it requires coordination across degree programmes, shared criteria, and a common understanding of expected levels of achievement.

Wider education systems also need to support this approach, which can conflict with institutional regulations around progression and assessment. As a result, the conditions required for programmatic assessment are not always easy to achieve.

A further complication lies in balancing formative and summative assessment approaches. Formative assessment is essential for supporting growth, offering feedback that guides ongoing development, while summative assessment is often required for accountability, certification, and progression decisions. Relying exclusively on one or the other creates distortions: a purely formative system may lack robustness for credit-bearing evaluation, while a purely summative system risks reducing complex competencies to simplistic scores. Therefore, many educators aim for a blended approach but integrating the two in a coherent and meaningful way remains a significant design challenge.

Finally, to ensure educator and student buy-in, workload considerations cannot be ignored. Effective competency development and assessment of this development demands time: time for students to reflect, time for educators to observe, and time for meaningful individualised and dialogic feedback to be given and understood. The organisation and workload mean the assessment can become centred around process rather than learning. Thus, without careful design, the process of assessing transferable competencies and skills can become overwhelming for both groups, overshadowing the centring of student development. Ensuring that assessment remains manageable while still capturing the complexity of competency development is therefore a central challenge for any educator seeking to implement such an approach. Balancing feasibility with pedagogical richness is thus a key consideration in assessment design.

7 From module-based judgements to programme-level perspectives

A key challenge in assessing transferable competencies and skills lies in the tension between single assessment moments and the longitudinal nature of competence development. This tension reflects a broader shift from modular, isolated judgements towards more holistic, programme-level perspectives on student learning.

According to McCafferty et al. (2025), a spectrum of programme level assessments exists from basic reflection mapping and matrices, followed by integrated assessment, and finishing with the most difficult, programmatic assessment.

- *Stage 1.* Basic reflection mapping and matrices aims to review current practice and increase diversity of assessments.
- *Stage 2.* Integrated assessment aims to design assessment that covers multiple modules or across semesters or years, therefore reducing the number of assessments.
- *Stage 3.* Programmatic assessment involves continuous multiple low-stakes assessments that take place throughout the entire degree.

All stages aim to view assessment from a holistic whole programme view rather than from an individual module perspective. This shows students the connections between modules and learning outcomes.

Programmatic assessment was introduced by van der Vleuten and Schuwirth (2005; van der Vleuten et al., 2012) in medical education and is based on the principle that assessment is a continuous process throughout a programme, as opposed to series of disconnected tests, using multiple low-stakes assessments recorded by portfolio (McCafferty et al., 2025). Programmatic assessment treats each assessment as one piece of evidence within a broader system, combining multiple data points, feedback, and learner reflections over time to support both learning and high-stakes decisions about progression. It does not rely on isolated tests and pass/fail judgements, but uses diverse assessment methods, triangulated evidence, and holistic decision making to provide a more comprehensive, learner-centred evaluation of competence (Heeneman et al., 2021). In this way, students are encouraged to become more self-reliant learners. Educators become coaches and encourage students to record evidence of their learning, which is used to determine a pass or failure. In this way, assessment shifts from isolated judgements towards a continuous, evidence-informed process of learning and development.

Nevertheless, programmatic assessment requires considerable work from educators in the beginning, as well as iterative development through evaluation (Ryan & Judd, 2022). Compared with traditional assessment, it requires more time investment in feedback provision, learner coaching, and the interpretation of multiple assessment data points to support robust progression decisions (van der Vleuten et al., 2012, 2015).

Additionally, the educational setting must be suitable for it: competency-based educational programmes can align with the use of programmatic assessment, whereas settings where knowledge transfer is the main objective might not. It also requires professional development of educators, as it considerably changes assessment, especially when educators are used to many formative assessment points. This represents a cultural as well as structural shift for an institution .

Additionally, using multiple low-stakes assessments is challenging alongside the call for reducing the number of summative assessments (Elkington, 2020). Therefore, using programme-level integrated assessment may be beneficial in reducing overassessment, as it requires students to "*synthesise and apply their learning across multiple modules*" (Walker, 2025, p. 5). This enables students to develop both knowledge and transferable skills, giving the opportunity to increase the teaching of these skills in a more in-depth manner.

Creating integrated assessment can be done at whole programme or degree level, or part-programme, i.e., by year or stage (Walker, 2025), and this can be context-dependent. However, key components of developing integrated assessment include having clear learning outcomes and assessment activities, all of which take time and collaboration to set up. This again highlights the importance of constructive alignment at the programme level.

8 Future-focused assessment: generative AI and emerging challenges

Emerging developments such as generative AI further challenge traditional product-focused assessment. AI is evolving so rapidly that we realise that anything we write in this chapter and handbook today may be outdated tomorrow. Nevertheless, the topic is too important and wide-reaching not to address when discussing learning and assessment.

With the rise in AI, design of authentic and robust assessment has become more difficult to achieve. Within engineering education, broadly speaking, there are two routes being taken: deal with AI or try to restrict its use. Restriction is unlikely to be a solution, as AI is embedded in so much of the technology we and our students use. Hence, it is important that students not only know how to use AI, but also how to critically evaluate it, understanding its limitations and the ethical implications of its use. When assessments are created, AI use has to be factored in. Myers (2025) states that we should not ask ourselves how to prevent AI use, or ask ourselves how to deal with AI use, but rather that we should ask ourselves what type of learning we want to protect and how we can design education to foster that kind of learning. Myers suggests activating didactics where the learning process itself is central, not the content. He describes six strategies that make AI use less relevant, as these strategies focus on learning process instead of end products: making assignments more personal and more reflective, showcasing the learning process in a portfolio, collaboration in class, reintroducing slower learning methods like concept mapping, teach with AI by providing students opportunities to analyse it, and talk about why this is important and thus (re)appreciating human elements.

Similarly, Mastrogiacomi (2023, p. 176) discusses how an evidence-based portfolio was used as a reaction to the Italian national AI ban in educational institutions. The author found that to capture creative and iterative teaching in a design module, a personal portfolio containing "*strategic thinking, peer interactions, ability to ask questions and active participation*" was more "*future proof"* than traditional exams, where large language models could be used to provide answers.

Chapter 3.6 discusses the use of portfolios and gives examples of four types. Whilst the example above would constitute a *showcase portfolio*, the most common use of portfolio in higher education is developmental. This enables students to reflect and act on the development of their transferable skills. By personalising a portfolio specifically for each student and their experiences through their university programme, as long as students are provided scaffolding and support, this kind of portfolio could be truly personal, as well as difficult to generate using AI, especially for assessors who are familiar with the module.

Key skills that should be developed when using AI tools are critical thinking, problem solving, and reflection. These skills can be integrated into assessments that use AI. An example of this is an '*egg drop'* challenge where AI was used to virtually assess the design of the students' parachutes, giving them potential shortcomings which enabled them to reflect and improve on their designs (Changzhou Institute of Technology Hertfordshire College, 2025). AI additionally aided the organisation and summaries of the data, enabling students to complete their logbooks. The use of AI in this assessment task saved time and physical resources, freeing students to focus on critical thinking and analysis of the feedback that AI produced, thus aiding in the development of the students' feedback literacy.

The most contentious topic related to AI and assessment is academic integrity and policy. Whilst universities scramble to develop policies and decide on the use of AI, students are already integrating AI tools in their learning. This creates a disconnect between institutional governance and actual student behaviour.

As AI for education is not going to go away, we need to learn to use it well and teach learners the critical thinking and analytical skills required to use AI responsibly. This positions AI not only as a challenge but also as an opportunity to redesign assessment in ways that better align with the development of transferable competencies.

9 Key takeaways and how to use Part 3

Assessing transferable competencies and skills in engineering education is far from a technical exercise; it is a reflection of what we believe knowledge is, how learning develops, and what kind of engineers we hope to shape. This chapter has shown that assessment is inseparable from individuals' preconceptions, culture, ethics, and educational purpose. When we privilege what is easily measurable, we risk narrowing the curriculum and students' understanding to technical content alone, overlooking the relational, reflective, ethical, and context-dependent dimensions of engineering practice. Yet these dimensions are precisely what enable engineers to navigate uncertainty, collaborate across boundaries, and act responsibly in a rapidly changing world. They are the definition of a human engineer.

Assessment is not a neutral act. The competencies that educators choose to evaluate signal what an institution values, shaping how students allocate their efforts and understand their identities as engineers. Alongside this, transferable competencies and skills develop slowly, unevenly, and across contexts. They cannot be captured well through isolated, single points in time or through reductive metrics that distort the very qualities they aim to measure. Instead, assessment must be designed to make learning and what is truly valued visible, support student development and growth, and recognise the nuance and complexity of becoming a professional engineer. This requires moving beyond product-focused approaches towards more developmental, longitudinal, and programme-level perspectives that align with the non-linear nature of learning.

This underscores why the assessment of transferable competencies and skills matters so deeply. It ensures alignment with accreditation and accountability requirements, but more importantly, it supports the development of engineers who can think critically, act ethically, collaborate effectively, and continue learning throughout their careers. Competency assessment is therefore not an optional add on to the curriculum; it is a cornerstone of future focused engineering education.

The chapters that follow offer practical pathways for putting these principles into action. Each assessment approach foregrounds different types of evidence and serves different educational purposes. You are invited to use these chapters reflectively rather than prescriptively: selecting, combining, and adapting methods to suit your own context and goals.

Peer assessment (Chapter 3.2) highlights how students can learn from and evaluate one another's contributions, making teamwork and communication visible. Self-assessment (Chapter 3.3) supports metacognition, reflection, and ownership of learning. Rubrics (Chapter 3.4) help articulate expectations and guide feedback. Observation (Chapter 3.5) captures behaviours that cannot be demonstrated through written products alone, while portfolios (Chapter 3.6) enable the documentation of development over time. As discussed in this chapter, combining these approaches at the programme level can provide a more holistic and coherent view of competence development.

Together, these approaches form a rich toolkit for designing assessment that is rigorous, inclusive, developmental, and future ready. As you continue through this part, you are encouraged to explore how the different methods connect and how they might be combined to create meaningful assessment ecosystems.

Finally, this part also lays the groundwork for Part 5, where evaluation becomes central. The choices made in assessment design directly shape how educational practices can later be evaluated for quality, effectiveness, and impact.

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AI statement

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