

Title

From Semi-Structured to Wicked Problems: A Construct–Deconstruct–Reconstruct Framework for Sustainability Education

Research Overview

This conceptual paper proposes a Construct–Deconstruct–Reconstruct framework for sustainability education. Based on curriculum analysis of Green Restaurant (semi-structured problems) and Fair Trade (ill-structured problems), it argues that problem structure—not content alone—shapes sustainability learning trajectories from cognitive scaffolding toward systems thinking, adaptive reasoning, and resilience as an emergent capacity.

Purpose of Study

Sustainability education encompasses a wide spectrum of problem structures, ranging from semi-structured issues with partial clarity to ill-structured or “wicked” problems characterized by ambiguity, uncertainty, and conflicting values. However, much of sustainability teaching implicitly assumes that content classification (e.g., SDGs) is sufficient to organize learning, without sufficiently addressing how problem structure itself shapes cognitive development.

This study is grounded in curriculum design experiences from two sustainability education units in Taiwan: Green Restaurant education and Fair Trade education. In Green Restaurant education, students engaged with semi-structured sustainability issues supported by established practices and institutional guidelines, providing relatively stable entry points for conceptual learning. In contrast, Fair Trade education involved ill-structured, globally interconnected sustainability problems that lack clear solution pathways and expose the limitations of static classification systems.

The study therefore examines how differences in problem structure shape learners’ ability to construct, question, and reorganize sustainability knowledge. It aims to:

- (1) analyze how semi-structured problems function as cognitive scaffolds for initial

learning;

(2) examine how ill-structured problems destabilize classification-based understanding and trigger critical reflection;

(3) propose a pedagogical model that supports transitions toward systems thinking, adaptive problem framing, and resilience-oriented learning.

Methods

This study adopts a conceptual analysis and integrative theoretical synthesis approach grounded in curriculum reflection. It does not rely on empirical measurement but instead develops a practice-informed theoretical model.

Cognitive Load Theory (Sweller, 1988) is used to explain how semi-structured problems reduce cognitive burden and support initial conceptual formation. The theory of Wicked Problems (Rittel & Webber, 1973) is used to characterize ill-structured sustainability issues that resist clear definition and resolution.

These theoretical perspectives are synthesized with sustainability governance and systems thinking literature (Fukuda-Parr, 2016) to construct a comparative analytical framework centered on problem structure as the primary unit of analysis.

Results and Discussion

The analysis suggests that sustainability learning is fundamentally shaped by the structure of problems encountered in educational contexts, and that resilience emerges as a dynamic capacity through iterative epistemic processes.

(1) Construct: Semi-Structured Problems as Cognitive Scaffolding

In Green Restaurant education, students engaged with semi-structured sustainability issues such as animal welfare eggs, sustainable ingredients, and responsible consumption. These issues, while multidimensional, are supported by established institutional practices in Taiwan. Such structure enables learners to construct foundational sustainability literacy through recognizable categories and partial solution pathways.

(2) Deconstruct: Ill-Structured Problems and the Limits of Classification

In Fair Trade education, students encountered ill-structured sustainability problems involving global supply chains, labor ethics, and consumption systems. These problems resist single-category classification and expose conflicting values and systemic interdependencies. As a result, students begin to question the adequacy of classification-based frameworks, revealing their epistemological limitations.

(3) Reconstruct: Toward Systems Thinking, Adaptive Reasoning, and Resilience

The final stage emphasizes reconstructing sustainability understanding beyond fragmented categorization toward systems-oriented reasoning. Sustainability competence is reframed as the ability to analyze interdependencies, recognize trade-offs, and reframe problems when existing frameworks are insufficient.

Importantly, resilience is not treated as a fixed learning outcome but as an emergent capacity developed through iterative cycles of constructing, deconstructing, and reconstructing knowledge in response to shifting problem structures. The Construct–Deconstruct–Reconstruct model thus provides a developmental pathway through which learners progressively cultivate systems thinking, adaptive reasoning, and resilience-oriented learning.