

DESIGNING REFLECTION: LEARNING ABOUT SUSTAINABILITY IN SMALL CRAFT-BASED DESIGN FIRMS

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ABSTRACT

Small craft-based design firms must address sustainability as a condition for long-term viability, yet training often remains expert-led, prioritising factual knowledge over reflective and organisational learning. This gap is critical in small firms, where tacit knowledge, cross-functional dynamics, and hierarchies shape how sustainability is understood and applied. This study examines how a design-based training programme can foster inclusive organisational learning by activating higher-order and metacognitive processes across roles. Grounded in Anderson and Krathwohl's Taxonomy, it adopts an interventionist single-case study in a small Italian fashion firm. A three-day immersive, screen-free programme used narrative, visual artefacts, and collaborative reflection to support progression toward evaluative and strategic thinking. Qualitative data from observations, external notes, and questionnaires show participants developed analytical, evaluative, and shared strategic intentions. Visual reflection helped surface tacit knowledge and co-create meaning, positioning design-based pedagogy as a driver of collective learning and organisational sense-making and offering a transferable model for engineering and design education, where sustainability learning can move beyond knowledge transmission toward evaluative and metacognitive competences.

Keywords: Design-based capacity building, sustainability competences, industry-academia collaboration, experiential learning, metacognitive reflection

1 INTRODUCTION

Small craft-based design firms are increasingly confronted with sustainability transition as a structural condition of their long-term viability. In these contexts where tacit knowledge and situated expertise are central, transmissive models of training and capacity building risk widening the gap in sustainability learning and everyday practices. If sustainability requires shifts in shared assumptions and interpretative frames, training must foster collective reflection and evaluative agency across roles. Assessment, in this sense, can be reframed as a learner-led reflective practice that surfaces tacit knowledge and supports organisational sense-making. Building on Anderson and Krathwohl's Taxonomy for Learning, Teaching, and Assessing, this study examines how training programmes can activate higher-order and metacognitive processes within a small Italian fashion firm. Through an interventionist single-case study, it explores whether immersive, screen-free, visually mediated reflection can enable cross-functional participants to analyse past actions, evaluate strategic alternatives, and articulate shared sustainability intentions. By designing reflection as a collective practice, the paper contributes to inclusive organisational learning in small craft enterprises.

2 BACKGROUND THEORY

2.1 Inclusive organisational learning for sustainability in small design firms

Design firms face rising environmental, regulatory, economic, and socio-cultural pressures; sustainability is now a structural condition for long-term viability. Yet adoption is often hindered by cognitive and organisational dissonance, creating gaps between commitments and practice [1]. This transition requires shifts in values, assumptions, and interpretative frames that guide decisions and everyday practices; it implies a paradigmatic change to build a sustainability culture in which members

balance economic efficiency, social equity, and environmental responsibility [2]. Sustainability thus lies in shared meanings, not isolated initiatives.

Developing this culture depends on intentional learning processes [3] that go beyond technical knowledge and promote collective critical reflection at the organisational level [4].

Indeed, organisational transformation entails shifts in shared understanding, collective assumptions, and patterns of thinking, which has been described as the “invisible glue” of institutions [5]. Thus, organisational change depends on organisational learning: the acquisition of competence in response to internal or external stimuli, producing lasting changes in collective behaviour and improved effectiveness [6]. This perspective emphasises that learning may involve not only incremental adjustments but also deeper reconsiderations of underlying assumptions [7], [8]. The relevance of organisational learning is particularly pronounced in small- and medium-sized enterprises (SMEs). While SMEs are often key contributors to national economic development [9], they face structural constraints in leveraging internal knowledge and capabilities [10]. These firms rely heavily on the learning capacities of owner-managers and teams. At the same time, they operate in turbulent environments that demand adaptability [11]. The development of effective organisational learning capabilities has therefore been identified as a decisive factor in SMEs' success. In parallel, several authors have highlighted that staff engagement and education are central to developing a sustainability culture [2], [12]. Research within a large multinational company shows that sustainability learning should not be restricted to leaders and senior managers but should be cross-functional and embedded across business functions [13]. To strengthen both knowledge and learners' commitment, it should include technical content and active learning methods [13]. When considering tiny organisations, these principles remain critical, since power dynamics and hierarchies are equally present; inclusion cannot be assumed but must be intentionally designed.

2.2 Limits of traditional *ex-cathedra* training models

Despite the transformative nature of the sustainability transition, training formats in small manufacturing contexts often remain conventional. *Ex-cathedra* models based on presentations, slides, and standardised tests are widely adopted and are oriented toward the transmission and verification of factual knowledge. Such an approach is incoherent with the contemporary constructivist conception of learning [14], and the widely adopted competence-based education, which entails an active, social, and situated process of personal meaning-creation through which learners move beyond the reception of information to develop the holistic competences to address complex, real-world challenges effectively. Within this contemporary framing, the present study focuses exclusively on the knowledge dimension of competence, which can be analytically understood with the support of the *Taxonomy for Learning, Teaching, and Assessing* proposed by Anderson and Krathwohl [3] (Fig. 1). It is a two-dimensional framework that organises learning goals by intersecting: the **cognitive processes dimension**, which contains six increasingly complex cognitive processes: remember, understand, apply, analyse, evaluate, and create; the **knowledge dimension**, which contains a continuum from concrete to abstract of four categories: factual, conceptual, procedural, and metacognitive. The taxonomy provides a detailed framework for intended learning outcomes at the intersection of a specific type of knowledge and the cognitive process required to master it, offering a precise definition that ensures alignment among teaching, learning, and assessment [3]. Traditional *ex-cathedra* approaches primarily activate lower-order cognitive processes (i.e., remembering and understanding) and convey factual or conceptual knowledge. Sustainability competence requires the activation of higher-order processes, including analysing, evaluating, and creating, as well as engagement with the metacognitive knowledge dimension: employees must become acquainted with critically evaluating organisational practices, assessing trade-offs, and envisioning alternative modes of action.

Earlier design-based innovation training, such as the diffusion of design thinking in the 2000s, often showed a knowledge-worker bias, focusing on them (i.e., white-collar) staff and excluding manual or skilled trades workers (i.e., blue-collar) from strategic processes [15]. If sustainability transformation concerns the entire organisation, higher-order thinking must be distributed across roles, requiring inclusive pedagogical models. Reflection is a central mechanism: in SMEs, practitioners can question assumptions in action and reinterpret experience retrospectively. Structured reflection externalises tacit knowledge and transforms it into shared organisational resources, helping to bridge professional cultures. *How can learning experiences be designed to foster shared reflection on sustainability transition across diverse organisational roles within small design firms?* To address this question, a

training intervention was implemented within the *Ecodeck* project (www.ecodeck.polimi.it) in a small Italian fashion company, drawing on Anderson and Krathwohl's Taxonomy to examine the activation of distributed reflective practices.

These insights are relevant to engineering and design education: while Anderson and Krathwohl's taxonomy is already applied to undergraduate (UG) and postgraduate taught (PGT) learning outcomes, sustainability teaching often remains limited to lower-order processes and specialist cohorts, reflecting a knowledge-worker bias. The immersive, design-based approach offers a transferable model for higher education that integrates reflection, narrative, and cross-functional dialogue. It encourages alignment between learning outcomes and pedagogy, and the inclusion of reflective, learner-led assessment alongside standard evaluation.



Figure 1. Revised Bloom's Taxonomy adapted from Heer, R. (2012) Iowa State University Center for Excellence in Learning and Teaching. Licensed under CC BY-NC-SA 3.0.

3 METHOD: INTERVENTIONIST SINGLE CASE STUDY

This research uses an interventionist single-case study, where the researcher acts as a change agent, supporting organisational transformation while observing it [16]. This approach suits real-life contexts, such as activating reflective practices in a small Italian fashion firm, where pedagogy and organisational sense-making intersect. Given the complexity of linking professional cultures for sustainability, a single case offers a holistic view without fragmenting data. Using a training programme as the case, the study frames reflection within action-based research, drawing on Anderson and Krathwohl's taxonomy to generate grounded insights. This enables analysis of how tacit knowledge becomes shared organisational resources in a small firm. Data were collected during testing in fall 2025 with a company of about 20 employees and five participants. Methods included observations by facilitators and external observers, plus daily open questionnaires on sustainability meanings and actions. Results are based on qualitative interpretation of these sources. Data analysis followed a deductive thematic approach: notes and questionnaires were coded against nine Intended Learning Outcomes (ILOs) from the taxonomy, linking reflections to cognitive processes and knowledge dimensions. Two researchers coded a subset independently and resolved differences through discussion. A key limitation is potential bias, as researchers were also designers and facilitators; external observers provided a partial check on these interpretations.

4 CASE STUDY: TRAINING PROGRAMME IMPLEMENTATION

4.1 Setting the learning goals: the intended learning outcomes

The training activities were designed to be delivered across three training days. In terms of the Intended Learning Outcomes (ILOs) related to knowledge about sustainability, the activities were developed using a progressive logic within the Anderson and Krathwohl taxonomy (Tab. 1).

Table 1. Outline of the ILOs analysed through Anderson and Krathwohl's Taxonomy

Training Day		Intended Learning Outcomes (ILOs) Analysis			
ID	Title	ID	Extended ILOs	Cognitive Process Dim.	Knowledge Dim.
1	Understanding individual sustainability competences and values	1.1	Classify sustainability actions, competences, and values according to the provided frameworks.	Understand	Conceptual
		1.2	Predict how personal sustainability competences influence the impact of individual actions in organisations.	Understand	Metacognitive
		1.3	Examine one's own sustainability values in relation to actions undertaken to face everyday sustainability challenges.	Analyse	Metacognitive
2	Analysing values and organisational actions	2.1	Distinguish past organisational actions for sustainability.	Analyse	Factual/ Conceptual
		2.2	Break down past sustainability actions by analysing when, why, what changed, and resulting impacts.	Analyse	Procedural/ Metacognitive
		2.3	Reflect on the evolution of sustainability actions, the cognition of sustainability challenges, and the values that these actions entail.	Evaluate	Metacognitive
3	Evaluating and prioritising strategies for transition	3.1	Classify alternative organisational strategies to address sustainability challenges.	Understand	Procedural/ Conceptual
		3.2	Select the most promising sustainability strategies to be implemented in one's own organisation.	Evaluate	Procedural/ Conceptual
		3.3	Reflect on the organisation's sustainability intention to inform the organisation's transition.	Evaluate	Metacognitive

4.2 Designing the learning experience: an immersive and screen-free approach

The training programme adopted an immersive, screen-free approach to foster engagement throughout the learning journey. Rather than relying on traditional ex-cathedra formats, participants were positioned as active protagonists within a narrative experience. At the core was a speculative storytelling framework inviting them to imagine entering an alternative world where sustainability operates under different rules. In contrast to their “world of origin,” where sustainability is perceived as a cost or constraint, this world framed it as an accelerator of innovation and a strategic lever. To deepen immersion, each day included carefully designed check-in and check-out rituals. Participants crossed a symbolic door, received a personalised “pass”, and engaged in short reflection activities. The physical environment supported this, reinforcing continuity between sessions. The programme privileged hands-on, low-tech interaction. Paper-based tools, value cards, templates, markers, and co-creation canvases stimulated discussion and collective sense-making. The deliberate absence of screens encouraged active participation and creativity, strengthening the collaborative and embodied nature of the learning process.

4.3 Detailing the instructional design: The learning activities and contents

4.3.1 DAY 1: Understanding sustainability values and systems

Day 1 included two main activities centred on individual sustainability competences and actions. The first activity aimed to raise awareness of the environmental, social, and economic dimensions of sustainability. Through a narrative simulation based on real organisational dilemmas, participants engaged with an AI-generated scenario, selected relevant competencies from a shared framework, and collaboratively identified potential sustainability actions informed by each competence. Iterative rounds of listening, reflection, and mapping fostered understanding of how competencies shape individuals' actions within an organisational context. The second activity focused on making participants' sustainability values explicit and prioritised. Using canvas and card-based tools, they mapped actions onto sustainability value areas, reflected on their behaviours, and built a shared value constellation. This process highlighted convergences, divergences, and tensions across environmental, social, and economic dimensions. At the end of the day, participants received an investigation kit (i.e., instructions, canvases to be filled) and were invited to collect evidence of sustainable change in their company for the next session.

4.3.2 DAY 2 – Analysing values and organisational actions

Day 2 included two collaborative activities focused on sustainability actions, competences, and values at the organisational level. In the first activity, participants mapped and critically examined their company's past sustainability-related actions, starting from real change stories. Actions were formalised and organised across temporal, environmental, and social dimensions, allowing the group to visualise patterns, gaps, and systemic effects. Working in pairs and plenary, they developed a shared analytical representation of the organisation's sustainability trajectory and reflected on its complexity. The second activity built on this mapping to examine the sustainability values underpinning organisational behaviours. Using a predefined set of value cards, participants associated values with the mapped actions and constructed a visual value constellation, making alignments and inconsistencies explicit. A closing reflection reconnected values, competences, and actions, and introduced an observation kit for investigating external organisations' sustainability actions before the next session.

4.3.3 DAY 3 – Evaluating and prioritising strategies for transition

Day 3 included two activities focused on sustainability strategies and the organisation's future positioning. Participants shifted focus beyond their own company to explore sustainability transformations in other organisations. They presented cases analysed with the kit through immersive role-play, enabling comparison of change trajectories. Participants then linked them to sustainable development clusters and examined strategies using furniture and fashion case sheets. The activity concluded with a facilitated discussion in which participants identified the priority strategies most relevant to their future development. The second activity used a forward-looking synthesis process to consolidate learning and define a shared strategic commitment. Introduced through the narrative metaphor of the "Sextant," participants revisited the organisation's past and present actions, values, and insights. They then adopted a future-oriented perspective, identifying sustainability challenges and selecting strategic directions aligned with the earlier clusters. The session culminated in the co-creation of a manifesto-style commitment statement and the selection of a limited set of guiding values.

4.4 Discussing the results: The assessment

Across the training, researchers observed that participants consistently engaged in reflective and analytical discussions, demonstrating progression toward the intended learning outcomes (ILOs). During the early sessions, participants demonstrated a solid conceptual understanding of sustainability competences, values, and actions, correctly classifying elements within the provided frameworks and even suggesting actions beyond the initial dilemmas (ILO 1.1). They predicted how their personal sustainability competences could influence the impact of individual actions in the organisation (ILO 1.2) and reflected on their own sustainability values in relation to everyday work practices (ILO 1.3). Researchers noted moments of metacognitive awareness, for example, when participants expressed surprise at recognising non-obvious values such as "Democracy, nonviolence, and peace," signalling a shift from recognition to reflection on prior assumptions. During mapping exercises, participants distinguished and deconstructed past organisational sustainability actions (ILO 2.1), analysing when, why, and what changes occurred, as well as the relationships that enabled them (ILO 2.2). They began connecting values to concrete actions: for example, interpreting "reduction of working hours" as socially driven and "water-based adhesives" as environmentally driven, demonstrating early evaluative sense-making (ILO 2.3). Reflections occasionally extended beyond the workplace, indicating the emergence of metacognitive internalisation. In later sessions, participants actively engaged with external cases and classified alternative organisational strategies (ILO 3.1). They discussed how these strategies were relevant or transferable to their own context, weighing options, and prioritising potential directions (ILO 3.2). In the final synthesis activity, in which participants collectively formulated a strategic commitment and translated it into a visual narrative, researchers observed negotiation, the articulation of assumptions, and shared reflection on future sustainability intentions, confirming achievement of ILO 3.3. Participants remained motivated and curious, demonstrating commitment to applying learning beyond the training. Overall, observations across all days suggest that participants progressed from conceptual recognition of sustainability competences and actions to reflective evaluation and strategic planning, fulfilling the training's ILOs across conceptual, procedural, and metacognitive dimensions.

5 CONCLUSIONS

This exploratory study shows how sustainability training in SMEs can be designed to activate higher-order and metacognitive processes across roles. Grounded in sustainability culture and organisational learning, and structured through Anderson and Krathwohl's taxonomy, the intervention demonstrates how visually mediated reflection can support a shift from conceptual understanding to shared evaluative agency. Learner-led reflection was key in surfacing tacit knowledge and enabling collective sense-making. The findings also inform engineering and design education. The taxonomy-based, reflective approach offers a transferable model for UG and PGT sustainability modules, supporting the development of evaluative and metacognitive competences beyond knowledge transmission. However, the study involved a single small firm and a limited group, restricting generalisability and capturing only short-term effects. While learning outcomes were achieved, longer-term behavioural and organisational change remains uncertain. Future research should adopt longitudinal approaches across diverse SMEs to assess sustained impact.

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