Inside Voice, Outside Voice: A Developmental Framework for Digital Emotional Literacy

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Inside Voice, Outside Voice: Interoceptive Awareness as a Mechanism for Digital Emotional Literacy in K-5 Populations — An Extended Summary

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ABSTRACT

This paper presents an accessible summary of the work-in-progress submitted to the ACM Interaction Design and Children (IDC) conference in 2026. The original submission proposes that interoceptive awareness — the capacity to perceive internal bodily signals such as heartbeat, breathing, and muscle tension — functions as a pre-conscious decision-making heuristic in children's digital behavior. Drawing on developmental psychology, embodied cognition, and bounded rationality theory, we argue that children's bodies "decide" before their conscious minds engage during technology use, and that mindfulness-based interoceptive training can create a temporal gap between digital impulse and action. This summary extends the conference submission with additional context on the MindfulBytes program through which this mechanism is being investigated, preliminary observations from co-design sessions with elementary-age children, and connections to the broader MaaS 2.0 theoretical architecture. We describe the practical implications of this framework for classroom settings and offer guidance for educators seeking to integrate interoceptive approaches into existing digital literacy programming.

Keywords: interoceptive awareness, digital emotional literacy, satisficing heuristics, K-5, MindfulBytes, embodied cognition, IDC 2026

1. BACKGROUND: THE INTEROCEPTION-DIGITAL LITERACY CONNECTION

The premise of this work begins with a deceptively simple observation: when a child reaches for a device, the reaching starts in the body before it starts in the mind.

This is not metaphor. Interoception — the sensory system by which the brain perceives the internal state of the body — provides a continuous stream of information about heart rate, respiration, gut state, muscle tension, and thermal regulation that shapes perception, emotion, and decision-making before conscious awareness engages (Craig, 2015). In adult populations, interoceptive awareness has been linked to emotional regulation, empathic accuracy, and decision-making quality (Garfinkel et al., 2015; Murphy et al., 2017). What has not been systematically explored is how interoceptive signals participate in children's digital behavior — the moment-to-moment decisions about what to watch, when to stop, whether to respond, and how much is enough.

Current digital literacy education for elementary-age children operates primarily at the cognitive level. Programs teach children what to do and what not to do online: protect personal information, be kind in digital communications, think critically about content, ask an adult when something feels wrong. These cognitive approaches have value, but they share a structural limitation: they require the child to think before acting. For young children — whose prefrontal cortex development lags behind their capacity for digital engagement — the instruction to "think before you click" arrives too late. The body has already made its assessment. The impulse has already fired. The click has already happened.

The interoceptive approach proposed here does not replace cognitive digital literacy. It provides a foundation for it. By teaching children to notice what their bodies feel during digital engagement — the quickened heartbeat of anticipation, the shallow breathing of absorption, the restless tension of wanting-more, the settled calm of satisfied completion — interoceptive training gives children access to information that their bodies already possess but that typically operates below the threshold of conscious awareness.

This is the "inside voice" of the title: the body's report on its own state, available to the child who has learned to listen.

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2. THEORETICAL FRAMEWORK: SATISFICING HEURISTICS MEET EMBODIED COGNITION

The theoretical contribution of the IDC submission lies in the integration of two literatures that have not previously been brought into conversation around children's digital behavior: Herbert Simon's (1956) bounded rationality and satisficing heuristics, and the embodied cognition tradition's treatment of interoception as a decision-making mechanism.

2.1 Satisficing in Digital Environments

Simon's satisficing model describes decision-making under conditions of bounded rationality — the realistic condition in which the decision-maker lacks the time, information, or cognitive resources to evaluate all options and instead selects the first option that meets a minimum threshold of acceptability. Adults satisfice constantly: choosing a restaurant based on the first acceptable search result, selecting a news article based on an appealing headline, stopping at the first parking space that is "good enough."

Children's digital environments are engineered to interact with satisficing processes in specific ways. Autoplay features present the next video before the child's satisfaction threshold has been tested. Infinite scroll mechanisms eliminate the natural stopping points that would trigger a satisficing reassessment. Notification systems provide intermittent reinforcement that resets the satisficing clock, making each new alert feel like a fresh decision point rather than a continuation of an ongoing engagement.

The result is a digital environment in which the child's natural satisficing process — the body's assessment of "this is enough" — is systematically suppressed or bypassed by design features that ensure the "good enough" threshold is perpetually met.

2.2 The Body as Satisficing Engine

The embodied cognition contribution to this framework is the recognition that satisficing is not primarily a cognitive process. It is a somatic one. The "good enough" assessment is not a thought; it is a feeling — a bodily state that registers satisfaction, dissatisfaction, or the ambiguous middle ground of "not yet done."

When a child is absorbed in a video and the body produces a subtle signal of restlessness — a shift in posture, a deepening of breath, a diffuse sensation of discomfort — that signal is the body's satisficing assessment: this engagement is approaching its natural endpoint. If the child has interoceptive awareness of this signal, they can recognize it as information: "My body is telling me I'm ready to stop." If they lack this awareness, the signal passes unnoticed, and the engagement continues past the point at which the body has registered sufficiency.

This is the mechanism through which interoceptive awareness becomes digital literacy. Not through rules about appropriate behavior, but through the child's capacity to read their own body's assessment of their own digital experience.

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3. THE MINDFULBYTES CO-DESIGN METHODOLOGY

The MindfulBytes program operationalizes this theoretical framework in elementary school classrooms. Developed by NM-CCCR and refined through the Harvard Center for Digital Thriving fellowship, MindfulBytes is a K–5 digital wellness curriculum grounded in interoceptive awareness.

3.1 Design Principles

Three principles govern MindfulBytes design. Body before mind: sessions begin with somatic awareness (interoceptive check-ins) before introducing cognitive frameworks. Children are asked to notice what their bodies feel before they are asked to think about what they should do. Children as experts: the program treats children's reports of their own bodily and digital experiences as primary data. When a child says "my chest gets tight when I see mean comments," that report is honored as a precise phenomenological observation — not corrected, reframed, or translated into adult vocabulary.

Co-design as methodology: the program is developed with children, not merely for them. Session activities, vocabulary, and assessment approaches are iteratively refined based on children's responses and contributions.

3.2 Session Structure: Three Moments

MindfulBytes sessions are organized around three temporal moments that correspond to the before, during, and after of digital engagement.

Before-screen activities establish an interoceptive baseline. Children are guided through brief body-awareness exercises — noticing their breathing, placing a hand on their chest to feel their heartbeat, scanning their bodies for areas of tension or ease. This baseline serves two functions: it activates the interoceptive system so that body signals become more salient during subsequent digital engagement, and it provides a reference point against which changes during screen use can be detected.

During-screen activities integrate interoceptive awareness into actual technology use. Children are invited to pause periodically during digital activities and check in with their bodies: "What does your stomach feel like right now?" "Has your breathing changed?" "Where in your body do you feel the game?" These pauses operationalize the Interoceptive Gap — the temporal space between bodily impulse and behavioral response that interoceptive training aims to expand.

After-screen reflections capture what changed. Children describe how their bodies feel now compared to before. They are invited to notice differences — more energy or less, calm or restless, satisfied or wanting-more — and to connect those differences to their digital experience. These reflections generate the child's own vocabulary for their digital-somatic experience, which becomes the foundation for ongoing self-awareness.

3.3 The Harkness Circle Approach

MindfulBytes employs the Harkness circle discussion format — a student-centered discussion model in which the facilitator's role is to pose questions and hold space rather than to direct conversation. In MindfulBytes Harkness circles, children discuss their digital experiences in their own language, building shared vocabulary for bodily sensations, digital impulses, and the felt experience of technology use.

The Harkness approach serves the co-design principle by ensuring that the language of digital emotional literacy emerges from children's experience rather than being imposed from an adult framework. When a group of second-graders collaboratively develops the term "brain sparkles" for the feeling of excited anticipation before a favorite game, that term carries phenomenological precision and communal ownership that no adult-designed vocabulary could replicate.

4. PRELIMINARY OBSERVATIONS FROM CO-DESIGN SESSIONS

The following observations are drawn from MindfulBytes co-design sessions conducted in partnership with elementary schools in New Mexico. These observations are preliminary and qualitative; they do not constitute validated findings and should be interpreted as directional rather than definitive.

4.1 Children Can Identify Digital-Somatic Signals

Children across the K–5 range demonstrated the capacity to identify and report bodily sensations associated with technology use when given structured support. Younger children (K–1) were most successful with body-mapping exercises — pointing to areas on a body outline where they felt sensations — while older children (grades 3–5) could articulate their experiences verbally with increasing precision. The developmental progression was consistent with established literature on interoceptive capacity in childhood (Koch & Pollatos, 2014).

4.2 Body Reports Precede Cognitive Evaluations

When asked about their digital experiences, children frequently offered somatic descriptions before cognitive assessments. "My tummy was doing flips" preceded "I liked that game." "My shoulders got all bunchy" preceded "I was frustrated." This temporal ordering — body first, mind second — is consistent with the theoretical framework's proposition that interoceptive signals function as pre-cognitive assessments of digital experience.

4.3 Children Express Interest in Their Own Body Signals

Perhaps the most striking preliminary observation is the degree of genuine interest children expressed in their own bodily responses to technology. The question "What does your body feel like when you're watching videos?" was consistently met with engaged, detailed responses rather than confusion or disinterest. This suggests that interoceptive awareness training meets a felt developmental need — children want to understand what they feel, and they respond with enthusiasm when given vocabulary and permission to explore their own somatic experience.

4.4 Language Development Is Emergent and Communal

Children developed their own vocabulary for digital-somatic experiences through group discussion rather than individual reflection. Terms were proposed, adopted, modified, and shared within peer groups, creating a communal language for experiences that had previously been private and unnamed. This emergent vocabulary is itself a form of data — it reveals the phenomenological landscape of children's digital experience as children themselves perceive it.

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5. IMPLICATIONS FOR DIGITAL LITERACY CURRICULUM DESIGN

The interoceptive framework has practical implications for educators seeking to integrate body-based approaches into existing digital literacy programming.

5.1 Integration, Not Replacement

Interoceptive digital literacy does not replace existing cognitive or behavioral approaches. It provides a foundation — an embodied awareness layer — on which cognitive understanding can be built more effectively. A child who has learned to notice that "my body feels speedy and tight when I've been scrolling too long" is better positioned to understand and apply the cognitive rule "take breaks during screen time" because the rule now connects to a felt experience rather than an abstract principle.

5.2 Minimal Curricular Footprint

The interoceptive approach requires minimal additional instructional time. Brief check-ins (one to three minutes) at transition points around technology use — before devices come out, at natural pauses during digital activities, and after devices are put away — can be integrated into any instructional context without significant schedule disruption. The approach is additive to, not competitive with, existing curricular demands.

5.3 Facilitator Stance

The interoceptive approach requires a specific facilitator stance: curiosity rather than instruction. The facilitator's role is not to tell children what they should feel but to ask what they do feel, and to receive their reports with genuine interest. This stance can be supported through brief facilitator orientation that covers the principles of interoceptive inquiry, the importance of preserving children's natural language, and the ethical considerations of asking children to attend to their internal states.

5.4 Developmental Adaptation

The framework adapts across the K–5 range through vocabulary and modality adjustments rather than conceptual changes. Kindergarteners work primarily with body-mapping (pointing, drawing) and simple feeling words (happy, fizzy, calm, tight). Third-graders can engage with more nuanced vocabulary and can begin to identify patterns across experiences. Fifth-graders can reflect on their own digital bonding patterns and discuss the satisficing process with emerging metacognitive awareness. The core principle — notice what your body feels — remains constant across ages.

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6. CONNECTION TO THE BROADER MaaS 2.0 FRAMEWORK

The interoceptive awareness mechanism described here operates within the broader Mindfulness as a Service (MaaS) 2.0 theoretical architecture (Davis, 2026a), which integrates five interconnected frameworks: interoceptive awareness, Digital Bonding Patterns, satisficing heuristics, creative atrophy, and Relational-Cultural Theory applied to digital contexts.

The IDC submission focuses on the intersection of interoceptive awareness and satisficing heuristics — the specific mechanism by which body signals function as decision-making inputs in children's digital behavior. The companion papers in this series address the other framework elements: Digital Bonding Patterns as the relational vocabulary for children's technology relationships (Davis, 2026b), the

Creative Hollowing as the consequence of AI-mediated creative delegation (Davis, 2026c), and the full dissertation summary presenting the theory-development methodology that generates and integrates these constructs (Davis, 2026d).

Together, these papers represent a cohesive body of work that positions interoceptive awareness as the foundational capacity — the mechanism through which all other elements of digital emotional literacy become accessible to the developing child.

7. FUTURE RESEARCH DIRECTIONS

Several research priorities emerge from this work. The development and validation of the Digital Wellness Assessment (DWA) as a reliable measure of children's interoceptive digital awareness is the most immediate priority. Controlled studies comparing the effectiveness of interoceptive approaches with conventional cognitive-behavioral digital literacy curricula would provide evidence for or against the framework's central claims. Physiological measurement studies — correlating children's self-reported body signals with objective measures such as heart rate variability and galvanic skin response — would establish whether children's interoceptive reports during technology use correspond to measurable bodily changes.

Longitudinal research tracking children's digital behavior patterns following interoceptive training would address the durability and transfer of body-based digital literacy skills. And cross-cultural studies investigating whether the interoceptive mechanism operates consistently across diverse cultural contexts would establish the framework's generalizability.

8. CONCLUSION

The title of this paper — "Inside Voice, Outside Voice" — captures the essence of the proposed framework. Every child navigating a digital environment is hearing two voices. The outside voice is the platform's: notifications, recommendations, autoplay prompts, social signals designed to sustain engagement. The inside voice is the body's: the heartbeat that quickens, the breath that shallows, the stomach that tightens, the restlessness that signals sufficiency.

Digital emotional literacy, as proposed here, is the capacity to hear the inside voice clearly enough to respond to it — even when the outside voice is louder, more persistent, and more expertly engineered.

The interoceptive approach does not ask children to reject technology. It does not ask them to follow rules they cannot yet internalize. It asks them to listen — to the oldest, most reliable information system they possess. Their bodies already know what technology does to them. The task of education is to help them hear what their bodies are saying.

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