Design Patterns in Computer-Supported Collaborative Learning: A Survey of ijCSCL Studies

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Overview

OBJECTIVES

- **Gap in CSCL design synthesis**:
  - CSCL: dedicated to generating sophisticated designs
  - **Lacks a comprehensive synthesis** of existing CSCL designs
- **Buried design knowledge**:
  - Effective CSCL designs buried within empirical studies
  - Impedes the iterative refinement of CSCL environments
- **Our contribution and Goal**:
  - Surveyed online higher-education projects published in the International Journal of Computer-Supported Collaborative Learning **(ijCSCL),** extracting **recurrent design patterns**
  - Elevate the **visibility and status** of CSCL design knowledge

METHODS

- **Paper Screening**:
  - **437** articles in ijCSCL (2006–present) screened; **23** selected
  - Selection Criteria: "related to task design", "higher education", and "fully online collaboration".
- **Coding Scheme**
  - Four dimensions: targeted learning outcomes, learning contexts, task sequences, and technology affordances.
- **Pattern Synthesis**:
  - **Step 1**, classified each **task sequence** by its **core task** (see Adapted Collaborative Task Framework for details) into: **CE-oriented**, **CP-oriented**, and **CR-oriented**
  - **Step 2**, examined how each **task sequence** was **organized** to support the core task and targeted learning outcomes, yielding **five** distinct **design patterns** across **three orientations**

Adapted Collaborative Task Framework

To systematically capture collaborative tasks—the **core elements** underpinning our **identification** of both task sequence and core task—we adapted a general learning design task taxonomy (Li et al., 2022) to align with CSCL contexts.

Task Category	Task Types	Examples
Directed Learning (D)	Receiving and interpreting information about collaborative tasks	Watching online lectures instructed by teachers, reading prescribed content materials containing task-related information or knowledge
	Receiving information about group members' knowledge basis and expertise	Reading prescribed content materials containing information of collaborators' knowledge basis and expertise
Collaborative Explorative Learning (CE)	Collaborative information exploration	Collaborative browsing, searching, evaluating, selecting
	Exploration through conversation	Explorative discussion, debating, collaborative knowledge construction
Collaborative Productive Learning (CP)	Co-construction of conceptual/visual artifacts	Collaborative essay writing, collaborative designing
	Co-construction of tangible/manipulable artifacts	Collaboratively creating computational artifacts (e.g., robots, games)
Collaborative Reflective Learning (CR)	Collaborative reflection	Reflective discussion, reflective notes
	Collaborative revision	Re-submission of group work after getting feedback
	Peer assessment/Group-level assessment	Peer/group-level assessment/evaluation, critical review

CSCL Design Patterns

Category	Pattern Name	Pattern Description	Examples
CE-Oriented Patterns	Pattern 1: Structured Asynchronous Discussion	**Task sequence**: "**CE-CP**" **CE**: Using an artifact as a scaffold to guide structured online discussions, facilitating idea exploration **CP**: Synthesizing and integrating arguments into the artifact	Nussbaum et al. (2007): students were tasked to responded to peers' posts using argumentation vee diagrams (AVDs) to explore discussion question (CE), and then created a joint AVD and summary note (CP).
	Pattern 2: Diverse Perspectives for Knowledge Co-Construction	**Task sequence**: "**D-CE-CR**" **D**: Reading prescribed materials to build a common knowledge base about the topic under discussion **CR**: Critically evaluating peers' contributions **CE**: Having discussions to co-construct knowledge, responding to diverse and conflicting views	Weinberger et al. (2013): after the study of the theoretical text (D), learners took on roles as a case analyst and two critics: with critics providing feedback (CR) and learners addressing conflicting views, leading to further in-depth exploration (CE).
CP-Oriented Patterns	Pattern 3: Collaborative Artifact Construction	**Task sequence**: "**D-CE-CP"** **D**: Receiving basic collaborative task-related knowledge and information **CE**: Deeply exploring and compiling task-related information and knowledge **CP**: Collaboratively creating the artifact as a group	Engelmann and Hesse (2010): students read task-related information and group knowledge bases (D), had explorative discussions to integrate information (CE), and finally negotiated their solutions (CP).
CR-Oriented Patterns	Pattern 4: Collaborative Reflection for Enhanced Collaboration Quality	**Task sequence**: "**CE-CR**" **CE**: Engaging in exploratory discussions **CR**: Reflecting on the discussion process, evaluating strengths, weaknesses, and potential improvements	Aldemir et al. (2022): learners discussed challenging topics (CE), then collectively assessed their collaboration and developed a strategy to address weaknesses in future discussions (CR).
	Pattern 5: Reflective Refinement based on Collaborative Assessment	**Task sequence**: "**CR-CR**" **CR**: Engaging in peer or group assessment of others' work **CR**: Critically reflecting and revising one's own work based on feedback	Zhang et al. (2021): learners were tasked with providing feedback on another group's product (CR) and then revising their own group product (CR).

Practical Implications

- For researchers: furnish **a structured foundation** for empirical studies to test, refine, and extend collaborative-learning theories across diverse contexts.
- For designers and developers: offer actionable insights into **structuring tasks and interactions**—informing **platform features**, **analytics indicators**, and the **purposeful integration of AI** to support
- For instructors: provide **practical templates** for organizing activities, facilitating peer interaction, and promoting reflection, which can be tailored to **specific course objectives and learner needs**.

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