Teaching Transversal Skills for Engineering Students: A Book Review

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Abstract
Teaching Transversal Skills for Engineering Students by Siara Isaac and Joelyn de Lima presents a comprehensive and practical framework for embedding transversal skills in engineering education through the innovative use of tangible objects and experiential learning. The book is based on the 3T PLAY project at EPFL, which was funded by the LEGO Foundation. It provides a robust conceptual foundation and practical activities to equip engineering students with essential non-technical competencies, including communication, sustainability, risk management, and emotional self-regulation. The book is valuable for educators seeking structured, evidence-informed, and engaging strategies to improve the acquisition of transversal skills. While its strengths lie in its playful pedagogical framework and practical guides, the book could further benefit from expanded coverage of cultural adaptability and broader case studies from non-European contexts. Nevertheless, the work stands as a pioneering contribution to engineering education and pedagogical innovation.

Keywords: Transversal skills, engineering education, experiential learning, tangible objects, 3T PLAY.

Introduction

Transversal skills — often known as soft, professional, or generic skills — have gained increasing prominence in engineering education, particularly due to the evolving demands of modern engineering practice. Engineers are no longer expected to only solve technical problems but also to work in diverse teams, manage projects, and respond to societal and ethical issues. Recognizing this gap, the book *"Teaching Transversal Skills for Engineering Students*" presents an innovative and actionable approach to systematically integrating the development of transversal skills into engineering curricula (Martins et al., 2021).

Developed as part of the 3T PLAY project at the Swiss Federal Institute of Technology in Lausanne (EPFL) and supported by the LEGO Foundation, the book introduces a "trident framework" — Knowing, Experiencing, and Learning from Experience — to design low-stakes, hands-on, and iterative learning experiences using tangible materials like LEGO or pasta. It combines theoretical grounding with ready-to-use activity templates, making it highly relevant for educators, instructional designers, and institutional planners (Manzini 2021).

The following section presents a chapter-wise summary and evaluation of the book's practical insights and academic contributions.

Chapter Summaries

Table 1. Summaries each Chapter

Chapter	Enhanced Summary
Chapter 1: How to Develop Engineering Students' Transversal Skills	This introductory chapter is pedagogically rich and grounded in both conceptual and empirical research. It defines transversal skills as critical, non-technical process competencies—such as collaboration, reflection, communication, adaptability, and ethical reasoning—that must be integrated with technical skills for holistic engineering education. The authors challenge the prevalent "hidden curriculum" assumption, where transversal

	skills are presumed to develop implicitly through group work or internships. Instead, they argue for deliberate and scaffolded learning. The chapter introduces the 3T PLAY Trident Framework — consisting of: • Knowing (conceptual knowledge of a skill), • Experiencing (hands-on, embodied practice using tangible objects), • Learning from Experience (structured reflection to promote transfer). Drawing on Kolb's Experiential Learning Cycle, embodied cognition, and constructivist learning theory, the authors advocate for micro-experiential learning. These brief, engaging, hands-on activities mimic real-world complexity while keeping cognitive load to a minimum. Tangible materials are used not just to "play" but to represent abstract concepts, make thinking visible, and foster meaningful interaction. This framework sets a robust foundation for transversal skill development that is replicable, adaptable, and research-informed.
Chapter 2: Retrospective Discussions to Improve Team Collaboration	It provides a specific approach to help groups learn to collaborate more efficiently by engaging in reflective practice. They state that, even though college students are accustomed to working in groups, they often struggle to discuss how their team operates. The main idea is to use retrospective discussions, which help teams think seriously about their work process rather than just the finished results they achieve. With the help of reflection cards, it becomes easier to see both the problems and positive aspects in areas such as how questions are asked, who handles different roles, and how accountability is shared. They employ team learning theory and social constructivism to demonstrate that reflection should be viewed as a collaborative and group-based activity. Through this activity, students learn to notice when members of a group may be demanding rights, their power is being abused, and members don't speak up, allowing group assumptions to influence their actions. Another essential aspect of management is developing trust and safety, as these are essential for providing honest feedback. Presenting teamwork as a skill people can strengthen, the author gives form to what was before, just a concept in team reflections. Teachers have detailed plans, instructional aids, and options to customize the activity to suit the size of their class and the way it is taught.
Chapter 3: Giving and Receiving Constructive Feedback	One of the most intense and crucial topics in this chapter is dealing with both giving and receiving feedback, mainly when it is negative. As the authors note, while feedback is essential in teams, people frequently give it poorly or avoid giving it since they dread facing conflicts. Practicing difficult conversations is the primary focus of the education process. Learners first examine ways to provide effective feedback: avoid criticizing personality flaws, offer specific details, and always approach their growth in a positive light. During the Experiencing phase, students practice giving and receiving difficult feedback by using ready-made scripts or cards that involve challenging, challenging situations. The act of scaring induces genuine fear in the players, enabling them to better match the challenges found in real life. Participants at this stage write in their journals and then discuss aspects of emotional control, good listening, and standard communication errors in a group setting. This approach is grounded in the theory of emotional intelligence, conflict resolution frameworks, and

	principles of nonviolent communication. The authors also embed guidance on cultural considerations, particularly relevant in international classrooms where feedback norms vary.
Chapter 4: Values-Based Negotiation and Sustainability	This approach differs from the conventional perspective on sustainability, as it focuses on how stakeholders agree on suitable values and principles. They are encouraged to build a LEGO model that demonstrates how they view sustainability (for instance, fairness, minimalism, and long-term). After creating their models, students must work together to form a standard model. During this playful game, it becomes clear that there are meaningful debates in the real world about which values to prioritize in sustainability, such as efficiency, equity, short-term gains, and long-term plans. In this chapter, Fisher and Ury's approach to ethically driven negotiation, value-sensitive design, and frameworks for understanding morality are used. It inspires students to examine and consider the SDGs from an ethical perspective. It also provides students with the opportunity to learn how to defend their own beliefs while being understanding of others. The chapter is special because it brings sustainability in a way that involves people in dialogue, making it relevant and easy to understand.
Chapter 5: Building Coaching and Peer-Teaching Skills Through Play	Although coaching is often viewed as a high-level job, I am presenting it as a key skill that anyone can develop in everyday work situations. It describes coaching as a set of actions that are useful for helping people learn, cooperate, and interact with one another. The basic activity involves students playing while communicating: one assembles a LEGO duck and guides the other person to build it without showing an example.

	Constrained communication highlights some standard flaws in coaching: instructions are sometimes unclear, important thoughts are often left unspoken, questions prove unhelpful, and misunderstandings can occur. Students soon notice how tough it can be to express their thoughts clearly, support each person's rights, and encourage common understanding. With guidance, they assess whether they provide beneficial advice, create questions that aid understanding, and consider what learners need to learn effectively. The activity employs approaches such as Vygotsky's Zone of Proximal Development, dialogic teaching, and peer learning in education. This chapter views coaching as an essential skill that any team member can learn, rather than being limited to central leadership or mentorship roles. The framework describes coaching as a set of behaviours that people can observe and use to facilitate learning, communication, and teamwork. In the central part, students play and learn insightful lessons: one creates a LEGO duck and assists another student in making a similar duck, but never reveals the original model. Using these constraints draws attention to typical errors during coaching, including blurry directions, unannounced expectations, ineffective questions, and misunderstandings between individuals. Soon, students notice how tough it is to discuss ideas openly, allow individuals to be independent, and reach a common understanding. By reflecting, they assess their ability to advise students effectively, use open-ended questions, and provide help tailored to the individual

	learner. The way students learn is supported by theories such as the Zone of Proximal Development, dialogic teaching, and peer learning. They make clear that coaching is not only a technique but also an activity that takes place in groups and supports the exchange of critical knowledge among team members. Pupils learn scaffolding, paraphrasing, active listening, and diagnostic questioning in a friendly environment where mistakes are expected and can be addressed. Playa has a very calming effect that encourages individuals to enjoy experimenting with new ideas. It is not enough to duplicate the duck perfectly; a coach must adapt it, control the meeting's flow, respond to suggestions, and guide the learning process effectively. As a result, students gradually transition from simply learning information to actively helping others grow, which is essential for engineers collaborating with other experts.
Chapter 6: Teaching Risk Awareness and Planning in Project Work	Risk planning involves devising solutions ahead of time and collaborating with others in the present. Here, learners are invited to design and build a physical object, such as a small sculpture, within a specified time frame. At the midpoint, the facilitators introduce occasions known as risk events, such as equipment problems, team members leaving, and unexpected changes in the goals. Due to these unexpected events, students must review risk matrices, adjust their strategies, and redistribute essential resources almost immediately. We should develop strong problem-solving skills, accept failures, and improve at adapting to new situations. By incorporating ideas from project management, agile methodology, and resilience engineering, this activity facilitates a clearer understanding of planning concepts. Touchable items, such as differently coloured bricks or dice, help make the concept of risk tangible and aid in people's understanding and retention of it. Notably, the chapter suggests that learning from failure is an integral part of the teaching process. Instead of dwelling on failures, students are motivated to understand and improve themselves in the face of failures. Such activities encourage them to reflect on their initial ideas, examine their response to pressure in decision-making, and assess how adaptable their resource management is. The chapter is helpful for instructors since it provides various examples for discussing risk, clear guides for debriefing teams, and reflective questions to aid in summarizing lessons and improving students' readiness for complex real-world projects.
Chapter 7: Creating Psychological Safety in Engineering Teams	Although psychological safety is crucial for teamwork and academic performance, it is rarely discussed in technical education. It provides helpful steps for educators and students to improve and support psychological safety in engineering teams. For this activity, students transform ideas about safety, feelings, or team norms into symbolic constructions, such as "safe spaces" or "trust bridges." They can be used to initiate conversations about inclusion, active listening, openness, and fostering respectful behaviours within a team. They also examine past team experiences to identify what factors helped or hindered psychological safety. Drawing on Amy Edmondson's findings, this task offers practical ideas for developing teaching skills and understanding our emotions, encouraging students to be more self-aware and sensitive in social situations. It helps

	students, particularly those who are not the same, to form a team where everyone respects each other and is open from the start. It is suggested that educators introduce this team task early in the term and revisit it periodically during the project to support the team's growth and development. Additionally, team charter templates, online questionnaires, and methods for observing behaviour can all help create and maintain a secure environment, enabling students and instructors to collaborate and achieve their long-term objectives.
Chapter 8: Designing Transversal Skills Activities Using the Trident Framework	The last chapter explains how teachers can plan their own transversal skills activities using the 3T PLAY Trident Framework. Building on what was learned earlier in this book, instructors are advised to choose more than the set activities and instead play an active role in planning and implementing lesson content that fits their specific context. The chapter introduces educators to practices where they can notice a lack of communication, ethics, or teamwork in the classroom. After that, it helps teachers launch skills-based lessons with matching tools and set up activities in the Trident way: introducing a concept, having students work on skills, and ending the lesson with a review to improve learning. Utilizing backward design, universal design for learning (UDL), and constructive alignment theories, the chapter explains that it is vital for learning goals, activities, and assessments to be in harmony. Educators get templates and planning tools that help them throughout the development process. Additionally, the authors share real-life experiences of instructors in fields such as sustainability, leadership, ship, and digital ethics who have applied the 3T PLAY model in their teaching. They demonstrate that this framework can be used flexibly, is relevant to various subjects, and may be more widely integrated into institutions. This chapter helps educators to join forces in developing environments that consider everyone, shine, and have a positive impact, with transversal abilities having a key role in engineering learning.

Strengths and Highlights of the Book

Teaching Transversal Skills for Engineering Students, written by Dr. Siara Isaac, Dr. Joelyn de Lima, Dr. Yousef Jalali, Valentina Rossi, Dr. Jessica Dehler Zufferey, offers a host of unique advantages from which readers can benefit greatly. Here are the main highlights, which include:

Explanation of Learning Theories in Transversal Skills Development

The 3T PLAY Trident Framework integrates three key theories for effective transversal skills development. Kolb's Experiential Learning Theory provides the foundation through four phases: concrete experience (hands-on activities), reflective observation (self-evaluation), abstract conceptualization (theory connection), and active experimentation (practical application). This approach ensures skills like communication and teamwork develop through repeated experiences and critical reflection.

Embodied Cognition Theory emphasizes using physical tools (models, prototypes) to facilitate understanding of abstract concepts. Game-based activities and simulations not only reduce cognitive load but also enhance long-term memory retention. For example, group model-building exercises train technical skills while strengthening teamwork.

Constructivism complements this model by emphasizing active learning through scaffolding. Facilitators provide reflective guidance and focused micro-activities, enabling students to construct knowledge progressively. The integration of these three theories creates a systematic approach that elevates transversal skills as core curriculum components, on par with technical skills. The outcome is engineering graduates who are not only technically proficient but also possess well-rounded social and cognitive competencies to meet professional challenges.

Excellent 3T PLAY core team and collaborators

Dr. Siara Isaac led the project as project manager and researcher, applying data-driven, evidence-based approaches to design and document transversal skills teaching activities. Dr. Yousef Jalali contributed his expertise at the intersection of engineering and education as a researcher. Dr. Joelyn de Lima and Valentina Rossi are cross appointed at the Teaching Support Center (CAPE), bringing to their work at 3T PLAY a rich understanding of higher education pedagogy, interactive facilitation and institutional relationships. Marta Ruiz Cumi skilfully managed and coordinated the many practical aspects of the project, often taking a hands-on approach to ensure smooth implementation. Dr. Jessica Dehler Zufferey provided strong pedagogical leadership and methodological support, and helped fit the work into a broader institutional framework.

In addition to the core team, Laura Persat's careful graphic design also contributed significantly to the organization and readability of the book. Over three years, the authors conducted workshops for more than 2,500 students and more than 1,500 faculty and researchers, extending the reach and impact of the project.

3T PLAY Trident Framework used

The 3T PLAY Trident Framework used in Chapter 8 provides an evidence-based approach to developing transversal skills in engineering students through three core elements: understanding, experience, and learning from experience. Understanding involves acquiring factual knowledge and concepts that underpin skills, such as learning various persuasion strategies. Experience provides low-stakes opportunities for students to focus, get feedback, and practice iteratively, such as negotiating a mutually acceptable solution and applying feedback in subsequent rounds. Learning from experience encourages students to engage in metacognitive and metaaffective reflection as they apply knowledge and skills, enabling students to transfer their learning to future contexts. The framework ensures deep learning by combining knowledge, practice, and reflection, enabling students to effectively apply what they have learned in new contexts.

Practical delivery method

One of the great strengths of this book is its practicality. It provides educators with detailed activity guides to ensure that the teaching of transversal skills is not only effective but also easy to understand. For example, Chapter 1 "How to develop transversal skills in engineering students" and Chapter 2 "How to support students in developing skills to improve collaboration, including retrospective discussions" are just a few examples. Each chapter is accompanied by clear instructions including timing, delivery methods and required materials, making it easy for teachers to integrate the activities into the course without extensive preparation. This feature saves time and allows teachers to focus more on improving student engagement. This is especially useful for teachers with large classes or who need flexible resources that can be modified quickly. Ready-to-use materials ensure that educators can start teaching transversal skills immediately without having to spend a lot of energy thinking about how the lesson should be conducted. This book covers both the conceptual and practical aspects of teaching transversal skills, significantly improving the teaching efficiency of engineering education.

Playful, actionable learning

This book incorporates fun into engineering education in a unique way, using real objects to teach transversal skills. This approach is inspired by the LEGO Foundation's philosophy of "learning through play", where playful and constructive visualization workshops using LEGO bricks and other materials can increase student engagement and understanding of data and visualization (Kejstová et al., 2023). The philosophy advocates hands-on and experiential learning to help students understand abstract concepts in a concrete way. For example, the use of real objects such as LEGO bricks in Figure 1.3 mobilizes students' senses and makes the learning process more interactive and fun. These real objects help reduce cognitive load, allowing students to focus on the application of skills rather than being overwhelmed by complex technical concepts. By incorporating games, students are encouraged to step out of their comfort zone, try new ideas, and take risks without fear of failure. This environment fosters creativity, problem-solving, and collaboration - all key transversal skills required of future engineers. In addition, the playful approach encourages repeated experimentation, where students can try multiple strategies, reflect on the results, and improve their methods. The edutainment approach makes the learning process interesting, comfortable and interactive, thereby enhancing students' engagement and learning experience (Feiyue, 2022).

Explicit Focus on Transversal Skills

Engineering education has traditionally focused on technical skills, but there is growing recognition of the importance of transversal skills for career success (Jalali et al.,2022).As engineering students increasingly participate in interdisciplinary and global teams, transversal skills such as communication, collaboration, leadership, and emotional intelligence have become critical to success (Hernandez-Linares et al., 2015).This book aims to remedy this gap by placing a strong emphasis on the explicit teaching of transversal skills, rather than assuming that students

will passively learn these skills through group work or projects. Each chapter focuses on developing a specific transversal skill, such as improving students' collaborative decision-making, providing constructive feedback skills, promoting sustainable development skills, and so on. By teaching these skills in a structured and targeted manner, this book ensures that engineering students not only have technical expertise but also the ability to work effectively in a diverse and dynamic environment. The explicit focus on these skills also highlights their equal importance within the engineering profession.

Backward Design, Customized Instruction

This book promotes a backward design approach that enables educators to tailor instructional activities to the specific needs and contexts of their students. Reverse design is a teaching method that first determines the expected learning outcomes, then determines the assessment methods, and finally plans teaching activities (Miller et al.,2020). This method can help educators create meaningful and motivating teaching and enhance students' awareness of the learning process. This method can help educators create meaningful and motivating teaching and enhance students' awareness of the learning process (Condrat,2018). The book provides educators with a framework for designing new activities that incorporate transversal skills, ensuring that they remain relevant and targeted to the course objectives. In addition, the book provides educators with the flexibility to adapt the activities to different classroom environments, course structures, and student groups. This customizability makes the book a versatile resource for teaching transversal skills, whether in a large lecture hall or a small interactive seminar. It enables educators to tailor the learning experience to the needs of their students, ensuring that every student acquires the skills they need to succeed in the engineering profession.

Scalable and Low-Cost

The activities presented in the book are designed to be scalable and low-cost, making them highly accessible for educators with varying resource constraints. Due to budget constraints, large class sizes and limited resources, engineering courses face challenges in providing practical experience (Baleshta, 2015). The use of physical objects such as LEGO bricks in the book reduces the need for expensive resources while still creating a dynamic learning environment. The materials are accessible, cost-effective, and adaptable to a variety of settings. The scalability of these activities makes them suitable for both large and small classes, providing a way to engage all students regardless of class size. The book's focus on simple, physical objects removes the financial barriers that often prevent educators from integrating experiential learning into their curriculum, making it a valuable resource for institutions of all sizes and budgets.

Aligned with Global Trends in Engineering Education

Engineering education is undergoing a major transformation to address complex social challenges and sustainability issues. Engineering courses are increasingly emphasizing interdisciplinary cooperation, systems thinking and sustainable development (Julius & Ibrahim, 2024). Horizontal skills are crucial for engineers to effectively perform their professional duties. These skills include leadership, ethical decision-making and sustainable practices, which are crucial for addressing complex engineering challenges in dynamic environments (Jalali et al.,2022). This book directly addresses this need by integrating sustainability and ethical considerations into the transversal skills framework. The book's activities are designed not only to enhance students' technical capabilities, but also to prepare them to take on leadership roles to address global challenges. By incorporating these broader themes into engineering curricula, this book helps educators align their teaching with current industry and societal needs. The focus on global relevance ensures that students in this book are better equipped to become agents of change, able to address the grand challenges of the 21st century.

Positive Educator Feedback

The methods outlined in this book have received positive feedback from educators around the world, demonstrating their effectiveness in increasing student engagement and skills development. For example, professors from institutions such as Queen's University in Canada and Praksha University in India praised the practicality and engaging nature of the activities and their success in promoting transversal skills development among students. The book's emphasis on playful learning and the use of real objects resonated strongly with educators. They reported that students were more engaged and willing to step out of their comfort zones after adopting these methods. Educators also appreciated the book's flexibility, which allowed them to easily adapt the activities to their unique teaching contexts. These responses suggest that the 3T PLAY approach has the potential to transform engineering education by integrating transversal skills development into existing curricula in a way that is both effective and fun.

Opportunities for Enhancement

Incorporate global, culturally diverse case studies.

Although the book draws heavily on Western (especially European and North American) educational models, transversal skills such as communication,

collaboration and leadership will be reflected differently depending on cultural values, for example, collectivist societies versus individualistic societies. However, adding more culturally diverse examples, activities and considerations will make the book more globally inclusive and help students prepare to work in a truly international environment. Case studies from Asia, Africa or Latin America can show how transversal skills can be applied in different cultural contexts, thus enriching the learning experience.

Provide deeper, varied assessment tools.

Although the book introduces model questionnaires and mentions rubrics for assessing skill development, the assessment strategies could be further expanded. Transversal skills are notoriously hard to assess reliably, and more examples of longitudinal assessments, peer evaluations, or real-time observation protocols would be valuable. Including validated assessment tools or case studies on how different institutions implemented and assessed the impact of these activities could give educators more practical guidance on measuring learning outcomes.

Increase use of illustrative visuals and sample videos.

While the book includes activity guides and downloadable slides, more visuals, flow diagrams, and even sample video case studies demonstrating real student teams engaging in the activities would be beneficial. Visual learners and novice instructors could greatly benefit from seeing how the activities look in practice, offering a more concrete model to emulate.

Conclusion and Recommendations

Teaching Transversal Skills to Engineering Students is a timely and practical contribution to engineering education. Using the 3T PLAY framework – centered on "knowing", "experiencing" and "learning from experience" – the book offers a structured, outcome-based approach to developing key transversal skills. The book uses tangible and micro-experiential learning activities to not only make skill acquisition easier and more engaging, but also bridge the gap between theory and practice in a creative and low-risk way. The book provides ready-made resources, allowing educators to easily integrate these activities into their courses.

The book's strengths lie in its clear focus on intentional skill development, play-based methodology, and its adaptability to varied classroom settings. It aligns well with the growing recognition that engineering graduates must be prepared not only with technical expertise but also with leadership, collaboration, and ethical reasoning skills necessary to address complex global challenges. Positive feedback from educators worldwide further validates its practical value.

However, to broaden its impact and remain relevant in a rapidly evolving educational landscape, the book could expand its use cases in diverse settings, enhance its assessment strategies, and incorporate digital learning models. These improvements would make the book an indispensable resource for a wider audience beyond engineering education.

Finally, the inclusion of case studies and examples from different cultural and educational backgrounds would enhance the global relevance of the activities and prepare students for cross-cultural teamwork and leadership. And more comprehensive and validated tools for assessing transversal skills, including peer review, longitudinal tracking, and reflective assessment, would strengthen the ability to effectively measure learning outcomes. Adding videos, visual case studies, and classroom demonstrations would further support instructors, especially those new to experiential learning approaches.

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Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this paper.

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