# Conceptualizing Online Feedback Engagement from a Sociomaterial Perspective: An Iceberg Model

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## Abstract

This study conceptualizes online feedback engagement through a sociomaterial lens, exploring how learners' feedback engagement is dynamically shaped by the entanglement of human and non-human actors in digital environments. While prior research has examined cognitive, behavioral, and affective dimensions of feedback engagement in face-to-face learning environments, few studies have explored how technological affordances and sociocultural values mediate these forms of engagement. Drawing on a sociomaterial perspective, this study proposes a multidimensional framework of feedback engagement comprising cognitive, behavioral, relational, and collaborative dimensions. By synthesizing existing literature and integrating insights from recent empirical studies involving digital feedback tools, the paper highlights how engagement is not solely a learner-driven phenomenon but is co-constructed through sociomaterial arrangements. The framework advances current understandings of online feedback engagement and offers implications for the design of pedagogically sound feedback practices in technology-mediated learning contexts.

## CCS Concepts

• **Social and professional topics** → **Student assessment**; *Professional topics.*

## Keywords

Feedback, feedback engagement, sociomaterialism, online learning

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## 1 Introduction

The transition to digital and hybrid modes of education has challenged familiar teaching routines and reshaped students' and educators' experiences of higher education engagement[17]. In this context, understanding feedback and learning in online educational settings has become particularly significant. Feedback is recognized as one of the most powerful influences on learning [21], and technology is often positioned as a means to enhance feedback effectiveness [7]. However, conceptions of effective feedback have evolved alongside a shift from the 'old paradigm'—where feedback is understood as information transmitted from one agent to another to a 'new paradigm' grounded in a socio-constructivist perspective which takes feedback as a dialogic process [5][6]. Within the new paradigm, the effectiveness of feedback lies not in the information delivered but in how students engage with and respond to it. Therefore, a nuanced understanding of how students engage with feedback can thus offer valuable insights into improving feedback practices.

Before moving to the next step of conceptualizing feedback engagement in online settings, it is important to unpack what constitutes online feedback itself. Jensen et al.[22] contribute significantly to this discussion in their review by identifying two central understandings of feedback—teacher-centered and student-centered. Student-centered perspectives understand feedback as a learning tool and as a dialogic process, aligning with the new paradigm. Synthesizing these student-centered positions, this study conceptualizes feedback as a dialogic tool that activates students' agency through interactions with both human and non-human actors throughout learning processes.

Earlier research on feedback engagement has focused on seeking feedback information [44], conducting adaptive or maladaptive behaviors [40], as well as students' willingness, attention, or activeness [42] [18] . These studies have directed scholarly attention primarily toward behavioral and cognitive aspects of feedback engagement. In parallel, research in educational psychology and cognitive literature [12] [11] [43] [33] has long emphasized the multidimensional nature of learning engagement—typically including cognitive, behavioral, and affective components from an individualistic learning perspective. Feedback scholars have increasingly adopted this multidimensional lens. For example, Zhang et al. [48] explored student feedback engagement in peer feedback practices; Tay and Lam [38], drawing on triadic reciprocity [2], examined engagement in teacher feedback through cognitive, affective and environmental dimensions; and Zhan and Yan [47] identified an additional metacognitive dimension in the context of English writing and Generative AI (GenAI) settings.

While these cognitive and psychological interpretations of feedback engagement are valuable, it is equally important to address the relational, contextual, and dialogic nature of feedback—elements that are central to the new paradigm. One notable exception is Zhan et al. (2025), who conceptualized feedback engagement from


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an ecological perspective across the stages of eliciting, processing, and enacting in GenAI supported settings. Similarly, Gan et al.[13] incorporated sociological and psychological foundations to emphasize the social dimension of feedback engagement.

These contributions have significantly enriched the understanding of feedback engagement across diverse contexts and perspectives. However, the construct of feedback engagement requires further refinement in online learning environments. In such settings, interactions between humans and technologies are as vital as human-to-human interactions. As [1] argue, both artefacts and technologies co-construct a social field, and a shared understanding of feedback process by all parties need to be raised if feedback is to meaningfully impact learning (p.262). Therefore, there is a pressing need for a more fine-grained conceptualization that captures the complex interplay between students' experiences and both human and non-human actors.

This study addresses this gap by conceptualizing feedback engagement from a sociomaterial perspective, which explores the entanglement of human and technological systems. A sociomaterial analytic lens enables a deep examination of how online tools, platform functionalities, and feedback interactions dynamically shape and are shaped by each other.

## 2 Theoretical Underpinnings

This study is grounded in a sociomaterial perspective, which foregrounds the entanglement of social practices and material elements—such as technological systems—in shaping learning experiences within specific contexts [49]. Sociomaterialism assumes that human and non-human actors are not separate but are co-constitutive and relationally embedded. Building on this, Gravett [16] extends the sociomaterial view of feedback by integrating insights from new materialism, posthumanism, and poststructuralism. From this stance, all entities—including humans, tools, and environments—are part of dynamic assemblages that are constantly interacting and evolving [11]. Within this framework, humans can adapt to, resist, or reconfigure technologies in learning situations, while technological artefacts (e.g., digital platforms, AI tools) possess affordances and agential capacities that shape feedback processes. These material agents may, for instance, bring cognitive overload to students, hinder students' from navigating online systems, reinforce algorithmic biases or trigger emotional responses. Thus, a central question emerges: how do technological tools mediate, support, or constrain students' multidimensional engagement with feedback?

## 3 Methods

To conceptualize the framework, this study adopted a deductive reasoning approach—one that proceeds from general theoretical propositions to context-specific conclusions. Deductive analysis begins with established theories or conceptual frameworks and applies them to new inquiries or particular contexts [8]. This approach enables the study to build upon existing theoretical foundations of sociomaterialism [16] [15] and well-established frameworks related to student learning and feedback engagement [12] [13] [28] [32], adapting them to the specific context of online feedback engagement in higher education.

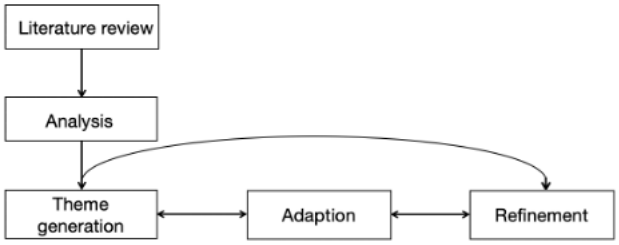


**Figure 1: Framework development process**

The development of the proposed framework followed four iterative stages inspired by Zhan et al.[46] model with minor adjustments: literature review, analysis, adaptation, theme generation and refinement (see Figure 1). First, a comprehensive literature review on online learning and feedback engagement—across both online and face-to-face learning environments—was conducted to identify relevant perspectives and dimensions. Second, constant comparative analysis [14] was employed to examine and contrast key elements and definitions across diverse conceptualizations of feedback and engagement. Themes were then refined through iterative cycles of adaptation and refinement, ensuring alignment with the particularities of online learning environments while remaining attentive to the ontological, epistemological, and ethical considerations relevant to the study.

## 4 Findings

In this section, four key components were involved in student online feedback engagement, including cognitive engagement, behavioral engagement, relational engagement and collaborative engagement on the basis of socio-materialism.

### 4.1 Cognitive Online Feedback Engagement

Synthesizing earlier studies, student cognitive engagement encompasses components of interpretation, attention, making evaluative judgments, and self-regulation skills. While these elements are closely intertwined with cognition, some researchers distinguish between surface-level and deep-level cognition engagement [32] [48]. This study argues that a distinguish between lower-order and higher-order cognition is necessary in defining cognitive dimension because these levels reflect varying degree of mental effort, processing depth and learner autonomy during engagement with feedback. Merely skim-reading comments would not constitute meaningful engagement with feedback, rather a process of 'doing time' as a representation of engagement [20]. Normally, lower-order cognitive process requires minimal cognitive effort, while higher-order cognitive process involves more complex, abstract, and autonomous thinking. Given that earlier literature of cognitive feedback engagement has not typically made such distinction, the study borrows a revised Bloom's Taxonomy of cognitive domain [24] in the definition. The revised Taxonomy is chosen as it reduced overlap among categories and ranged the elements from simple to complex. To better accommodate this framework with feedback research, I combined the components of analyzing and evaluating into one term

'evaluative analysis' since they are inseparable in making evaluative judgments [6] [30]. Therefore, the cognitive online feedback engagement involves the following five major components. The first two are considered as two lower-order cognition, while the latter three are viewed as higher-order cognition.

Remembering: The use of technology to access, store, and revisit feedback plays a vital role in fostering feedback appreciation, leading to student engagement in the notion of student feedback literacy [6]. From a sociomaterial perspective, the accessibility of technological tools enables students to re-read and recall feedback information through multimodal approaches. For instance, features such as feedback in Learning Management Systems (e.g. Canvas or Moodle), in-text comments in Google Docs, or annotated video feedback via platforms like Zoom with its function of AI companion allow students to revisit feedback in different forms and at their own pace.

Understanding: To process feedback information, students must decode the feedback message [4]. However, this could sometimes be challenging for students, thus impeding their feedback engagement. AI tools are not merely used for feedback provision but used by students to decode information by paraphrasing it for better clarification. Platform designs offering multiple options, such as rubrics, narrative comments and exemplars, can influence how feedback is interpreted. In sum, these material-discursive tools have great potential to support memory and understanding in mediating students' cognitive engagement at the low-order level.

Applying: Applying refers to students applying feedback information to accommodate with their diverse learning needs, performance goals, and adopting monitoring and other metacognitive strategies [26]. Technology mediation enables this process to occur. For example, LMS interface allows side-by-side comparison of different feedback sources, which is a basic step for generating internal feedback [29].

Evaluative analysis: Making evaluative judgements is a crucial component in both student feedback literacy and internal feedback generation processes [44] [10]. Technological affordances may shape when and how students identify the differences between teacher feedback, peer feedback and automated feedback. Collaborative annotation tools (e.g.Hypothesis, Leganto) enable feedback elicited from multiple sources and support students in making distinctions.

Creating: In this study, creating is understood with two meanings: (1). Students, who act as feedback givers, provide meaningful feedback information to themselves and their peers; (2). Students create their own feedback mechanic systems to inform their learning in a long term. In other words, students are enabled to flexibly choose the feedback approaches that best meet their own learning needs.

## 4.2 Behavioral Online Feedback Engagement

Building upon [31], Winstone et al.,[41] emphasizes accessing and paying attention as two dimensions of e-feedback engagement. Zhan et al.[46] explored behavioral engagement in AI-supported environments, where interactions, such as prompt generation with GenAI tools, which serves as observable indicators of students' engagement. Gan et al.'s[13] synthesis further frames behavioral feedback engagement in terms of participation, persistence, and active use of feedback for planning, revision, and self-reflection, blurring the lines between cognitive and behavioral dimensions.

Martin and Borup's argument—that behavioral engagement serves as the visible manifestation of cognitive and affective processes—resonates with the perspective adopted in this study. This study understands behavioral online feedback engagement as emergent and tangible actions, which may somehow reflect cognitive and affective dimensions. It is co-constructed through the socialmaterial assemblage of learners, technologies, features of feedback, and contextual norms. It includes practices such as seeking feedback from or through both human (peers, teachers) and non-human (e.g., AI, LMS) actors, engaging in feedback dialogue to resolve ambiguities, and co-constructing revised outputs through technology-mediated platforms. These observable actions could encompass accessing online feedback, initiating feedback dialogues with human or nonhuman actors, seeking online feedback clarification.

## 4.3 Relational Online Feedback Engagement

In feedback research, affective engagement is commonly understood as students' emotional responses—positive or negative—and the value they attribute to feedback from various sources [13] [38] [47]. Recognizing that feedback is inherently emotional and relational, and drawing on sociomaterial perspectives, this study adopts the term relational engagement to foreground the notion. Relational feedback engagement in online contexts can be understood across two interrelated layers. First, it involves students' emotional responses to feedback comments—whether provided by teachers, peers, or technological systems in synchronous or asynchronous online learning settings [27] [35]. Second, it underscores how students negotiate a sense of belonging, inclusion, and emotional security within digitally mediated learning communities.

While some studies treat affective engagement and communication engagement as distinct constructs [28], this study deliberately uses relational engagement to integrate both, recognizing that they are often enacted simultaneously through sociomaterial configurations. Feedback processes are more likely to be enhanced when emotional sensitivity, mutual empathy and trust foster relational support between interlocutors [36] [7]. These relational dynamics can occur between students and peers, students and teachers, or students and technologies. Importantly, interactions between these three categories can vary. Compared with human interactions, GenAI seems less likely to elicit students' emotions of embarrassment or fear [37].

It remains important to explore how relational affordances—such as praise, encouragement of self-efficacy, stimulation of interest, curiosity and intrinsic motivation can be meaningfully cultivated in a technology-mediated feedback environment. This is particularly salient with the growing role of GenAI, whose relational potential must be balanced against ethical concerns and culturally situated values. Scholars have cautioned against the use of AI in terms of its potential biases and ethical dilemmas [34] [25].

## 4.4 Collaborative Online Feedback Engagement

Traditionally, collaborative learning has been defined as "two or more people working together toward a shared learning goal"

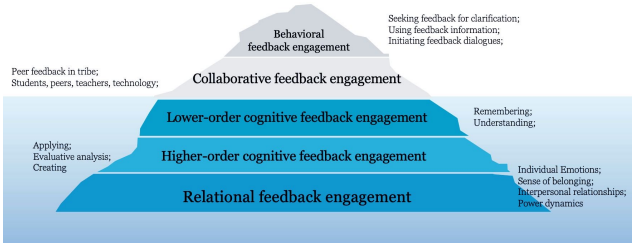


**Figure 2: Proposed Conceptual Framework of Student Online Feedback Engagement: An Iceberg Model**

[23]. Its theoretical underpinnings span constructivism, sociocultural theory—particularly Vygotsky's Zone of Proximal Development (ZPD)—and self-regulated learning frameworks such as co-regulation and socially shared regulation [19]. In feedback research, collaboration is enacted through peer feedback activities in triads, where learners take on dual roles as feedback providers and receivers [39].

From a sociomaterial perspective, collaborative online feedback engagement is emergent from the entangled interplay between human and nonhuman actors. For example, natural language processing (NLP)-based adaptive measures can direct learners in peer feedback analysis [3], thus shaping the nature and focus of peer collaboration. AI-assisted peer feedback helps to improve the quality of feedback content [9] and enhance student feedback literacy [45]. In platforms like Perusall or Microsoft Teams, peer feedback is shaped by technology affordances which mediates and constrains how learners contribute. A seemingly simple thumbs-up function can act as a mediating artefact that allows feedback receivers to express appreciation or show recognition, which reinforce social bonds and potentially motivate students to engage more in future learning activities.

## 5 Discussion and Implications

Drawing upon a sociomaterial perspective, this research contributes to the literature by proposing a conceptual framework for student online feedback engagement in an iceberg model (see Figure **??**). The iceberg shape is not intended to suggest a hierarchical relationship among the dimensions. Instead, it is to highlight that behavioral engagement and collaborative engagement are more visible and tangible in research, which might be easier to detect and identify, for example, using trace data in learning analytics. This newly established framework provides a more comprehensive understanding of student feedback engagement in online settings by accounting for dimensions of cognitive, behavioral, relational and collaborative engagement. The cognitive dimension spans from lower order cognition to higher order cognition with five elements: remembering, understanding, applying, evaluative analysis, and creating. A key contribution of this cognitive dimension lies in its theoretical foundation, which is based on a reconstructed version of Bloom's Taxonomy adapted specifically for the context of feedback to identify cognitive engagement across levels.

The behavioral dimension of feedback is perceived as tangible actions that students enact with technological materials which may reflect cognitive, collaborative, and relational dimensions. It involves students' actions of feedback seeking, asking for clarification and initiating or engaging in feedback dialogues. The relational dimension of feedback captures not only students' emotional responses but also the interpersonal relationships with both humans and technologies. Lastly, the collaborative dimension focuses on peer-to-peer interaction and the ways students engage with non-human actors, such as digital platforms or AI tools, in co-constructing feedback experiences.

These multidimensional insights open up promising directions for future research. In particular, studies could investigate how various feedback technologies scaffold the progression from lower- to higher-order cognitive engagement. Moreover, further exploration is needed to understand how technological systems mediate collaborative feedback practices and shape emerging feedback ecologies.

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