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Introduction to Embedding Individual Transferable Competencies and Skills

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This introductory chapter presents Part 2 of the handbook, dedicated to individual transferable competencies and skills. It outlines the conceptual foundations of transferable competencies and skills in academic teaching, with a focus on engineering education, and explains the common structure of all chapters in this section. The transferable competencies and skills are then placed within the broader framework of the handbook, linking them to the theoretical considerations in Part 1 and to subsequent discussions on assessment, evaluation, and programme-level development in Parts 3 to 5. This introduction concludes with a call to action, encouraging you as an educator to embark on a shared learning journey with your students.

1 Objective of Part 2: From concept to application in the classroom

The objective of this part of the handbook is to provide you, in your role as engineering educator, with evidence-informed chapters about teaching transferable competencies and skills. The chapters in this part are written to provide practical guidance, tested methods, and proven approaches for integrating these competencies and skills into your teaching practice and supporting their development in students. In this part, we aim to explain how such integration can be done intentionally, strategically, and in an informed, learning outcome-oriented way, so that it truly contributes to the development of transferable competencies and skills in students. Our focus is on engineering education; our intention is to share effective, constructive methods and inspire further development of successful interventions. Part 2 focuses on 17 individual transferable competencies and skills. Each chapter defines and describes one of these and offers examples of how and where it can be embedded in teaching and learning. Wider discussions of curriculum design and programme-level strategies appear in Part 4 of the handbook.

This handbook builds on the SEFI Position Paper (2025), which distinguishes between technical, transferable, and transdisciplinary competencies and skills. A more detailed discussion of the terminology can be found in Chapter 1.2, while Chapter 1.3 provides a contextual overview of the various frameworks relevant to engineering education. In this handbook, we understand transferable competencies and skills as those that are needed to *"adapt to various life contexts and that people can potentially transfer to different social, cultural or work settings"* (UNICEF, 2022, p. 3). They are essential for engineering professions and practices and complement technical or disciplinary as well as transdisciplinary competencies and skills that involve, in a nutshell, active engagement with traditional and non-traditional sources of knowledge from academic and non-academic domains (SEFI, 2025). However, we do not cover technical or transdisciplinary competencies and skills in this handbook. Our points of reference and theoretical foundations are presented in detail in Chapter 1.5, in which we also explain the classification and selection criteria for the transferable competencies and skills included in this handbook.

With Part 2, we move from these broader reflections and frameworks to a closer look at individual transferable competencies and skills, focusing on practical aspects and questions of implementation within specific modules. Our commitment in this section is to place practical guidance for educational practice at the centre. You can expect to find hands-on insights and support for your work as an educator.

2 How Part 2 chapters are structured and how they can be used

All chapters in Part 2 follow the same structure. Instead of beginning with a traditional introduction, each chapter opens with a comprehensive definition, i.e., a clear and detailed explanation of the competency or skill under discussion. This approach ensures a shared understanding and allows the authors to be transparent about how they define the concept, before exploring arguments and different ways of

implementation in higher education, and particularly in engineering education. The definition may include the core concept of the competency or skill, relevant theoretical references, frameworks, or models, key authors or foundational works, etymological or semantic considerations, connections to or overlap with other skills or competencies, essential components or dimensions, and contextual variations that influence how the skill is understood and applied. What you can expect, in short, is a solid foundation for the discussions that follow in each chapter. This also serves as a helpful guide to understanding the essence of each competency or skill so that you can make an informed decision about whether it is relevant for you and your own educational context.

The second section of each chapter presents a comprehensive argument. Here, the authors explain why the competency or skill matters. To that end, they ground their claims in empirical evidence and demonstrate its relevance for engineering education. This section shows how the competency or skill can or should be developed in learners and provides a well-founded rationale for its inclusion in educational practice. The argument may address a range of aspects and is designed to be both informative and useful for you. It may include a discussion of research methods used to study the skill, explanations of how these methods help to generate evidence, the presentation of data, statistics, or empirical findings, a demonstration of relevance for engineering students, or an exploration of its importance to practising engineers in their professional roles. Throughout this section, the focus is on providing arguments that are supported by literature, research, or tested practice, in order to answer the question of why this skill or competency is relevant for engineering education and for professional engineers alike.

Thirdly, each chapter then focuses on implementation and provides practical guidance for you as an educator by helping you to integrate the discussed competency or skill into your own teaching or educational practice. You may find that the authors address any or all of the following aspects: the context in which implementation is appropriate and whether the skill is best developed in an individual module, across several modules, or as part of a full programme, as well as the student's level of study for which an intervention is suited, and whether students should be at undergraduate or graduate level (first, second and third-cycle degree programmes). You may learn if the skill requires progressive development across study phases, be inspired to reflect on assumptions about teaching or learning methods, which can be aligned with the arguments and literature discussed in the previous section, and be reminded of specific module design elements that you may need to consider supporting effective implementation. Moreover, you will find practical examples to serve as inspiration and guidance. Some chapters will highlight challenges and offer possible solutions, others will list necessary or helpful resources such as textbooks, online materials, tools, or other supporting measures that can be integrated into modules to foster the development of competencies and skills. Importantly, this section also considers what factors should be taken into account if you want to adapt examples and use cases across institutions or in different contexts. Overall, this section, as much as the next,

aims to offer actionable guidance and provide ideas and strategies you can use directly in your own modules and settings.

The fourth section of each chapter covers recommendations for implementation and learning. It is designed to provide you with actionable guidance, offering concrete ideas and strategies that can be applied easily in your own teaching and educational context. This section focuses on practical insights and instructions, grounded in research, evidence, and tested experience. It includes concise lists of key recommendations for implementing the competency or skill in engineering education settings, different rationales for these recommendations linked back to the evidence and arguments presented earlier, a list of dos and don'ts that highlight good and best practices explaining why they matter, as well as common pitfalls or mistakes to avoid. By reflecting lessons learned from case studies, experience, or research, the authors offer insights into what has proven effective in practice. They point out critical factors that require your attention when implementing these competencies and skills in your modules. Furthermore, you will find aspects to consider when acting on the guidance provided, for example, how recommendations might vary depending on class size, available resources, or programme structures; how attention to institutional and cultural aspects may influence outcomes; or how to incorporate and value student perspectives. In addition, this section offers reflection on how recommendations may evolve through iteration and continuous improvement, including methods such as ethical risk analysis, peer feedback, and resilience-based interventions, which are discussed in chapters 2.4, 2.11, and 2.15, respectively. These recommendations will also help you to address different levels of study and learning progression, as well as scaffolding effects relevant for your didactical design in light of your particular context. All recommendations are either evidence-based or grounded in well-documented professional experience. The goal is once again to equip you with clear and actionable guidance that will help you integrate competencies and skills effectively into your engineering education practice.

Finally, where possible, each chapter offers you recommendations to help you deepen your understanding of the respective competency or skill beyond the scope of the chapter. They offer a path forward for those who want to broaden their perspective while at the same time maintaining a strong focus on practical relevance for engineering education.

We warmly invite you to read specific chapters based on your own interests or questions that may arise from your teaching context, your educational practice, your engineering field, your institutional setting, or the particular skill or competency you wish to integrate into your teaching. As noted earlier, there may be overlapping areas or shared dimensions between some of the competencies and skills. In such cases, it can be helpful to read and connect two or more chapters, especially where they complement one another or address similar aspects from different angles. Common to each of these chapters is that they contribute to a better understanding of the respective competency or skill. They offer practical insights, useful contextual information, and implementation strategies at the module level.

3 Transferable competencies and skills covered in Part 2

All chapters in Part 2, each focusing on an individual competency or skill, are derived from the three themes described in detail in Chapter 1.5. Each theme brings together a set of competencies and skills that are thematically aligned, thus shaping the overall structure of this part of the handbook. This introductory chapter (2.1) is followed by Chapter 2.2, which marks the beginning of the competency- and skill-focused contributions.

The first theme, *Responsibility, Project Management, and Leadership*, spans Chapters 2.2 to 2.6. In Chapter 2.2, Faith Nightingale and Raffaella Manzini present a process-oriented approach to project management. Chapter 2.3 by Ryan Grammenos and Jevgenija Prisutova explores effective meeting practices. Claire Lucas and Diana Martin examine risk management in Chapter 2.4. Chapter 2.5, on leadership skills, is contributed by Ewa Marjańska, Cindy Rottmann, Meagan Kendall and Anna Maria Trzaskowska.

The second theme, *Communication and Interpersonal Skills*, in Chapters 2.6 to 2.12, focuses on expression and collaboration. Chapter 2.6 by Éva Kalmár, Siqing Wei, Yousef Jalali, and Homero Murzi covers teamwork, while Chapter 2.7 by Patrick van Delft and Martijn Wackers and Chapter 2.8 by Oscar van Putten and Angeniet Kam explore oral and written reporting. Visualisation is the focus of Chapter 2.9 by Nathalie Al Kakoun, Rehan Shah, and Ilanthiraiyan Sivagnanamoorthy. Chapter 2.10 by Vladislav Krivoshchekov, Ina Peters, Sabine Ammon, and Siara Isaac addresses interpersonal communication, followed by feedback-focused Chapters 2.11 by Leah Ridgway, Aled Davies, Greg McNamara, Brendan Hayes, and Ceri Morris, who discuss feedback and 2.12 by Alexandra Werth, Stephanie Fuchs, Jonathan Butcher, and Jennifer Meyer who discuss feedback literacy.

The third theme, *Professional Commitment and Lifelong Learning*, in Chapters 2.13 to 2.19, covers metacognition, adaptability, resilience, information literacy, motivation, and perseverance. Chapter 2.13 on self-regulation is by Shan Tuyaeerts, Lynn Van den Broeck, Vicent Rutagangibwa, Peter Ruijten-Dodoiu, and Tinne De Laet. In Chapter 2.14, Samantha Brunhaver discusses adaptability and change management. Chapter 2.15 explores resilience and is authored by Natalie Wint, Stephanie Lunn, Inês Direito, and Curwyn Mapaling. Chapter 2.16, authored by Natalie Wint, William Bennett, Deborah Bauder, Cristina Tripon, and Freeha Azmat, and focuses on information literacy. Chapter 2.17 on autonomous motivation and learning beliefs is by Dan Jiang, Olga Pierrakos, and Nathalie Al Kakoun, while Chapter 2.18 on initiative and perseverance is authored by AraOluwa Adaramola, Nathalie Al Kakoun, and Alexandra Werth.

The editorial team of this handbook's Part 2 will conclude Part 2 in Chapter 2.19, offering a reflection on the themes presented and exploring tools for critical reflection and integrative learning.

4 Aligning transferable competencies and skills with assessment and evaluation

Just as Part 2 builds directly on Part 1, it also sits within the broader structure of the handbook. The themes and chapters introduced here connect to Part 3, which focuses on assessing transferable competencies and skills. It also connects forward to Part 4, which highlights how the core of engineering curricula supports transferable competencies and skills, and finally to Part 5, which addresses how to evaluate needs, interventions, and outcomes related to teaching transferable competencies and skills.

We cannot stress enough that transferable competencies and skills can only be effectively taught and developed with students if they are properly aligned with and clearly connected to appropriate learning outcomes (as the starting point), as well as to suitable forms of assessment (Biggs & Tang, 2011). That makes Part 3 on assessment particularly significant for transferable competency-oriented engineering education practice.

With that in mind, we strongly encourage you to engage attentively with Part 3 of this handbook, as it offers support in identifying relevant assessment forms and formats for competence-based teaching practice. These can be further complemented by Part 5, which focuses on evaluating educational needs, interventions, and outcomes. Meanwhile, Part 4 may serve as a valuable source of inspiration, showcasing examples of systematic integration of transferable competencies and skills on a programme level. This may be especially helpful for those interested in organisational development and broader institutional strategies. It highlights case studies that can guide and inform your own practice.

5 Call to action: Get going and learn together (with your students)

Like the rest of the handbook, each chapter in Part 2 has been written to be read independently. However, these contributions are most effective when you use them as a toolkit rather than just reading material. Whether you are designing a brand-new module, tweaking a current one, or just looking for a fresh perspective, these chapters are here to support your specific goals. They are written for you, the practitioner, to help you not only understand these competencies and skills, but to embed them into the engineering classroom in a way that works for you and your students alike.

We suggest treating these competencies and skills just like an engineering problem: prototype, experiment, and iterate. There is no single *right way* to teach transferable competencies and skills, and successful competence and skill development will depend entirely on your approach, your students, and the setting you are in. Do not be afraid to try something that might not work perfectly the first time. In fact, by showing students that you are refining your methods based on feedback, you model the very adaptability and resilience this handbook champions.

Also, moving toward competence-based teaching does not mean tearing down your curriculum to start from scratch. You likely foster many of these competencies and skills already, perhaps without naming them. This handbook can simply help you make

those implicit habits explicit. Articulating what is already there validates your current practice and makes the learning path much clearer for your students, often without adding a heavy workload.

Reflective practice like this brings your hidden assumptions to the surface, making them easier to discuss and share with colleagues. We hope the evidence and examples in this handbook prove useful in your own context. Remember, there is no one-size-fits-all approach! Instead, we invite you to take these ideas, adapt them, and make them your own. We believe this handbook is a rich resource, and we strongly encourage you to draw inspiration from it and try any and all strategies, methods, and tools in your engineering education practice. Feel free to share your experience; we would love to hear from you.

References

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AI statement

During the preparation of this work, the authors used ChatGPT (OpenAI) for proofreading and editorial support (e.g., grammar, clarity, and concision). After using this tool, the authors reviewed, edited, and adapted the content as needed. They take full responsibility for the content of the publication.

Contributor statement

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