

SDM-MOOC: Artifact-Based Social Learning for 21st Century Skills

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Abstract

This study develops the Social-Distributed Micro-MOOC (SDM-MOOC), a digital learning approach that emphasizes social interaction, the use of thinking artifacts, and guided reflection to deepen learners' conceptual understanding. The model was designed through theoretical review, needs analysis, and an initial pilot involving participants familiar with digital learning platforms. Data were collected from digital artifacts, collaborative conversations, and reflective notes, and were analyzed using qualitative content analysis techniques. The findings indicate that the SDM-MOOC framework is capable of fostering a learning ecosystem that makes thinking processes visible, sustains meaningful dialogue, and enables learners to reorganize their understanding through structured reflection. Participants demonstrated cognitive growth through a sequence of activities including stimulus engagement, artifact creation, collaborative discussion, and reflection. These results highlight that even simple digital platforms can serve as effective spaces for collaboration and knowledge construction when supported by appropriate pedagogical design. This study provides both conceptual and practical foundations for implementing socially oriented microlearning. The SDM-MOOC model holds potential for use across diverse educational settings and opens avenues for further research exploring artifact quality, discussion dynamics, and the relationship between distributed learning processes and learners' conceptual development

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1. INTRODUCTION

Advancements in digital technology over the past decade have significantly transformed the ways people engage in learning. One of the most prominent innovations is the Massive Open Online Course (MOOC), which has been regarded since the early 2010s as a major step toward expanding educational access. However, recent studies reveal that many MOOC implementations still rely on traditional instructional models centered on video-based content delivery and test-oriented assessments (Hew & Lo, 2020; Bates, 2022). As a result, learning in many MOOC environments remains focused on content distribution rather than meaningful participation and deeper knowledge construction. At the same time, the demands of 21st-century education highlight the need for learning approaches that foster collaboration, communication, creativity, and critical thinking. International research emphasizes that digital learning should be understood as a social space in which learners exchange ideas and develop shared understanding (Carvalho & Yeoman, 2021; Zhang et al., 2023). These perspectives indicate a growing shift toward distributed learning networks, learning communities, and collaborative knowledge creation that extends beyond mere content consumption.

Research in the learning sciences and computer-supported collaborative learning (CSCL) further underscores the importance of social interaction and the use of digital artifacts to represent learners' thinking (Chen, 2023; Kimmerle & Cress, 2021). Nevertheless, much of this evidence remains conceptual and has not been translated into operational MOOC designs. Most MOOCs still emphasize content transmission and provide limited opportunities for dialogue, idea exploration, or collaborative meaning-making.

This gap highlights the need for a MOOC model that meaningfully integrates social interaction, artifact-based thinking, and distributed learning principles within a micro-learning format that is feasible across diverse educational contexts. Moreover, no existing model has fully utilized lightweight communication platforms such as WhatsApp and Google Classroom as a distributed learning ecosystem that supports dialogue, collaboration, and the production of knowledge artifacts.

In response to this need, this article proposes the Social-Distributed Micro-MOOC (SDM-MOOC), a model that conceptualizes digital learning environments as epistemic communities where learners construct understanding through social interaction and the creation of thinking artifacts. The model outlines its theoretical foundations, design structure, implementation procedures, and an artifact-based assessment mechanism. By emphasizing structured, collaborative, and reflective learning processes, the SDM-MOOC offers a more inclusive and pedagogically relevant alternative for digital learning in the 21st century.

2. MATERIAL AND METHODS

The development of the Social-Distributed Micro-MOOC (SDM-MOOC) model was grounded in an extensive theoretical examination aligned with the focus of the study. A comprehensive review of research in educational technology, learning sciences, and computer-supported collaborative learning (CSCL) published between 2020 and 2025 served as the main foundation for constructing the model. These studies emphasize that contemporary digital learning increasingly relies on social interaction, collaborative knowledge construction, and the use of digital artifacts to make learners' reasoning visible. Findings from scholars such as Carvalho and Yeoman, Chen, Kimmerle and Cress, and Zhang and Chen highlight that meaningful digital learning requires more than content delivery; it depends on dialogue, meaning negotiation, and externalized thinking processes expressed through artifacts. Additional literature on microlearning, visible thinking, and communication tools in education reinforces this foundation, while research demonstrating the pedagogical value of lightweight platforms like WhatsApp provides practical justification for their use. Together, these sources offer a strong theoretical backbone, with more than ten reputable references supporting the conceptualization of the model.

The research was conducted through a chronological sequence beginning with a pre-research phase. In this initial stage, the researcher examined discrepancies between conventional MOOC practices and the demands of twenty-first-century learning. The analysis revealed an urgent need for a MOOC design that foregrounds social interaction, distributed cognition, and the creation of thinking artefacts. These insights informed the initial conceptual framework of the SDM-MOOC model, which integrates meaning negotiation, collaborative engagement, and the use of digital artefacts as mediators of cognitive processes.

The conceptualization phase then refined these theoretical insights into a coherent model. Concepts drawn from the literature were translated into a structural framework that conceptualizes learning as a dynamic process occurring through continuous interaction among learners, tools, and the digital environment. This framework underwent theoretical validation by comparing it with additional research until a robust model structure was achieved and ready for piloting.

The model was subsequently tested through a small-scale implementation involving between six and twenty participants, depending on contextual availability. Participants were selected based on their familiarity with digital tools. Two accessible platforms—WhatsApp and Google Classroom—were chosen as the learning environment. WhatsApp functioned as a space for social dialogue, enabling rapid exchange of ideas, while Google Classroom served as a repository for learning materials, a submission space for artifacts, and an environment for reflective writing. The choice of these platforms aligns with empirical evidence demonstrating their effectiveness in supporting microlearning and collaborative communication.

Learning activities were conducted over several days through short yet intensive sessions. The sequence began with exposure to stimulus materials such as brief readings, short videos, or case studies designed to activate prior knowledge. This stage was informed by principles from multimedia learning and the ICAP framework, which stress constructive engagement and cognitive activation. Following the stimulus, learners created thinking artifacts—mind maps, infographics, argumentation diagrams, or short narrative videos—as a means of externalizing their conceptual understanding. These artifacts then became the basis for collaborative dialogue on WhatsApp, where learners exchanged questions, clarified ideas, and negotiated understanding collectively. The learning cycle concluded with individual reflections in Google Classroom, allowing participants to consolidate their thinking and review the development of their conceptual insights.

Data were collected from three primary sources: the digital artifacts created by participants, discussion logs from WhatsApp, and written reflective notes. All data were analyzed using qualitative content analysis following the procedures outlined by Elo and Kyngäs and the methodological principles of Krippendorff. This approach enabled the identification of interaction patterns, conceptual development, and changes in learners' reasoning structures across the learning process. Through this systematic and theoretically informed procedure, the study generated a comprehensive account of how the SDM-MOOC model operates and its potential as a distributed, collaborative digital learning approach.

3. RESEARCH RESULTS

The findings of this study offer a comprehensive description of how the Social-Distributed Micro-MOOC (SDM-MOOC) operates and how well it aligns with current developments in digital learning. When viewed alongside scholarly work published between 2020 and 2025, the results demonstrate that the model maintains a strong theoretical foundation while contributing new insights to digital instructional design.

The first major finding indicates a clear shift in digital learning practices from content-centered delivery toward socially driven learning processes. During the pilot phase, conversations among participants on WhatsApp revealed patterns of deep engagement, including questioning, conceptual clarification, and collective reasoning. These interactions show that WhatsApp functioned not merely as a communication tool but as an epistemic space in which ideas were negotiated and co-constructed. This aligns with recent literature emphasizing that meaningful conceptual understanding arises through ongoing dialogue and the negotiation of shared meaning.

The second key finding highlights the central role of thinking artifacts in the learning process. Artifacts such as mind maps, infographics, argumentation diagrams, and short videos provided explicit representations of how learners structured and expressed their ideas. Analysis of these artifacts shows a progression from simple representations toward more interconnected and elaborate conceptual structures. This reinforces evidence from learning sciences research suggesting that digital artifacts are powerful mediators for organizing ideas, surfacing misconceptions, and supporting the gradual refinement of conceptual understanding.

The third finding relates to the function of reflection in distributed learning. Participants’ reflective notes reveal how reviewing artifacts and social interactions enabled them to recognize gaps in understanding, refine core concepts, and appreciate the impact of peer contributions on their thinking. This pattern is consistent with the views of Schön and Rodgers, who argue that reflection is a foundational mechanism for developing metacognition and consolidating learning.

When examined as a complete cycle, the results indicate that the SDM-MOOC facilitates an iterative and distributed learning pattern. Initial stimuli activate prior knowledge, thinking artifacts make reasoning visible, social interaction broadens understanding, and reflection consolidates emerging concepts. This progression mirrors the principles of distributed cognition, which posit that cognitive development is shaped through the interplay of external representations, individuals, and digital environments.

Overall, the findings show that SDM-MOOC is not only conceptually sound but also holds strong potential as a process-oriented, interactive, and inclusive digital learning model. The approach demonstrates that microlearning environments can effectively foster epistemic engagement and support learners in expressing their reasoning more explicitly and collaboratively. To clarify how these processes unfold in practice, the structured implementation flow of SDM-MOOC is presented in **Table 1**.

Table 1. SDM-MOOC Implementation Flow

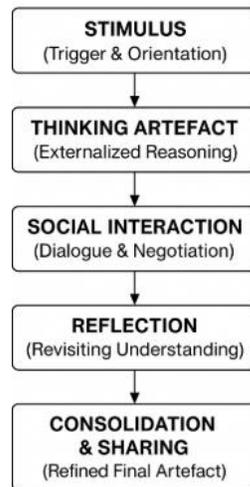
Phase	Description	Key Activities	Expected Learning Output	Expected Learning Output
1. Stimulus Phase	Learners receive a concise trigger that activates prior knowledge and orientates learning.	Readings, short videos, guiding questions, problem scenarios.	Initial awareness; conceptual readiness.	Initial awareness; conceptual readiness.
2. Artefact Creation	Learners produce artefacts that externalize their reasoning.	Mindmaps, infographics, argument diagrams, reflective captions, short videos.	Visible thinking; structured ideas.	Visible thinking; structured ideas.
3. Social Interaction	Learners negotiate meaning through dialogue.	WhatsApp discussions, questioning, peer feedback.	Refined ideas; Collective understanding.	Refined ideas; collective understanding.
4. Reflection	Learners revisit artefacts and interactions.	Reflective notes, revised artefacts, self-explanation.	Deeper comprehension; metacognitive awareness.	Deeper comprehension; metacognitive awareness.
5. Consolidation & Sharing	Learners integrate new understanding and share final artefacts.	Posting final artefacts, summary statements.	Completed artefact; evidence of cognitive growth.	Completed artefact; evidence of cognitive growth.

Explanation of Table 1

The sequence reflects a recursive learning process in which each stage strengthens the one that follows. The artifacts created during Phase 2 serve as prompts that initiate peer discussions in Phase 3, and the insights gained from these social exchanges subsequently inform the reflective work carried out in Phase 4. This pattern is consistent with recent scholarship on distributed cognition, which emphasizes that cognitive development is shaped by the interaction between external representations and collaborative meaning-making (Zhang et al., 2022; Kim & Rummel, 2024).

The use of lightweight digital platforms such as WhatsApp and Google Classroom also demonstrates the wider educational push for learning tools that are inclusive, easy to access, and adaptable across diverse learning environments (Hew & Lo, 2020; Bates, 2022).

Figure 1. Conceptual Structure of the SDM-MOOC Model



Explanation of Figure 1

The diagram illustrates the epistemic structure underlying the SDM-MOOC model. The learning process is organized as a distributed cycle in which thinking artifacts serve as mediators of reasoning, dialogue stimulates the refinement of concepts, and reflection brings these understandings together. This circular framework aligns with current perspectives on cognition as an iterative process shaped through social interaction (Kapur, 2022; Cress & Kimmerle, 2023).

Notably, the model does not depend on the platform-centered frameworks common in conventional large-scale MOOCs. Instead, it reframes everyday communication applications as epistemic spaces that can facilitate community-driven knowledge co-creation.

Integrated Discussion

This integrated discussion connects the research findings with the theoretical foundations and recent scholarly developments to demonstrate the coherence between the core principles of the SDM-MOOC model, its implementation in practice, and the scientific implications that emerge from it. Overall, the study illustrates that micro-scale digital learning can be intentionally designed as a social space that supports epistemic engagement, collaborative knowledge construction, and guided reflection.

The findings related to the role of social interaction highlight that collaborative dialogue is crucial for deepening conceptual understanding. Conversations that unfolded through WhatsApp revealed that participants actively revisited ideas, posed critical questions, and offered constructive feedback on one another’s thinking. These interaction patterns are

consistent with insights from Carvalho and Yeoman (2021) and Chen (2023), who argue that collaborative dialogue is a central component of meaningful learning in digital environments. Consequently, the SDM-MOOC model demonstrates that even simple communication platforms can become effective epistemic environments when interaction is structured and facilitated systematically.

The integration of thinking artifacts also emerged as a significant contribution. The artifacts produced by participants served not only as visual outputs but also as explicit representations of their reasoning processes. Shifts in the structure and clarity of these artifacts over time showed how learners reconstructed and refined their conceptual understanding. This finding aligns with research in the learning sciences (Kimmerle & Cress, 2021; Zhang et al., 2023), which emphasizes the value of digital artifacts in supporting visible thinking and knowledge-building processes.

Reflection represents another essential component in distributed learning settings. Participants' reflective notes indicated that they were not only evaluating their own understanding but also becoming aware of how peer feedback and social interaction influenced their thinking. This pattern is consistent with the perspectives of Schön (2017) and Rodgers (2020), who describe reflection as a key mechanism for strengthening metacognitive awareness and consolidating conceptual understanding.

When social interaction, thinking artifacts, and reflection are brought together, SDM-MOOC forms a cyclical learning process in which learners move between representing ideas, engaging in dialogue, and integrating new understanding. This iterative pattern aligns with the theory of distributed cognition (Zhang et al., 2022; Kim & Rummel, 2024), which views cognitive development as arising through continuous interaction among individuals, artifacts, and digital environments.

This discussion also underscores the meaningful contribution of SDM-MOOC to ongoing conversations in digital learning research, particularly within community-based microlearning contexts. The model offers a fresh perspective by showing that effective learning does not depend on sophisticated or large-scale platforms; rather, well-structured communication within simple digital tools can support deep knowledge construction. The study further opens avenues for subsequent research, such as examining the quality of digital artifacts, exploring the relationship between discussion patterns and learning outcomes, and investigating the scalability of distributed learning environments across broader contexts.

Overall, the findings affirm that effective digital learning is not defined by the volume of content delivered, but by the social dynamics that allow learners to negotiate meaning, make their thinking explicit, and engage in continuous reflection. This work enriches the contemporary literature and points toward new directions for designing digital learning spaces that are more human-centered, collaborative, and developmentally iterative.

4. CONCLUSION

From the overall investigation, it can be concluded that the implementation of the Social-Distributed Micro-MOOC (SDM-MOOC) provides clear evidence of how the model functions within a micro-scale digital learning environment. Observations from the field demonstrate that social interaction, the creation of thinking artefacts, and structured reflection serve as core mechanisms that support learners in deepening their conceptual understanding. The WhatsApp-based discussions revealed that collaborative dialogue enabled participants to revisit ideas, clarify their thinking, and co-construct knowledge, illustrating that even lightweight communication platforms can become effective epistemic spaces when properly facilitated.

The findings further show that digital artefacts operate not only as learning outputs but also as tools through which participants externalize and refine their reasoning. The evolving structure

of these artefacts indicates a gradual organization and elaboration of learners' conceptual frameworks. At the same time, reflective entries written by participants highlight their ability to recognize gaps in understanding, incorporate feedback, and realign their ideas based on insights generated through social interactions.

Overall, what was observed, implemented, and produced throughout this study indicates that SDM-MOOC functions as a distributed learning cycle integrating idea representation, social dialogue, and conceptual consolidation. The model offers a pedagogically grounded and human-centered approach to digital learning, while also contributing scientifically to the growing body of research on community-based microlearning. These results open pathways for further investigation into the model's broader applicability, including deeper analysis of artefact quality, discussion patterns, and their relationship to cognitive development.

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