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STRATEGIC INNOVATION BY DESIGN IN DUAL HIGHER EDUCATION: EMBEDDING ETHICAL, SUSTAINABLE LEADERSHIP THROUGH WORK-INTEGRATED POSTGRADUATE LEARNING

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Abstract

Dual higher education increasingly requires pedagogical approaches that integrate academic learning with the complexity of contemporary organisational challenges. This paper examines how the Perception-Blueprint-Envision-Execution (PBEE) framework, a structured design-led pedagogical scaffold, is embedded in work-integrated postgraduate learning to support ethical, sustainable, and systems-oriented innovation. Drawing on the Sustainable Design for Innovation (SDI) module, the paper analyses how PBEE structures learners' engagement with transformational workplace projects addressing sustainability, responsible leadership, and organisational complexity. Adopting a conceptual and practice-based orientation, the analysis illustrates how PBEE supports structured sensemaking around organisational context, problem framing, responsible solution generation, and reflective engagement with implementation. The paper positions PBEE as a pedagogical model aligned with the development of Future Skills, including reflexivity, problem framing, ethical awareness, stakeholder engagement, and adaptability. In doing so, it contributes a coherent design-led framework for advancing societally relevant and responsible innovation within dual higher education.

1 Introduction

1.1 Context: Dual higher education in a changing world

Rapid technological, environmental, and societal shifts are reshaping the capabilities required of contemporary organisations and their workforces. The World Economic Forum's Future of Jobs Report (2025) highlights the accelerating demand for organisations to navigate AI-enabled transformation while strengthening responsible leadership, ethical governance, and resilience (Chiu, 2024). Employers increasingly prioritise analytical and creative thinking, collaboration, adaptability, and social influence in a labour market shaped by automation, sustainability transitions, and demographic change (Alt et al., 2023; Doherty & Stephens, 2023; World Economic Forum, 2025).

Dual and work-integrated higher education models are particularly well positioned to respond to these demands because they formally integrate academic learning with sustained professional practice (Smith & Worsfold, 2014; Ferns et al., 2025). In this paper, dual higher education refers to educational models that integrate academic study with workplace-based application and support

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reflective integration, professional agency, and competence development through authentic organisational challenges (Ferns et al., 2025; Sági & Fülöp, 2024). Empirical studies indicate that such models can enhance soft skills, professional competence, and learner agency at master's level (Prada et al., 2022; Urkia-Basterra et al., 2025).

Within this context, work-integrated postgraduate learning can serve as a critical mechanism for bridging theory and practice in ways that support societal relevance and professional readiness. The Sustainable Design for Innovation (SDI) module examined in this paper represents such an approach by enabling learners to undertake transformational projects within their own organisations. To support sustainability-oriented and ethically informed innovation practice, the module uses the Perception-Blueprint-Envision-Execution (PBEE) framework as a design-led pedagogical scaffold.

1.2 Purpose of the study

Despite growing interest in dual higher education and work-integrated learning, limited practice-based insight exists into how structured pedagogical scaffolds can operationalise sustainability, ethical responsibility, and systems thinking within postgraduate professional contexts. Although design thinking and responsible innovation scholarship emphasise the importance of reflexivity, stakeholder engagement, and societal alignment (Brown, 2009; Freeman, 1984; von Schomberg, 2013), there remains a gap in understanding how such principles can be embedded coherently in work-integrated postgraduate curricula.

The purpose of this study is to examine how the PBEE framework, a design-thinking-inspired pedagogical scaffold, supports competence development, learner agency, and societal relevance within a work-integrated postgraduate module. Drawing on conceptual scholarship in design thinking, responsible innovation, and stakeholder theory, and informed by qualitative, practice-based evidence from the SDI module, the paper explores how PBEE structures learner inquiry, reflection, and action throughout transformational workplace projects.

1.3 Research Questions

The study is guided by the following conceptual questions, which are explored through a qualitative, practice-based analysis of a work-integrated postgraduate module rather than through hypothesis testing:

- How can PBEE support competence development in dual higher education?
- How does the SDI module empower student agency through real-world, work-integrated projects?
- What Future Skills emerge when postgraduate learners apply PBEE within their professional context?
- How can responsible innovation and stakeholder theory provide a conceptual foundation for understanding the societal relevance of work-integrated postgraduate learning?

1.4 Contribution to the literature

This paper makes four key contributions to existing literature on dual higher education, design-led pedagogy, and responsible innovation. It also contributes to current discussions on how work-integrated learning curricula can be structured to support transformational capability development among postgraduate learners (Ferns et al., 2025). Although critical scholarship highlights the value of design thinking as a practice-oriented, context-sensitive approach to innovation (Kimbell, 2011), it has also been applied in diverse professional contexts to support problem framing and stakeholder engagement (Kenny et al., 2021). However, limited pedagogical guidance remains on how such design-led frameworks can be systematically embedded in work-integrated postgraduate curricula to support ethical, sustainable, and societally relevant innovation capability development.

First, it proposes PBEE as a pedagogical scaffold that supports transformative, work-integrated postgraduate learning. PBEE is presented as a structured practical learning process that

guides perception, problem framing, ideation, and execution within real-world professional settings (Brown, 2009; Ferns et al., 2025; Kenny et al., 2021; Urkia-Basterra et al., 2025), while stakeholder identification and salience provide a useful lens for understanding organisational dynamics (Mitchell, Agle & Wood, 1997).

Second, the study integrates concepts from design thinking, responsible innovation (RRI), and stakeholder theory to illustrate how pedagogical design can encourage learners to adopt ethical, inclusive, contextual, and systems-based perspectives on organisational and societal challenges (Freeman, 1984; Blok & Lemmens, 2015; von Schomberg, 2013). Responsible innovation scholarship emphasises anticipation, reflexivity and responsiveness in addressing societal challenges (Macnaghten et al., 2014; Owen et al., 2021).

Third, the paper contributes practice-based evidence from authentic work-integrated projects undertaken by postgraduate learners. These vignettes illustrate how students use PBEE to navigate sustainability issues, digital transformation, social impact challenges, and product/service innovation. Table 1 positions PBEE in relation to established design and innovation frameworks, clarifying its distinctive responsible and work-integrated orientation.

Table 1. Conceptual positioning of PBEE in relation to established design and innovation frameworks

Framework	*Core organising logic*	*Treatment of sustainability and ethics*	*Role of stakeholders*	*Orientation to responsibility and societal impact*	*Primary application context*
IDEO Design Thinking (Desirability–Feasibility–Viability)	Human-centred problem solving balancing user needs, feasibility, and viability	Treated as contextual considerations rather than structuring principles	Primarily framed as users or customers	Indirect; dependent on design intent rather than embedded criteria	Product, service, and organisational innovation
Double Diamond (Design Council)	Divergent–convergent cycles of problem definition and solution development	Sustainability and Ethics may be incorporated but not structurally embedded	Engaged mainly during discovery and testing	Focus on problem–solution fit rather than explicit societal responsibility	Design process management and innovation practice
Responsible Research and Innovation (RRI)	Normative framework emphasising anticipation, reflexivity, inclusion, and responsiveness	Central normative commitments	Core principle across the innovation process	Explicit focus on societal desirability, ethics, and public value	Science, technology, and innovation governance
PBEE (Perception–Blueprint–Envision–Execution)	Pedagogical scaffold guiding contextual analysis, systems-framing, responsible ideation, and reflective implementation	Embedded across all stages as boundary conditions for innovation decisions	Engaged throughout the process as part of sensemaking, framing, and evaluation	Societal impact is foregrounded through reflexive inquiry and responsible innovation principles	Work-integrated postgraduate learning and professional education

Fourth, the paper aligns PBEE with the development of Future Skills and transformative capabilities identified as central to dual higher education and contemporary policy frameworks (European Commission, 2018; European Commission, 2023; OECD, 2024; Prada et al., 2022; Urkia-Basterra et al., 2025). These include problem-solving, reflexivity, ethical reasoning, adaptability,

systems thinking, stakeholder engagement, collaboration, and innovation capability. By enabling students to choose transformative projects within their own workplaces, the module embeds agency, responsibility, and professional relevance at the heart of the learning process.

1.5 Structure of the paper

The paper is structured as follows. Section 2 outlines the conceptual and methodological orientation of the study, including the pedagogical context of the SDI module and the PBEE scaffold that supports work-integrated learning. Section 3 presents thematic vignettes from learners' transformational projects and discusses the development of competencies and Future Skills. Section 4 examines PBEE's contribution to dual higher education and its alignment with societally relevant pedagogy. Section 5 concludes by reflecting on implications for practice, limitations and directions for future research.

2 Methodology

2.1 Research design and conceptual orientation

This paper adopts a conceptual, qualitative, and practice-based methodological orientation, drawing on pedagogical scholarship, experiential learning theory, and design-based learning approaches in postgraduate management education. The methodological purpose is to examine pedagogical design and curriculum architecture in a work-integrated learning context, rather than to conduct an empirical study of learners or evaluate learning outcomes.

Experiential learning theory provides a foundational lens for the analysis. As articulated by Kolb (1984), experiential learning conceptualises learning as a cyclical process of concrete experience, reflective observation, conceptual interpretation, and active experimentation, making it particularly well suited to work-integrated and real-world innovation projects. Similarly, action learning approaches - where learners engage with authentic organisational challenges through iterative cycles of inquiry, analysis, and reflection - have long been recognised for their role in developing leadership capability, problem-solving capacity, and reflective judgement in professional education (Marquardt, 2014; Revans, 1982; Volz-Peacock et al., 2016). These approaches align closely with the work-integrated structure of the Sustainable Design for Innovation (SDI) module examined in this paper. This practice-based methodological stance also responds to critiques suggesting that responsible innovation frameworks can become overly procedural, with limited attention to power, politics, and institutional uptake in real organisational contexts (van Oudheusden, 2014).

The study is situated within constructivist epistemological traditions that view knowledge as co-constructed, situated, and context-dependent (Guba & Lincoln, 1989), while also drawing on reflexive methodological perspectives that recognise the researcher's interpretive role in meaning-making (Alvesson & Sköldberg, 2009). Within this framing, pedagogical design is understood as an embedded professional practice shaped by institutional context, disciplinary norms, and practitioner judgement. Accordingly, the unit of analysis in this paper is the design and enactment of the SDI module, including its curriculum structure, learning architecture, and integration of the PBEE framework, rather than individual students or participant characteristics.

The analysis focuses on how the Perception-Blueprint-Envision-Execution (PBEE) framework is embedded within a work-integrated postgraduate module and how it functions as a pedagogical scaffold within authentic professional projects. References to student engagement are used illustratively to demonstrate how the framework is enacted within the learning design, rather than as empirical evidence derived from systematic data collection, or outcome measurement. The pedagogical stance underpinning this analysis is informed by professional experience at the intersection of academia and industry. Working across these domains has highlighted the importance of perception, contextual awareness, and practical problem-solving in effective innovation practice. This experience shapes the rationale for the SDI module design, which emphasises empathy, systems thinking, and real-world application. These principles underpin the

choice of experiential action learning and the integration of PBEE as the guiding framework for learning design. This aligns with reflexive practitioner research traditions that emphasise critical engagement with professional experience while remaining attentive to its interpretive limits (Cunliffe, 2003, 2016, 2020).

This conceptual and practice-based orientation informs the following sections, which outline the context, structure, and pedagogical architecture of the SDI module. All illustrative student material referenced in this paper derives from routine teaching and assessment processes and was not generated for research purposes. As such, the study does not involve human subjects research, and all examples are presented as anonymised educational artefacts used to support a conceptual discussion of pedagogical design.

2.2 PBEE framework as pedagogical and analytical lens

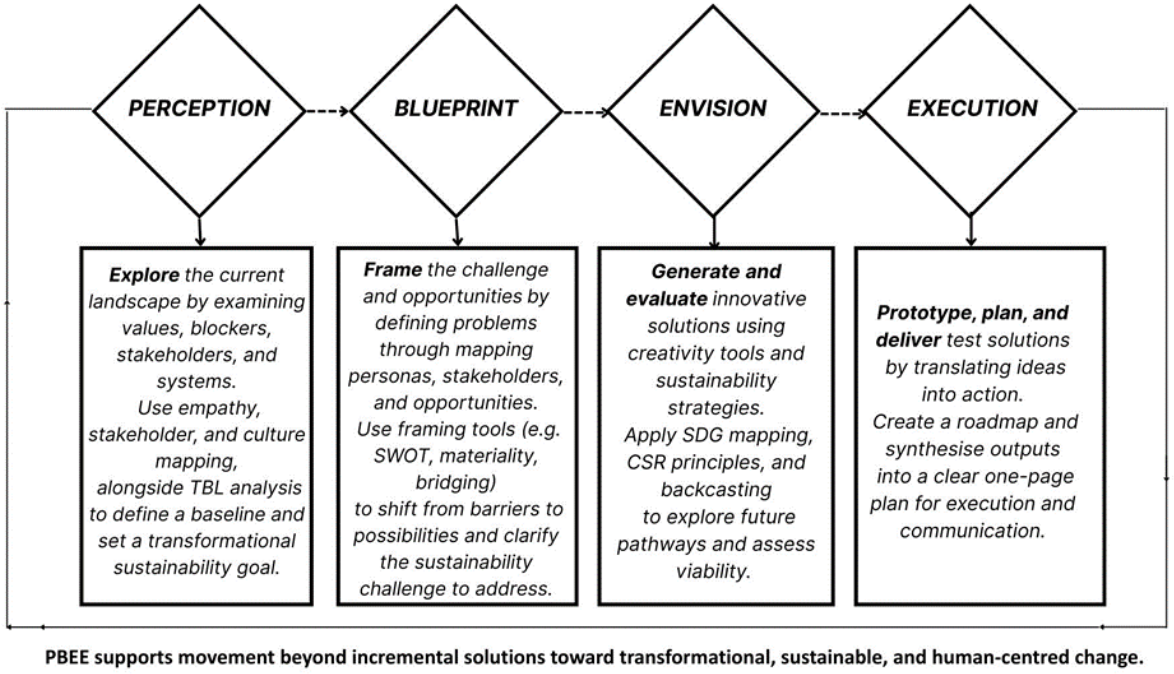

Figure 1. The PBEE framework as a reflexive scaffold for responsible and sustainable innovation

2.3 Context of the SDI module

The Sustainable Design for Innovation (SDI) module forms part of a part-time postgraduate MBA programme and has been delivered across multiple cohorts since its introduction in 2023. It has evolved through ongoing pedagogical refinement informed by practitioner insight. Learners are working professionals drawn from diverse sectors, primarily multinational organisations, alongside government agencies and, to a lesser extent, start-ups and owner-managed SME's. In the Irish context, SMEs are defined as enterprises with fewer than 250 employees and categorised as micro (<10 employees), small (10-49), or medium (50-249), with additional financial thresholds applied in funding contexts (CSO, 2024).

Given the professional backgrounds of participants, the module adopts an experiential action learning approach that emphasises doing, reflecting, and revising practice. Learning is structured through the design thinking-inspired PBEE framework (Perception, Blueprint, Envision, Execution) and supported by continuous reflective activities. Figure 1 illustrates the PBEE learning model as introduced in the SDI module and outlines the four interconnected stages that guide learner engagement throughout the innovation process.

To operationalise PBEE, students work in a structured Miro workspace that mirrors the four stages of the framework. This digital environment guides learners through stakeholder mapping, sustainability analysis, ideation, prototyping, and reflective synthesis. The workspace supports accountability and iterative learning by making decision-making processes visible across the module. It also provides a visual trace of the innovation journey used within assessment activities. Figure 2 presents the Miro workspace used to scaffold learner engagement with the PBEE process.

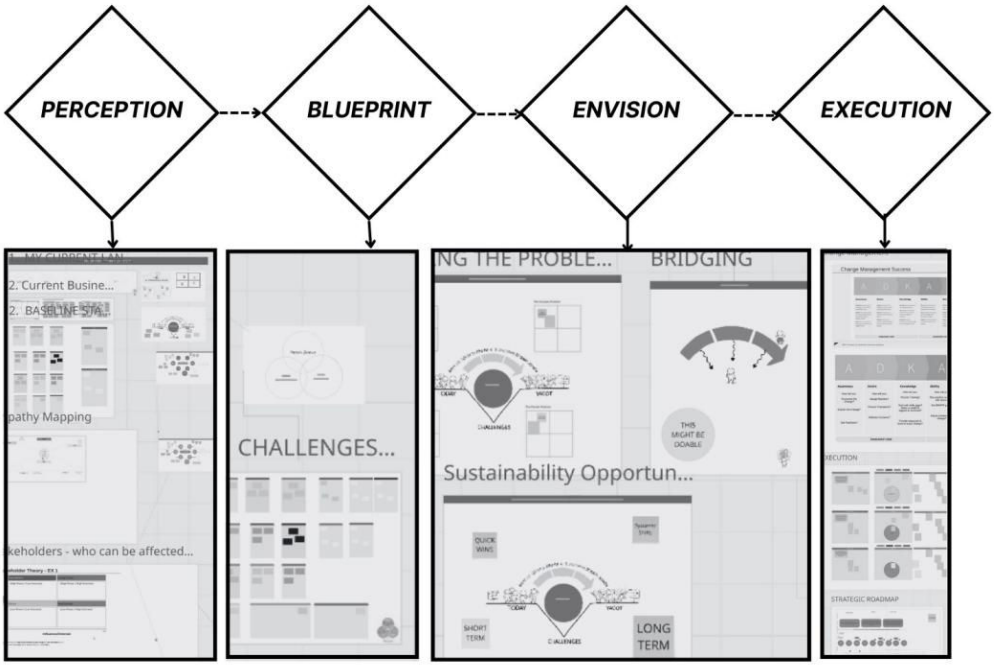

Figure 2. Miro workspace used to scaffold learner engagement with the PBEE process.

The SDI module places particular emphasis on sustainability, ethical leadership, and systems thinking. Experiential learning tasks encourage learners to analyse interconnected challenges, evaluate environmental and social impacts, and develop responsible innovation proposals within their own organisational contexts. Students are required to select a transformational workplace project that demonstrably addresses sustainability and inclusion, thereby ensuring that innovation is purpose-driven and contextually relevant. A formative project pitch in Week 3 provides an opportunity to present proposed projects, receive feedback, and confirm feasibility within the module timeframe.

2.4 Learning activities and assessment structure

Learning within the SDI module is organised around three interconnected assessments designed to scaffold the application of the PBEE framework throughout of the module.

2.4.1 Assignment 1: Sustainable design for innovation proposal (individual)

Students prepare an initial project brief outlining their chosen transformational workplace project. This proposal requires analysis of environmental and social impacts, identification of relevant stakeholders, mapping of sustainability considerations, including ESG and SDG alignment, and articulation of SMART objectives. The output establishes the foundation for subsequent learning activities and assessments.

2.4.2 Assignment 2: Collaborative product redesign (group hackathon)

Midway through the module, students participate in a collaborative redesign challenge focused on improving the sustainability performance of an existing product. Working with predefined products that present sustainability challenges, groups apply rapid design methods informed by lifecycle analysis, materiality considerations, relevant legislation, and sustainability principles. Outputs include a short presentation, a design rationale, and supporting documentation.

2.4.3 Assignment 3: Transformational project presentation (individual)

In the final assessment, students present the outcomes of their workplace innovation projects. They reflect on implementation processes, compare planned and actual progress, consider feasibility and potential impact, and discuss organisational barriers and enablers. The presentation synthesises learning across the module and demonstrates applied integration of PBEE, sustainability principles, and responsible innovation within a real-world professional setting.

Together, these learning activities form a coherent, practice-based learning architecture designed to support competence development, reflective capability, and responsible innovation leadership in a work-integrated postgraduate context.

2.5 Data and practice-based evidence sources

Since its introduction, the SDI module has been delivered across multiple cohorts, with approximately 65 postgraduate learners engaging with the PBEE framework through assessed transformational projects and reflective coursework. The analysis presented in this paper draws on practice-based educational artefacts generated through routine teaching and assessment processes, including project proposals, collaborative hackathon outputs, final project presentations, and structured reflective submissions. In addition, longitudinal practitioner observation of project development and classroom engagement informed interpretive insights into how the PBEE framework operates in practice in a work-integrated postgraduate learning context.

These materials are not treated as data for statistical measurement, systematic qualitative coding, or causal inference. Rather, they are considered at an aggregate and illustrative level to support interpretive sensemaking around recurring pedagogical patterns, thematic project trajectories, and modes of learner engagement enabled by the PBEE scaffold. This interpretive orientation aligns with qualitative traditions that emphasise meaning-making and pattern recognition without formal analytic procedures (Braun & Clarke, 2006). All examples referenced are anonymised and used solely to support a conceptual discussion of pedagogical design and learning architecture, rather than to report evaluative findings or generalisable evidence of learner outcomes.

3 Results and discussion

3.1 Overview of PBEE in practice

Within the Sustainable Design for Innovation (SDI) module, the Perception-Blueprint-Envision-Execution (PBEE) framework is used as a pedagogical scaffold through which learners structure and navigate transformational workplace projects. Rather than functioning as a prescriptive method, PBEE provides a staged learning architecture that supports contextual exploration, structured problem framing, responsible ideation, and reflective consideration of implementation in work-integrated postgraduate learning settings.

Across module deliveries, PBEE has been enacted in a wide range of organisational and sectoral contexts. Although the specific focus of workplace challenges varies, the framework offers a consistent structure through which learners engage with sustainability-oriented inquiry, leadership considerations, and systems-level constraints. The emphasis in this analysis is therefore on how PBEE organises thinking, reflection, and professional sensemaking rather than on evaluating individual learner outcomes.

To illustrate the pedagogical architecture underpinning the SDI module, Figure 3 presents a conceptual cycle showing how PBEE is embedded in a wider work-integrated learning process. The model situates learner-identified workplace challenges at the centre of the learning experience, supported by academic input, structured learning activities, assessment, and iterative feedback loops. In this way, PBEE operates as a connective mechanism between professional practice and academic learning, enabling sustained engagement with responsible and sustainability-oriented innovation within real-world organisational contexts.

3.2 Perception: Understanding complex contexts

Within the SDI module, the perception stage foregrounds values-led leadership and contextual awareness at the outset of learners' transformational projects. At this stage, PBEE emphasises the articulation of personal and organisational values alongside examination of internal beliefs, structural constraints, and contextual pressures shaping workplace practice. This pedagogical focus reflects scholarship highlighting the importance of ethical voice and the organisational and societal costs associated with moral disengagement or "looking the other way" (Gentile, 2012).

The Perception stage also incorporates principles associated with psychological safety and collaborative cultures as enabling conditions for innovation (Bunderson & Boumgarden, 2010; Carmeli, 2007; Carmeli & Gittell, 2009; Edmondson, 1999, 2004, 2014; Tucker et al., 2007). These concepts are embedded within learning activities to support open engagement with complexity and uncertainty in professional contexts.

In practice, this stage structures sensemaking activities, such as mapping organisational processes, exploring user journeys, identifying key stakeholders, and analysing contextual constraints. These activities support learners in surfacing ethical considerations, sustainability tensions, and systemic or digital challenges relevant to their organisations. The focus is on developing contextual insight and reflexive awareness, providing a foundation for subsequent problem framing and design work.

Beyond its immediate pedagogical role, the Perception stage aligns with broader competence development priorities within Dual Higher Education. As shown in Table 2, this stage supports the development of reflexivity, ethical awareness, and systems awareness, contributing to learners' capacity to exercise professional judgement within work-integrated learning settings.

Table 2. PBEE stages mapped to competence in dual higher education

PBEE Stage	*Work-Integrated Learning Activities*	*Competence Areas Emphasised (Future Skills)*	*Dual Higher Education Alignment*
Perception	Context analysis, stakeholder mapping, values clarification, ethical questioning	Reflexivity, ethical awareness, systems awareness	Understanding workplace context; developing professional judgement
Blueprint	Problem framing, systems mapping, materiality analysis, barrier–opportunity mapping	Analytical thinking, strategic awareness, problem framing	Translating academic tools into authentic challenges
Envision	Ideation, scenario-building, responsible design, sustainability evaluation	Creativity, responsible innovation, adaptive thinking	Generating organisationally relevant solutions
Execution	Prototyping, feasibility testing, workplace engagement, reflective learning	Collaboration, leadership, communication, practical judgement	Applying learning within real work settings

Source: Author's conceptual framework (PBEE)

3.3 Blueprint: Structured problem framing

The Blueprint stage supports the transition from broad contextual exploration to structured problem framing. At this stage, learners apply systems thinking tools to identify interdependencies, examine underlying causal structures, and move beyond surface-level symptoms. This approach aligns with systems thinking perspectives that emphasise relationships and feedback structures rather than isolated issues (Meadows, 2008).

Pedagogical activities in the Blueprint stage focus on mapping competing priorities, stakeholder expectations, and inclusion-related considerations that shape organisational challenges. This structured framing process reflects core design thinking principles emphasising reframing of initial problem definitions to surface deeper and more strategically relevant challenges (Dorst, 2011). Attention to stakeholder salience further supports clearer articulation of organisational problem contexts (Mitchell et al., 1997).

Through this stage, PBEE functions as a scaffold that organises analytical inquiry and supports deliberate engagement with complexity, establishing a foundation for subsequent ideation and envisioning activities.

3.4 Envision: Creative and responsible ideation

The Envision stage focuses on the generation of creative, responsible, and sustainability-oriented solution concepts. Learning activities draw on principles of eco-design and circular economy thinking to support ideation that considers environmental, ethical, and organisational implications (Bocken et al., 2014; Geissdoerfer et al., 2017). Scenario-building and impact assessment encourage reflection on potential consequences of proposed solutions, consistent with responsible innovation frameworks (von Schomberg, 2013).

This stage reflects design thinking practices that balance creativity with responsibility and feasibility (Brown, 2009). Through structured ideation, PBEE supports engagement with future-oriented considerations such as adaptability, ethical reasoning, and imaginative problem-solving, aligning with emerging Future Skills priorities in sustainability-oriented innovation contexts (Caeiro-Rodríguez et al., 2021; Kenny et al., 2021).

3.5 Execution: From concept to practice

The Execution stage reflects core principles of work-integrated and action learning, in which conceptual ideas are explored within authentic professional settings (Ferns et al., 2025; Revans, 1982). At this stage, PBEE structures engagement with prototyping, feasibility exploration, stakeholder feedback, and reflective consideration of implementation pathways.

Workplace constraints, such as organisational culture, regulation, resources, and timeframes shape how execution unfolds, highlighting the situated nature of innovation practice. Reflective activities embedded within this stage align with experiential learning models that emphasise action and reflection as central to professional learning (Kolb, 1984; Volz-Peacock et al., 2016). As such, the Execution stage foregrounds practical judgement, leadership awareness, and collaborative engagement within real-world contexts.

3.5.1 Thematic project vignettes

Analysis of assessed transformational projects and associated reflective submissions across multiple SDI cohorts reveals recurring thematic patterns that illustrate how PBEE operates in practice in work-integrated postgraduate learning. These vignettes are drawn from routine assessment artefacts and practitioner observation and are presented to illustrate the range of organisational contexts, challenge types, and innovation trajectories supported by the framework.

A prominent theme across projects relates to organisational culture as both an enabler and a constraint of innovation, reflecting established links between workplace culture, leadership norms, and innovation capacity (Schein, 2010). PBEE provided a structured means for engaging with ethical

tensions, sustainability trade-offs, and systems-level constraints embedded in everyday organisational practice.

Several projects focused on sustainability and community-oriented innovation, including lifecycle assessment, waste reduction initiatives, and sustainability-aligned financial products. These projects align with approaches to sustainable value creation and business model innovation that integrate economic, environmental, and societal considerations (Osterwalder & Pigneur, 2010). Other vignettes addressed digital and AI-enabled transformation, including process redesign, data transparency, and user journey optimisation, reflecting the growing role of digital technologies in sustainability-oriented innovation (Chiu, 2024; OECD, 2024).

Across thematic areas, reflective submissions consistently engaged with questions of ethical responsibility, long-term societal impact, and the challenges of implementing change in constrained organisational environments. Rather than evidencing learning outcomes, these reflections provide insight into how PBEE structures professional sensemaking and supports engagement with complexity and leadership responsibility. Similar patterns are reported in wider studies of work-integrated and dual master's programmes across Europe (Ferns et al., 2025; Smith & Worsfold, 2014; Urkia-Basterra et al., 2025).

Table 3 provides an overview of the thematic distribution of transformational projects, illustrating the diversity of sectors, innovation challenges, and areas of focus through which PBEE has been enacted in practice.

Table 3. Overview of transformational projects undertaken by learners

Theme	*Sector Examples*	*Type of Challenge*	*Illustrative Project Focus*
Sustainability & Community Innovation	Semi-state, finance, manufacturing	LCA, waste reduction, green lending	Sustainability related KPIs
Market/System Level Innovation	Biomedical, logistics	Prototyping, service innovation	Biomedical device prototype, e-cargo concept
Digital & AI Transformation	Public services, marine environment	User journey redesign, data transparency	User journey redesign, data transparency
Health & Social Impact	Disability services, wellbeing programmes	Accessibility, inclusion	Improved documentation, inclusive programme design
Product/Process Innovation in SMEs	Hair & beauty, medtech	Waste reduction, workflow redesign	Operational process improvements

Source: Author's synthesis of illustrative student project themes drawn from assessed coursework.

3.5.2 Sustainability and community innovation

A number of assessed transformational projects focused on sustainability and community-oriented innovation in organisational contexts. One project situated in a semi-state enterprise used the PBEE framework to explore place-based sustainability opportunities by mapping stakeholder interests, long-term environmental targets, and potential community co-benefits. In the financial sector, a project examined the development of a sustainability-aligned lending concept, considering feasibility, organisational risk appetite, and green finance principles. In a manufacturing context, another project explored waste reduction in production processes, applying lifecycle thinking to identify opportunities for material efficiency. These projects illustrate how PBEE structures engagement with complex sustainability challenges that span environmental, organisational, and societal systems, consistent with systems thinking perspectives (Meadows, 2008; Fry, 2009). The vignettes align with responsible innovation scholarship emphasising anticipation, inclusion, and societal alignment within innovation processes (von Schomberg, 2013; Macnaghten et al., 2014).

3.5.3 Innovation with market- or system-level potential

A subset of assessed transformational projects focused on innovations with potential organisational, market, or system-level relevance. These projects drew on rapid prototyping and creativity tools consistent with design-driven innovation practices (IDEO, 2015). One project situated within the biomedical sector explored the redesign of a medical waste container component, resulting in a functioning prototype and consideration of potential pathways for industry collaboration. Such exploratory prototyping aligns with design-led innovation scholarship that emphasises iteration, experimentation, and cross-sector engagement (Brown, 2009; Kenny et al., 2021). Other projects addressed service and system-level challenges. In the transport and logistics domain, one project developed a sustainability-oriented last-mile delivery concept using e-cargo solutions, applying PBEE to analyse feasibility, stakeholder needs, and environmental implications. In a hospital context, another project examined the transition from paper-based medical device instructions to a digital alternative, engaging with regulatory requirements and operational constraints.

Although these projects remained at early or exploratory stages of development, they illustrate how PBEE structures opportunity identification, problem framing, and the articulation of responsible and sustainable innovation pathways within real-world professional settings. The emphasis on feasibility, stakeholder consideration, and ethical awareness reflects core principles of design thinking and responsible innovation (Kimbell, 2011; von Schomberg, 2013).

3.5.4 Digital and AI transformation in SMEs

A subset of assessed transformational projects focused on digital transformation and service redesign in public and semi-public organisational contexts. One project situated in a national social protection service examined the user journey for jobseekers, identifying barriers to navigating digital pathways and proposing a more integrated and inclusive support model. Such challenges are well documented within digital transformation research, particularly in public service and SME contexts where legacy systems and accessibility issues persist (European Commission, 2025; OECD, 2024).

Another project applied the PBEE framework to explore how open data tools could enhance transparency and stakeholder engagement in marine environmental protection within a government department. Across these examples, the projects illustrate how PBEE structures engagement with stakeholder mapping, empathy-based inquiry, and feasibility analysis to identify opportunities for digital or service redesign. The focus on accessibility, transparency, and ethical service delivery reflects broader principles of digital inclusion and stakeholder-centred design (Chiu, 2024; Interreg Europe, 2024).

3.5.5 Health, wellbeing and social impact projects

A number of assessed transformational projects addressed social impact challenges in community organisations, health settings, and support services. One project situated within a disability employability service examined organisational sustainability documentation and client-facing materials, proposing a more accessible and ethically aligned digital resource. Another project focused on the enhancement of a wellbeing programme, using the PBEE framework to balance user needs, organisational constraints, and long-term inclusivity considerations.

These projects illustrate how PBEE structures engagement with empathy-based inquiry, reflexive sensemaking, and ethical judgement in socially responsive innovation contexts. This emphasis aligns with scholarship on reflexive practice and ethical leadership (Cunliffe, 2003, 2020) and with research highlighting the role of psychological safety and learning-oriented leadership in enabling inclusive and responsible organisational change (Edmondson, 2014, 2018). Collectively, the vignettes demonstrate how PBEE functions as a pedagogical scaffold for translating ethical and responsible leadership principles into practical interventions within social and community-facing services.

3.5.6 Process innovation and leadership in workplaces

A number of assessed transformational projects undertaken in SME contexts focused on product development, process innovation, and operational efficiency. One project situated in the hair and beauty sector explored the development of a new product concept aimed at reducing industry waste and improving health and safety practices. Another project, located within a medical context, applied the PBEE framework to the early-stage development of a multi-purpose support device, examining patient needs, innovation feasibility, and potential pathways for prototyping and stakeholder engagement.

Other projects addressed internal organisational processes, identifying opportunities for workflow redesign or more sustainable resource use. Collectively, these vignettes illustrate how PBEE structures strategic problem framing and iterative exploration within smaller organisational settings where resources and capacity may be constrained. This emphasis on action-oriented inquiry and reflective problem-solving aligns with action learning scholarship highlighting the role of real workplace challenges in supporting leadership judgement and practical decision-making (Revans, 1982; Volz-Peacock et al., 2016).

3.5.7 Learner reflections and competence alignment

Across thematic areas, reflective submissions provide insight into how learners engaged with complex organisational challenges, ethical considerations, and systems-level thinking through the PBEE framework. These reflections are used illustratively to examine how structured innovation processes support professional sensemaking in work-integrated postgraduate learning, rather than as evidence of measured competence development.

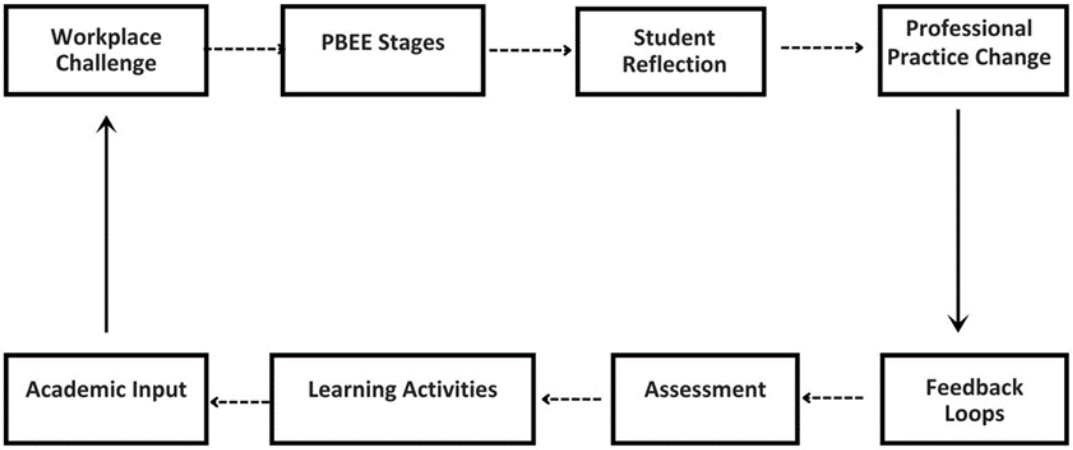

*Figure 3. Integration of the PBEE framework within a work-integrated dual higher education learning cycle**

Recurring reflective themes include renewed attention to systems thinking, ethical awareness, stakeholder engagement, and sustainability-oriented problem framing. Several reflections describe

* This conceptual cycle illustrates how learner-selected workplace challenges are explored through the PBEE stages, supported by academic input, structured learning activities, assessment, and iterative feedback loops. The model highlights how PBEE is embedded within a work-integrated learning architecture that enables learners to reflect on their professional context and engage with responsible, sustainability-oriented innovation within workplace settings.

shifts towards more holistic consideration of organisational challenges, reconnecting strategic intent with everyday professional decision-making. Others emphasise reflexive questioning of assumptions, empathic consideration of multiple perspectives, and heightened awareness of ethical risks in supply chains and sustainability transitions. These themes resonate with scholarship on reflexive practice and systems thinking in professional education (Cunliffe, 2003; Meadows, 2008).

Rather than indicating learning outcomes, the reflections illustrate alignment between PBEE-enabled reflective activity and competence areas commonly associated with work-integrated and dual higher education, including ethical reasoning, adaptability, strategic awareness, and future-oriented transversal competences (Ferns et al., 2025; Sá & Serpa, 2022). Across submissions, PBEE is described as a useful scaffold for integrating sustainability considerations into professional practice and supporting reflective engagement with leadership challenges in complex organisational environments. Table 4 presents selected student micro-reflections mapped to dual higher education competence areas, illustrating alignment with PBEE-supported reflective practice.

Table 4. Examples of student micro-reflections mapped to dual higher education competences[*]

Reflection Insight	*Competence Category*
"I regained a holistic perspective I'd lost in my managerial role"	Systems thinking / strategic awareness
"PBEE forced me to revisit assumptions and deepen my empathy"	Ethical reasoning / empathy
"I see supply chains differently now - including modern slavery risks"	Ethical awareness / critical reflection
"The structure gave me confidence to plan sustainable projects"	Agency / problem-solving

3.6 PBEE's contribution to dual higher education

The integration of PBEE into the SDI module aligns closely with the aims of dual higher education by structuring connections between academic concepts and real-world professional practice. Through learner-selected workplace projects, PBEE provides a coherent process for exploring complex organisational issues, framing sustainability-oriented opportunities, generating responsible solutions, and reflecting on implementation.

PBEE's emphasis on systems analysis, stakeholder awareness, and iterative reflection foregrounds competence areas widely associated with dual higher education, including ethical reasoning, adaptability, collaborative engagement, and professional judgement (Alt et al., 2023; Caeiro-Rodríguez et al., 2021; Meadows, 2008; Mitchell et al., 1997). This positioning aligns PBEE with contemporary DHE competence frameworks rather than presenting it as a mechanism for measuring learning outcomes. Taken together, the project vignettes illustrate how the SDI module operationalises the aims of dual higher education through a structured, design-led learning architecture. Within this context, PBEE functions as a pedagogical scaffold that supports integration of academic learning with meaningful professional engagement, consistent with responsible innovation principles emphasising anticipation, inclusion, and societal alignment (Macnaghten et al., 2014; OECD, 2024; von Schomberg, 2013).

3.7 PBEE as a model for societally relevant higher education

Building on the preceding analysis, this section offers a conceptual synthesis of PBEE's alignment with societally relevant higher education agendas rather than introducing additional empirical findings. The PBEE scaffold aligns closely with the aims of societally relevant higher education by structuring learner engagement with real-world challenges that have environmental, social, or ethical significance. Contemporary higher education is increasingly called upon to

* Note. Reflections are presented as anonymised illustrative examples drawn from assessed reflective coursework and are not intended as evaluative evidence of learning outcomes.

foreground sustainability, responsibility, and societal contribution in professional learning (OECD, 2024; European Commission, 2018). By requiring learners to examine context, stakeholders, systems, and potential long-term consequences, PBEE encourages forms of inquiry that extend beyond organisational boundaries and foreground societal considerations.

This positioning reflects the principles of responsible innovation, which emphasise anticipation, reflection, inclusion, and responsiveness in addressing complex societal challenges (von Schomberg, 2013; Macnaghten et al., 2014). Within the SDI module, PBEE provides a structured lens through which sustainability, accessibility, public service improvement, supply chain responsibility, and digital inclusion can be examined as interconnected design challenges situated in professional practice.

Table 5 positions PBEE in relation to core domains of societally relevant higher education, illustrating how its staged structure aligns with established scholarly and policy frameworks. Across these domains, PBEE foregrounds values clarification, systems awareness, reflexive iteration, and workplace alignment as integral components of learning design rather than as discrete outcomes to be measured.

Table 5. Positioning PBEE against societally relevant higher education goals

Societal Relevance Domain	*PBEE Contribution*	*Supporting Literature*
Sustainability & Ethics	Context analysis, RRI-guided ideation, long-term impact reflection	von Schomberg (2013); Macnaghten et al. (2014)
Agency & Responsibility	Values clarification, stakeholder engagement	Cunliffe (2003); Alt et al. (2023)
Systems Thinking	Blueprint systems mapping, materiality analysis	Meadows (2008)
Reflexivity & adaptability	Iterative reflection across all stages	Edmondson (2014)
Work-integrated professional competence	Practical implementation, workplace alignment	Ferns et al. (2025); Smith & Worsfold (2014)

Source: Author's conceptual synthesis, informed by the cited literature.

In this sense, PBEE functions as a pedagogical anchor that supports engagement with agency, responsibility, and ethical sensitivity in complex professional and societal contexts. This aligns with scholarship on reflexive and values-led leadership, which emphasises the importance of critically examining assumptions, power relations, and ethical implications in practice (Cunliffe, 2003). The framework's structured and iterative design supports holistic problem framing and consideration of wider impacts, consistent with contemporary accounts of Future Skills associated with sustainability transitions and digital transformation (Caeiro-Rodríguez et al., 2021; Alt et al., 2023).

By embedding PBEE in work-integrated learning, the SDI module illustrates how design-led, reflective, and responsibility-oriented pedagogies can align higher education with societal needs while maintaining professional relevance. In this context, PBEE contributes a transferable pedagogical model for higher education programmes seeking to integrate sustainability, ethics, and systems thinking within authentic professional learning environments (Ferns et al., 2025; Smith & Worsfold, 2014).

4 Conclusions

4.1 Summary of contributions

This paper has examined how the PBEE scaffold, when embedded in a work-integrated postgraduate module, aligns with the aims of dual higher education by structuring connections between academic concepts and real-world organisational challenges. Adopting a conceptual and practice-based orientation, the analysis has focused on pedagogical design, learning architecture,

and the role of PBEE as a design-led scaffold supporting professional sensemaking in authentic workplace contexts.

The paper illustrates how PBEE provides a structured pathway for engaging with complexity through staged attention to context, systems, stakeholder perspectives, and reflective iteration. Across the SDI module, the framework functions as a transparent learning architecture that supports inquiry into sustainability-oriented challenges, responsible innovation, and implementation considerations without reducing learning to predefined outcomes. In this respect, PBEE aligns with competence areas commonly associated with Future Skills and societally relevant higher education, including systems awareness, ethical sensitivity, reflexivity, and collaborative engagement.

This contribution is situated within wider European and international policy agendas that emphasise sustainability, digital capability, and transversal competences as central to future-oriented professional education. Frameworks such as the EU Green Deal, Pact for Skills, Digital Decade 2030, EntreComp, GreenComp, DigComp, and the OECD Skills for 2030 agenda consistently highlight the need for learning approaches that integrate ethical reasoning, adaptability, systems thinking, and applied problem-solving. By foregrounding these dimensions within a work-integrated learning structure, PBEE offers a pedagogical model that is conceptually aligned with these priorities.

For educators and programme designers, the analysis suggests that structured innovation frameworks such as PBEE can complement existing dual higher education models by offering a coherent, iterative scaffold that links conceptual learning with professional practice. More broadly, the paper positions PBEE as a transferable pedagogical approach for higher education programmes seeking to integrate sustainability, ethics, and systems thinking within authentic, practice-based learning environments.

4.2 Limitations and recommendations for future research

This study is limited to a single postgraduate module and adopts a conceptual, practice-based orientation that draws on practitioner-generated educational artefacts rather than empirical measurement. As such, the analysis does not seek to produce generalisable findings. Future research could explore the application of PBEE or comparable structured innovation frameworks across additional dual higher education contexts, examine learner engagement and competence alignment through mixed-methods approaches, or conduct comparative studies across institutions, sectors, and national settings.

Notwithstanding these limitations, the analysis contributes to growing scholarship on work-integrated and societally relevant higher education by illustrating how design-led pedagogical scaffolds can structure connections between academic learning and professional practice. In doing so, it highlights the potential of structured, reflective, and responsibility-oriented learning architectures to support the broader educational mission of dual higher education in contexts characterised by complexity, sustainability challenges, and rapid change.

Ethical declaration

This article presents a conceptual and practice-based analysis of curriculum and pedagogical design in a postgraduate module. No human-subjects research was conducted. Illustrative examples drawn from routine teaching and assessment activities, including anonymised and non-identifiable student reflections, are used solely to support pedagogical discussion. These materials were generated as part of standard educational practice and are not treated as research data. Accordingly, formal institutional ethics approval was not required.

References

Alt, D., Naamati-Schneider, L., & Weishut, D. J. N. (2023). Competency-based learning and formative assessment as precursors of soft skills acquisition. *Studies in Higher Education, 48*(12), 1901–1917. https://doi.org/10.1080/03075079.2023.2217203

Alvesson, M., & Sköldberg, K. (2009). *Reflexive methodology: New vistas for qualitative research* (2nd ed.). Sage.
Blok, V., & Lemmens, P. (2015). The emerging concept of responsible innovation: Three reasons why it is questionable and calls for a radical transformation of the concept of innovation. In B. J. Koops et al. (Eds.), *Responsible innovation 2* (pp. 19–35). Springer.
Bocken, N. M. P., Short, S. W., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production, 65*, 42–56. https://doi.org/10.1016/j.jclepro.2013.11.039
Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa
Brown, T. (2009). *Change by design: How design thinking creates new alternatives for business and society*. Harper Business.
Bunderson, J. S., & Boumgarden, P. (2010). Structure and learning in self-managed teams: Why "bureaucratic" teams can be better learners. *Organization Science, 21*(3), 609–624. https://doi.org/10.1287/orsc.1090.0486
Caeiro-Rodríguez, M., Manso-Vázquez, M., Mikic-Fonte, F. A., & Llamas-Nistal, M. (2021). Teaching soft skills in engineering education: A European perspective. *IEEE Access, 9*, 29222–29242. https://doi.org/10.1109/ACCESS.2021.3059516
Carmeli, A. (2007). Social capital, psychological safety and learning behaviours from failure in organisations. *Long Range Planning, 40*(1), 30–44. https://doi.org/10.1016/j.lrp.2006.12.002
Carmeli, A., & Gittell, J. H. (2009). High-quality relationships, psychological safety, and learning from failures in work organizations. *Journal of Organizational Behavior, 30*(6), 709–729. https://doi.org/10.1002/job.565
Central Statistics Office. (2024). *Business in Ireland 2021: Small and medium enterprises*. https://www.cso.ie/en/releasesandpublications/ep/p-biidr/businessinireland2021detailedresults/smallandmediumenterprises/
Chiu, T. K. F. (2024). Future research recommendations for transforming higher education with generative AI. *Computers and Education: Artificial Intelligence, 6*, 100197. https://doi.org/10.1016/j.caeai.2023.100197
Cunliffe, A. L. (2003). Reflexive inquiry in organizational research: Questions and possibilities. *Human Relations, 56*(8), 983–1003. https://doi.org/10.1177/00187267030568004
Cunliffe, A. L. (2016). On becoming a critically reflexive practitioner. *Journal of Management Education, 40*(6), 747–768. https://doi.org/10.1177/1052562916674465
Cunliffe, A. L. (2020). Reflexive practice: Theoretical perspectives, practical implications. *Human Relations, 73*(8), 1082–1108.
Doherty, O., & Stephens, S. (2023). Hard and soft skill needs: Higher education and the FinTech sector. *Journal of Education and Work, 36*(3), 186–201. https://doi.org/10.1080/13639080.2023.2174954
Dorst, K. (2011). The core of 'design thinking' and its application. *Design Studies, 32*(6), 521–532. https://doi.org/10.1016/j.destud.2011.07.006
Edmondson, A. C. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly, 44*(2), 350–383. https://doi.org/10.2307/2666999
Edmondson, A. C. (2004). Psychological safety, trust, and learning in organizations: A group-level lens. In R. M. Kramer & K. S. Cook (Eds.), *Trust and distrust in organizations* (pp. 239–272). Russell Sage Foundation.
Edmondson, A. C. (2018). *The fearless organization: Creating psychological safety in the workplace for learning, innovation, and growth*. Wiley.
Edmondson, A. C., & Lei, Z. (2014). Psychological safety: The history, renaissance, and future of an interpersonal construct. *Annual Review of Organizational Psychology and Organizational Behavior, 1*, 23–43. https://doi.org/10.1146/annurev-orgpsych-031413-091305
European Commission. (2018). *EntreComp: The entrepreneurship competence framework*. Publications Office of the European Union.
European Commission. (2023). *Digital Economy and Society Index (DESI)*. Publications Office of the European Union.
European Commission. (2025). *State of the Digital Decade 2025 package*. https://digital-strategy.ec.europa.eu/en/policies/2025-state-digital-decade-package
Ferns, S. J., Zegwaard, K. E., Pretti, T. J., & Rowe, A. D. (2025). Defining and designing work-integrated learning curriculum. *Higher Education Research & Development*. Advance online publication. https://doi.org/10.1080/07294360.2024.2444748
Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Pitman.
Fry, T. (2009). *Design futuring: Sustainability, ethics, and new practice*. Berg.
Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The circular economy – A new sustainability paradigm? *Journal of Cleaner Production, 143*, 757–768. https://doi.org/10.1016/j.jclepro.2016.12.048
Gentile, M. C. (2012). Values-driven leadership development: Where we have been and where we could go. *Organization Management Journal, 9*(3), 191–205. https://scholarship.shu.edu/omj/vol9/iss3/7
Guba, E. G., & Lincoln, Y. S. (1989). *Fourth generation evaluation*. Sage.
IDEO.org. (2015). *The field guide to human-centered design*.
Interreg Europe. (2024). *Digital inclusion and regional innovation: Insights from Interreg projects*. Interreg Europe.
Kenny, T., et al. (2021). Empathising, defining and ideating with the farming community to develop a geotagged photo app for smart devices: A design thinking approach. *Journal of Responsible Innovation, 8*(1), 1–19.
Kimbell, L. (2011). Rethinking design thinking: Part I. *Design and Culture, 3*(3), 285–306. https://doi.org/10.2752/175470811X13071166525216
Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall.
Macnaghten, P., Davies, S. R., & Kearnes, M. (2014). Responsible innovation across borders: Tensions, paradoxes and possibilities. *Journal of Responsible Innovation, 1*(2), 191–199. https://doi.org/10.1080/23299460.2014.922249

Marquardt, M. (2014). *Optimizing the power of action learning*. Nicholas Brealey.
Meadows, D. H. (2008). *Thinking in systems: A primer* (D. Wright, Ed.). Chelsea Green Publishing.
Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a theory of stakeholder identification and salience. *Academy of Management Review, 22*(4), 853–886. https://doi.org/10.2307/259247
OECD. (2024). *Regions in transition: Skills, resilience and inequalities*. OECD Publishing.
Osterwalder, A., & Pigneur, Y. (2010). *Business model generation*. Wiley.
Owen, R., von Schomberg, R., & Macnaghten, P. (2021). An unfinished journey? Reflections on a decade of responsible research and innovation. *Journal of Responsible Innovation, 8*(2), 217–233. https://doi.org/10.1080/23299460.2021.1948789
Prada, E. D., Mareque, M., & Pino-Juste, M. (2022). Teamwork skills in higher education. *Psicologia: Reflexão e Crítica, 35*, Article 5. https://doi.org/10.1186/s41155-022-00207-1
Revans, R. (1982). *The origins and growth of action learning*. Chartwell-Bratt.
Sá, M. J., & Serpa, S. (2022). *Higher education as a promoter of soft skills in a sustainable Society 5.0*. *Journal of Curriculum and Teaching, 11*(4), 1–13. https://doi.org/10.5430/jct.v11n4p1
Sági, N., & Fülöp, T. (2024). *Dual higher education in Hungary*. *European Journal of Dual Higher Education (Online)*, *1*(1), 11–19. https://doi.org/10.25162/EJDHE-2024-0001
Schein, E. H. (2010). *Organizational culture and leadership* (4th ed.). Jossey-Bass.
Smith, C., & Worsfold, K. (2014). WIL curriculum design and student learning: a structural model of their effects on student satisfaction. *Studies in Higher Education*, *39*(6), 1070–1084. https://doi.org/10.1080/03075079.2013.777407
Tucker, A. L., Nembhard, I. M., & Edmondson, A. C. (2007). Implementing new practices. *Management Science, 53*(6), 894–907. https://doi.org/10.1287/mnsc.1060.0692
Urkia-Basterra, I., Imaz Agirre, A., & Álvarez-Huerta, P. (2025). The influence of dual higher education programmes on soft skills development. *European Scientific Journal for Dual Higher Education, 1*(1), 1–12.
van Oudheusden, M. (2014). Where are the politics in responsible innovation? *Journal of Responsible Innovation, 1*(1), 67–86. https://doi.org/10.1080/23299460.2014.882097
Volz-Peacock, M., Carson, B., & Marquardt, M. (2016). Action learning and leadership development. *Advances in Developing Human Resources, 18*(3), 318–333. https://doi.org/10.1177/1523422316645884
von Schomberg, R. (2013). A vision of responsible research and innovation. In R. Owen, J. Bessant, & M. Heintz (Eds.), *Responsible innovation* (pp. 51–74). Wiley.
World Economic Forum. (2025). *The future of jobs report 2025*. https://www.weforum.org/publications/the-future-of-jobs-report-2025