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Original Article

Advancing Early Childhood Learning through Structured Multimodal Engagement: Evidence from Kindergarten Classroom

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Abstract

Background: *Learner engagement is a critical factor in educational success. It reflects the depth of students' involvement in learning activities and is shaped by both individual and contextual factors within the classroom. Given its multifaceted nature, engagement poses definitional and analytical challenges. This paper explores the dimensions and manifestations of engagement by analyzing its phases in classroom activities.*

Methods: *Adopting a multilayered analysis, we employed Dimensions of Engagement and Multimodal (Inter)action Analysis to analyze two video extracts of kindergarten classroom interactions. We examined how engagement is manifested by different dimensions and how it develops dynamically through verbal and non-verbal interactions.*

Results: *Findings reveal that the type of instructional inputs learners receive influences the dimensions of their engagement. Additionally, engagement is not a single-dimensional construct; rather, it is manifested by learners in an overlapping and interconnected manner where different forms of engagement (e.g., behavioral, emotional, and cognitive) interact progressively.*

Conclusion: *This study contributes to a deeper understanding of learner engagement in early childhood education by highlighting its temporal and multimodal nature, with an emphasis on the role of instructional inputs and classroom interactions in shaping engagement over time.*

Keywords

engagement, multimodal (inter)action analysis, young learners, multimodality, classroom interactions, instructional inputs, early childhood education, behavioral engagement, emotional engagement, cognitive engagement

INTRODUCTION

Engagement is a central construct in the study of teaching and learning (Alrashidi et al., 2016; Lindström et al., 2021), particularly in young learners' classrooms where maintaining involvement remains a challenge for educators and researchers alike (Hindeme, 2025; Ho & Nguyen, 2021; Lu & Rameli, 2024). As young learners' cognitive and emotional capacities develop, understanding how engagement unfolds in these contexts becomes essential for improving instructional design and learning outcomes (Oga-Baldwin & Nakata, 2020).

Fredricks and colleagues (2004) identified two rationales for studying engagement. First, there is a concerning decline in students' respect for authority and institutional structures (Janowitz, 1978; Modell & Elder, 2002) as well as diminishing motivation across grade levels (Eccles et al., 1984). Second, engagement is deeply influenced by an individual's interaction with their environment. Suppose these factors reflect ongoing

issues in the education system. In that case, there is a pressing need to redesign instructional strategies to address challenges such as low achievement, high dropout rates, and student disengagement (Chapman et al., 2010; Fredricks, 2015). While Fredricks et al. (2004) emphasized commitment and investment as central concepts in understanding engagement, research has produced a fragmented understanding of the construct. Definitions vary widely across studies, with engagement being referred to as student engagement at school, educational engagement, or study engagement (Alrashidi et al., 2016). The lack of a unified definition makes it difficult to establish clear methodological approaches. As Christenson, et al. (2012) demonstrate, engagement is a complex construct that warrants deeper examination across its various dimensions.

The study of engagement has traditionally relied on self-reports, questionnaires, and rating scales. For example, the Student Participation Questionnaire (Finn et al., 1991) has been used to measure behavioral engagement, while the Rochester School Assessment Package (Wellborn & Connel, 1987 as cited by Lei, et al., 2018) assesses both behavioral and emotional engagement. Additionally, the Motivated Strategies for Learning Questionnaire (MSLQ) by Pintrich et al. (1991) and observational techniques (Helme & Clarke, 2001) have been employed to analyze cognitive engagement related to motivation and self-regulation. More recently, new tools such as the Informal Second Language Engagement (Arndt, 2023) and the International Student Engagement Instrument (Meškauskienė & Šimkienė, 2024) have emerged, further expanding the landscape of engagement assessment. Despite these advancements, existing tools often focus on specific aspects of engagement without fully capturing its complexity, particularly in early childhood education. Engagement is not merely a behavioral response but an evolving process that manifests through multiple dimensions: behavioral, emotional, and cognitive. The context in which engagement occurs plays a critical role in shaping how learners interact with instructional activities (Christenson et al., 2012). Engagement is not static; it emerges as an active, dynamic process that is continually influenced by the learning opportunities and scaffolding teachers design and facilitate within the classroom (Wylie, 2009).

In this study, engagement is operationalized as active participation in class activities. Drawing from Appel (2010) and Goodwin and Goodwin (2004), participation itself is a visible manifestation of engagement. Participation within a pedagogical context is attributed primarily to learners' verbal contributions (Jacknick, 2021). In writing activities, the role of L1 in fostering dialogic engagement leads to students' empowerment, as it provides opportunities to develop micro-skills, such as expanding ideas and giving examples, during the pre-writing stage (Salayo et al., 2024). To advance the study of engagement, this research adopts a multimodal perspective, recognizing that engagement is demonstrated not only through verbal contributions but also through non-verbal and material interactions. Before moving forward, however, it is worth revisiting significant influences on classroom engagement. Previous studies, such as those by Christopher and Newman (2022), have identified several classroom practices associated with higher student engagement in prekindergarten and kindergarten classrooms. Classroom practices, such as fostering a favorable climate, allocating more time to instruction than to transitions, and using sequential activities, showed lower correlations with engagement. Stronger correlations were found in teachers' behavioral practices, which we believe warrant closer attention from practitioners. The study claimed that when teachers exhibit behavior approval and a positive tone, more engagement among learners is generated. Regarding emotional engagement, Xie and Derakhshan (2021) and Sun et al. (2023) have explored influential factors within the context of EFL classrooms. In the bigger picture, teachers' positive interpersonal behavior (respect, care, and compassion) enhances students' engagement. On a cognitive level, Pietarinen et al. (2014) have claimed that cognitive engagement is primarily influenced by the interplay between learners and the school environment, while learners' experiences and well-being at school mediate their emotional and cognitive engagement. However, we argue that engagement extends beyond speech, encompassing behavioral, emotional, and cognitive dimensions that often overlap with one another. For example, consider the study comparing the Swedish preschool curriculum with those of the United States and Portugal, as presented by Åström (2023) and Coelho et al. (2020). They pointed out that changing activity settings (Coelho et al., 2020; Vitiello et al., 2012), such as free play indoors and outdoors, fosters interactions between adults and children, as well as between children, which also promotes engagement in many dimensions.

Traditional self-report and questionnaires may not fully capture the materiality of engagement in real-time classroom interactions. In contrast, Multimodal (Inter)action Analysis (MIA) (Geenen, 2023; Geenen & Pirini, 2019; Norris, 2004; Pirini, 2016) provides a more holistic methodological approach by enabling fine-grained analysis of salient modes of communication, including gaze, gestures, postures, and body orientation (Adami, 2017; Jewitt, 2014; Jewitt et al., 2016; Norris, 2004; O'Halloran, 2006).

This perspective aligns with the argument that engagement in educational settings is not solely mediated through language but also through non-verbal and material modes of communication. This study contributes to engagement research by providing a multimodal analysis of young learners' participation, highlighting how engagement emerges dynamically through various modes of communication. By examining engagement beyond self-reports and rating scales, this study offers a more comprehensive understanding of learner involvement in classroom activities. Furthermore, the findings have practical implications for instructional design, emphasizing the need to create learning environments that support diverse engagement modes (Magnaye, et al., 2024). By recognizing the overlap between behavioral, emotional, and cognitive engagement, educators can develop more effective strategies to foster sustained participation in childhood education. Examining how engagement unfolds in kindergarten classrooms advances both theoretical and methodological understandings of learner engagement.

Building on the work of Fredricks et al. (2004), the Dimensions of Engagement framework, this study investigates the phases of engagement and the types of engagement demonstrated by young learners during classroom activities. A key objective is to identify the factors that precede and shape learners' participation, as well as the multimodal resources they utilize in engagement.

METHODS

Study design, settings and population

This study employs a qualitative and observational research design, focusing on in-depth analysis of classroom interactions to understand learner engagement. It is characterized by a micro-ethnographic approach, allowing for the detailed examination of engagement. Additionally, the study employs a multilayered analytical strategy by integrating two primary frameworks: Fredricks et al.'s (2004) framework, which categorizes engagement into behavioral, emotional, and cognitive dimensions, and Norris' (2004) Multimodal (Inter)action Analysis (MIA) for analyzing video extracts of classroom interactions. This combined approach enables a fine-grained examination of the dynamic manifestations of engagement as evidenced through learners' gaze, gestures, postures, and body orientation.

This study was conducted in a medium-sized international school in Bangkok, Thailand. It adopts a British curriculum, integrating the Early Years Foundation Stage (EYFS), Executive Functions (EF), and 101 Positives curricula—English Medium of Instruction (EMI) — in core subjects and activities. Lead Teachers (LTs) are native English speakers, while Teaching Assistants (TAs) come from outer-circle English-speaking countries, following Kachru's concentric circles model. In this classroom, there are three adults (a lead teacher and two teaching assistants) and eight learners.

The in-depth analysis focused on two learners (L1 and L4) out of eight learners being observed. In the classroom being studied, there are eight learners (coded L1 to L8), consisting of four boys and four girls, who are seated from left to right during the Circle Time. Although traditional Thai classrooms (which refer to schools subsidized by the government as well as temple schools) could serve as a setting for this research, the language barrier posed a significant challenge for the primary researcher.

Data collection

The video recording took place during the Circle Time (CT) activity, where the LT, TA, and learners sat in a semi-circle formation. The LT occupied a central position in front of the teacher's table, serving as the focal point of interactions, while the TA sat between L5 and L6 (see Figure 1). Two specific classroom activities were recorded: (1) the teaching of days, dates, and months, (2) the storytelling activity of The Busy Working Ant and the Singing Cicada. The recording yielded a 27-minute video, which was reviewed iteratively to identify key moments of engagement. From this process, two extracts were selected for in-depth analysis: Extract 1: 16:52:00 – 17:47:28, and Extract 2: 20:04:00 – 21:34:11, respectively. Emergent in our previous study, which delineates the influences of multimodal inputs on learners' attention/awareness, is the concept of engagement. Re-examining engagement as an emerging concept led to the problematization of what transpires around the engagement process. The extracts selected for further analysis typify and dichotomize the concept of engagement. Following the guidelines from Multimodal (Inter)action Analysis (MIA), we selected two extracts as the unit of analysis, also known as mediated actions. These mediated actions are classified into higher-level actions (HLAs), actions with communicative goals (e.g., ordering coffee at the shop), lower-level actions (LLA), present significant shifts in the use of communicative modes (e.g., gaze, posture, and body orientation shifts),

and frozen action (FA), entailed in the objects in the environment (e.g., a storybook during the storytelling activity). Using VLC (VideoLan, 2006) video playback software, the frame rate (fps) was extracted, yielding 30 fps, or approximately 30 frames per second. Frames with significant modal shifts in plates were arranged into plates, which included elements such as language prosody, circles, and arrows to highlight key engagement indicators.

Additionally, ethical approval was also obtained from the governing institution (KMUTT-IRB-COA-2021-026), and the study was conducted in accordance with the participating school's Child Protection and Safeguarding Policy. Consent forms were distributed to the administrators, teachers, and parents/guardians of the learners. To ensure participants' anonymity, all images were converted into line drawings (see Figure 1).

Figure 1. *Kindergarten classroom during the Circle Time activity*

Data analysis

The analysis follows a layered approach to engagement, integrating two frameworks. First, Dimensions of Engagement (Fredricks et al., 2004) which typifies engagement into behavioral (observable participation behaviors, such as gestures, posture, and spatial orientation), emotional (facial expressions, tone of voice, and body language to indicate emotional states), and cognitive (the use of multiple modes—e.g., speech combined with gestures or writing—to engage with complex tasks). Behavioral engagement was analyzed through embodied modes such as leaning forward, raising hands, or making gestures to indicate participation. Emotional engagement was inferred through behaviors such as nodding, smiling, or laughing, as well as avoidance behaviors like looking away. Cognitive engagement was examined in instances of multimodal interaction, where learners combined verbal and non-verbal communication to navigate classroom tasks. Second, Multimodal (Inter)action Analysis enables a fine-grained analysis of communicative modes beyond verbal language, including gaze, gestures, posture, spatial orientation, and artifacts. Furthermore, the integration of Norris' (2004) MIA and Fredricks et al.'s (2004) engagement framework offers a robust methodology for capturing the intricacies of classroom interactions. One methodological challenge in analyzing multiparty interactions is that learners may have varying levels of access to classroom interactions, which can influence their participation. To maintain analytical clarity, this study focused on L1s and L4s' engagement, examining their participation at pre-, during-, and post-engagement phases in response to the LT's interactional strategies. By narrowing the analysis to two learners, the study ensures depth and

manageability while tracking engagement patterns. Additionally, L1 and L4 were chosen for their analytical utility in demonstrating different engagement styles (verbal vs. non-verbal, immediate vs. gradual). Both learners also illustrate the variability in how engagement manifests among young learners rather than being strictly representative of a single, broader pattern..

Figure 2. *Two-page spread from the story, The Busy Working Ant and the Singing Cicada. Reproduced for analytical purposes under fair use*

RESULTS

This section presents a detailed analysis of L1 and L4's engagement during the storytelling activity. Drawing on two extracts, the analysis examines how each learner demonstrated different types of engagement across various phases of the activity as well as the factors that influenced these forms of engagement.

HLA 1. *L4's Manifestation of Engagement*

Pre-Engagement Phase

Figure 3. *Pre-engagement phase*

The pre-engagement phase of this extract featured the LT reading a story that contrasted the diligent ant storing food for rainy days with the carefree singing of a cicada. In Photo 1, the LT pointed to a page in the storybook and asked, "Hmmm, I wonder what happened here." This rhetorical question signaled that something was amiss in the cicada's situation, fostering curiosity. As the LT panned the book across the room, L4 leaned forward and reoriented his body, visually tracking the LT's movement while trying to get a closer look at her image. The LT's strategic use of gestures, gaze shifts, tonal variation, and side comments, which extend beyond the text, serves as multimodal cues that invite learners' attention and participation.

These observations highlighted the interplay of engagement dimensions. L4's forward-leaning posture and reorientation reflected behavioral engagement, signaling readiness to attend to the story. At the same

time, his posture shift in response to the LT's rhetorical question indicated emotional engagement, as curiosity was translated into physical action. The LT's use of rhetorical prompts and multimodal scaffolding fosters cognitive engagement, as learners were encouraged to anticipate what might have happened in the story rather than merely recalling details. Together, these strategies illustrated how teacher cues and learner responses overlapped across behavioral, emotional, and cognitive dimensions to create an inclusive and participatory learning environment.

During Engagement Phase

Figure 4. *During the Engagement Phase*

After the LT panned the book, L4 immediately reacted to an illustration of an ant carrying a cart full of grains with an exclamation, "Whoaaaa! That is a huge one …(unintelligible)… A LOT!" (17:17:20). His spontaneous response and tone of surprise indicated emotional investment, suggesting that the visual stimulus effectively captures his attention. At the same time, maintain a steady gaze and posture. L4 demonstrated continued behavioral engagement throughout the pre-engagement phase. The LT validated and extended this observation by rephrasing it, "And he is working a lot!", thereby refining L4's conceptualization of the ant's effort.

Building on this exchange, the LT asked, "What do you think he is carrying in here? (17:21:09), pointing at the cart loaded with food. L4 promptly responded, "A lot of beans." , interpreting the mixed items as beans. He then extended his observation metaphorically, exclaiming, "Like SHOPPING!" The LT scaffolded this analogy by linking it to familiar routines, "Just like Mommy and Daddy, right?" while panning the storybook from right to left (17:30:15). This playful extension elicited peer interaction when L3 humorously asked, "Mommy and Daddy are ants?", a remark that generated laughter from the TA and a lighthearted reply from the LT, "Maybe".

Taken together, L4's crouched posture and focused gaze reflect behavioral engagement, indicating bodily orientation that supports close attention to the storybook. His surprise and humor illustrated emotional engagement, which was further reinforced through peer laughter and the LT's playful responses. Finally, his quick verbal responses and metaphorical connection between the ant's labor and everyday routines highlight cognitive engagement, demonstrating how teacher scaffolding and peer interaction can foster more profound meaning-making. This phase illustrated how the behavioral, emotional, and cognitive dimensions overlap dynamically, with teacher prompts and classroom humor amplifying engagement across these modes.

Post-Engagement Phase

Figure 5. *Post-Engagement Phase*

The post-engagement phase reveals a continuation of L4's behavioral patterns observed from the earlier stages, reinforcing his sustained engagement. As the LT continues reading, his forward-leaning posture and gaze toward the storybook eventually shift into a crawling position with flat palms and knees, an intensified physical expression of engagement. The camera also captured his attentive facial expression, further confirming his focus.

This phase highlights not only L4's engagement but also classroom interaction dynamics. When the LT began the line, "With his own...", he was interrupted by the learners' chatter, prompting him to interject, "Okay, listen." The need for this explicit prompt suggested that while humor and interactivity foster participation, teacher intervention remains crucial for managing transitions and maintaining collective attention.

Taken together, L4's posture, gaze, and orientation illustrated behavioral engagement, showing consistent attentiveness beyond verbal contributions. His affective investment in the activity reflects emotional engagement; however, the LT's timely prompt also revealed how emotional engagement can fluctuate without proper management. Finally, L4's sustained attention and responsiveness demonstrated cognitive engagement, countering the assumption that young learners have a limited attention span. His bodily shifts and verbal contributions underscore the interdependence of the three engagement

dimensions and point to the importance of teachers recognizing subtle multimodal cues when monitoring and supporting learner engagement.

HLA 2. *L1's engagement during the storytelling activity*
Pre-Engagement Phase

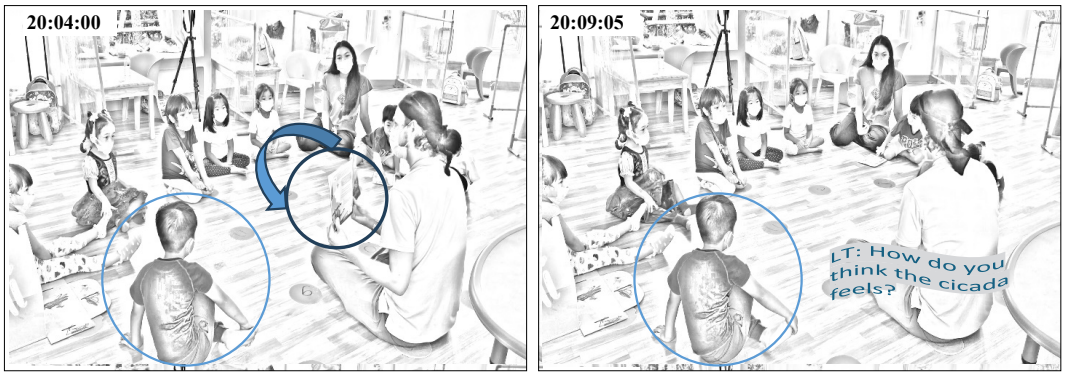

Figure 6. *Pre-Engagement Phase*

The second extract examines the engagement patterns of L1, who is seated to the left of the LT during the continuation of the storytelling activity. At the onset of the pre-engagement phase, the LT holds and displays a page of the storybook, panning it from right to left (20:04:00). He initiates the interaction with the question, "How do you think the cicada feels?" a reference to the cicada's predicament of having no food stored for the rainy days. Compared to Photo 1 (20:04:00), Photo 2 (20:09:05) shows a notable shift in the LT's gaze towards the right, signaling an opportunity for learners on that side to engage.

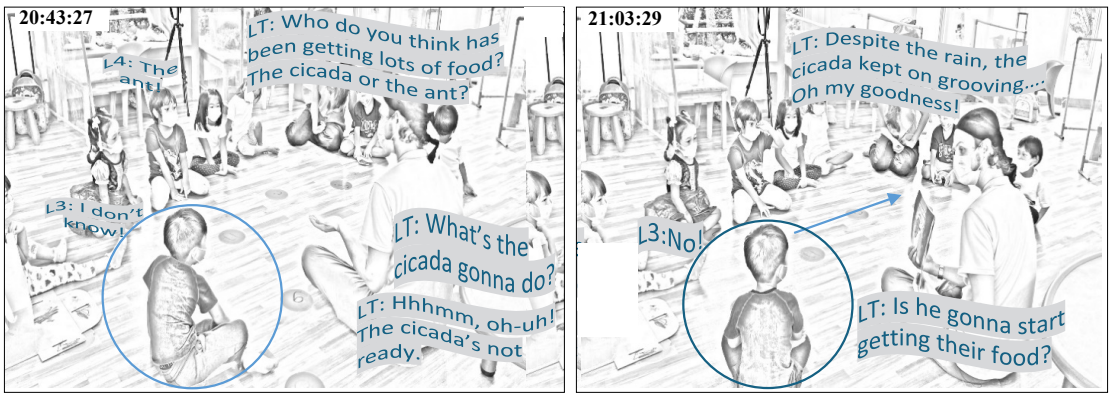

Figure 6. *continued*

During this sequence, L1 sat with bent knees with his left palm on the floor while maintaining a steady gaze toward the LT. Although he did not contribute verbally, his posture and gaze direction indicated attentiveness to the unfolding interaction. As the LT continued with inferential prompts, "Who do you think has been getting lots of food? The cicada or the ant?" and later, "What is the cicada gonna do?", other learners responded while L1 remained a quiet observer. Nonetheless, the LT's questioning escalated the cognitive demand, requiring predictions beyond recall.

The LT further sustained engagement through pauses, exclamatory phrasing, and personal commentary, turning narration into an interactive event rather than a passive reading. By prompting learners to anticipate the cicada's next move, "Is he going to start getting their food?", he heightened suspense and fostered active participation. Taken together, L1's non-verbal attentiveness demonstrates behavioral engagement, showing that silence does not equate to disengagement. His consistent orientation and steady gaze also reflect emotional engagement, as learners, including those who are silent, such as L1, are prompted to process

information and make predictions internally. These findings underscore the importance of multimodal strategies that support all three dimensions of engagement, ensuring that even less vocal learners are actively involved in the meaning-making process.

During the Engagement Phase

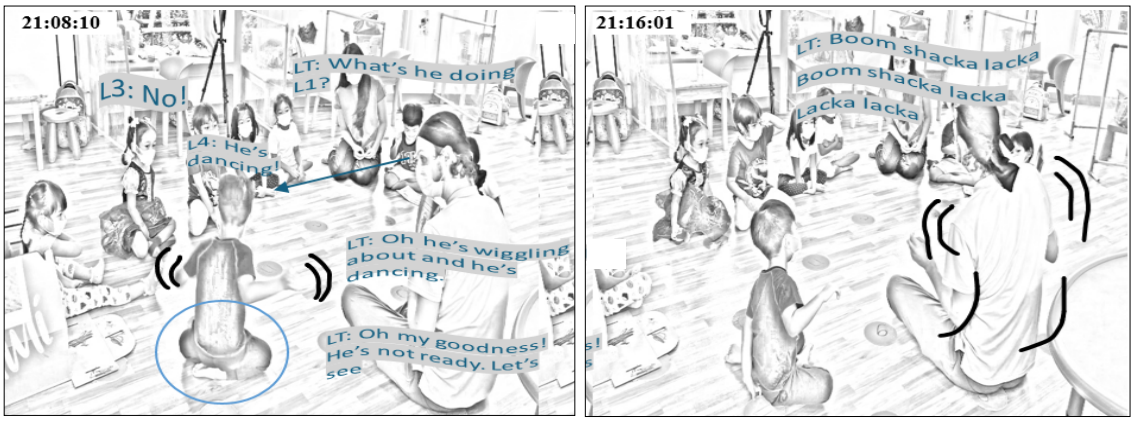

Figure 7. *During the Engagement Phase*

The LT's series of questions in this phase blurred the distinction between the pre- and during-engagement phases. When he asked, "What is he gonna do, L1?" (21:08:10), it was L4 who responded first with, "He's dancing!" Simultaneously, L1 quickly raised his upper body and flipped his arms, physically imitating the cicada's movement. The LT built on these responses by exclaiming, "Ohh, he's wiggling about and he's dancing. Oh my goodness! He's not ready. Let's see!" He then initiated the rhythmic chant, "Boom shacka lacka, Boom shacka lacka, lacka lacka!" (21:16:01) while swaying his body from side to side.

Figure 7. *continued*

This spontaneous shift from narration to performance prompted L3 and L4 to stand and dance. Observing his peers, L1 soon joined in, raising his hands and shaking his feet (21:20:25). This sequence demonstrated how engagement extended beyond verbal participation, with bodily initiation and group movement enriching the interaction.

This phase underscored the inclusive nature of the LT's questioning technique. Although the prompt was directed at L1, L4's immediate response showed how classroom questions often elicited broader participation, creating collaborative opportunities. While this opened space for peer-supported learning, it also suggested the risk that quieter learners might rely on more vocal peers. The fluidity of the phase transitions illustrated that engagement was not linear but interconnected, with learners shifting between observation and participation.

Altogether, L1's movement from silent observation to embodied participation reflected behavioral engagement, while his playful imitation of the cicada signaled emotional investment in the activity. The LT's use of chanting, body movement, and questioning encouraged cognitive engagement, prompting learners to interpret and enact the story beyond recall. This extract illustrates how verbal and non-verbal participation coexist to sustain attention and foster deeper involvement, highlighting the effectiveness of multimodal storytelling in early childhood learning environments.

Post-Engagement Phase

Figure 8. *Post-Engagement Phase*

Distinguishing between engagement phases in a storytelling activity was not always clear, as interactions often overlapped and evolved dynamically. In this instance, the LT briefly interrupted the narrative to manage learner participation. Four learners continued dancing enthusiastically (21:27:25) while the LT attempted to redirect them, remarking, "Oh, silly, silly cicada!" before reading the following line, "And with the music, he kept grooving…" When the learners did not immediately stop, the LT paused, observing their movements before saying, "Alright, yeah, alright." Here, "Alright" functioned as a directive to cease dancing, while "Yeah" validated their enthusiasm.

This episode illustrated the interconnection between classroom management and engagement. The LT's pause served as an implicit cue, giving learners space to regulate their behavior, while his verbal prompt provided the explicit boundary needed to transition back to the story. By first permitting playful movement and then re-establishing focus, the LT balanced active participation with instructional flow.

From an engagement perspective, the learners' dancing reflected behavioral engagement through sustained physical involvement, while their laughter and enthusiasm demonstrated emotional engagement. The LT's validation of their playfulness supported affective investment even as he guided them back toward the lesson. Meanwhile, the return to the narrative required cognitive engagement, as learners shifted attention from movement back to the storyline. This interaction highlighted the importance of adaptive teacher strategies that both encourage learner motivation and maintain purposeful progression of the activity.

DISCUSSION

This study examined the engagement styles of young learners during Circle Time storytelling by analyzing the pre-, during, and post-engagement stages across two video extracts. Findings revealed that engagement is not static but dynamically shaped by the LT's multimodal scaffolding, learners' embodied responses, and peer interaction. More importantly, the results demonstrated how behavioral, emotional, and cognitive dimensions of engagement intersect and contribute to the meaning-making in the classroom storytelling.

In the pre-engagement stage, learners' behavioral readiness was elicited through LT's multimodal cues, such as gestures, gaze, body orientation, and book-panning movements that oriented attention and signaled

the start of the interaction. Open-ended prompts such as "Hmm, I wonder what happened here," combined with embodied actions, invited cognitive curiosity while simultaneously stimulating emotional anticipation. These multimodal strategies align with constructivist perspectives (Piaget, 1952), which emphasize that learning begins with active exploration rather than passive reception. Learners' embodied responses, such as leaning forward or adjusting gaze, reflect behavioral signals of attentiveness that are cognitively and emotionally anchored.

During the storytelling, engagement became dialogic (Alexander, 2008) and participatory. LT's questioning, affirmation, and expressive cues scaffolded learners' thinking while validating their contributions. L4's analogy linking the ant's role to adult responsibilities illustrates higher-order cognitive engagement (Bloom, 1956), while peer humor and playful exchanges created positive affective bonds that sustained attention (Fredricks et al., 2004). Simultaneously, embodied enactments such as dancing and singing lured the boundaries between teacher and learner roles, fostering both emotional investment and cognitive involvement in the narrative. The LT's use of subtle disciplinary cues ("Alright, yeah, alright") illustrates adaptive classroom management that preserves enthusiasm while channeling behavioral engagement back to task focus. This aligns with Vygotsky's (1978) notion of scaffolding within the Zone of Proximal Development, where affective support complements cognitive growth.

In the post-engagement phase, transitions highlighted the importance of balancing freedom with structure. LT's interlocutions and embodied directives functioned as cues to close down playfulness and reorient learners toward upcoming activities. While maintaining emotional validation through affirmations ("Yeah"), the LT simultaneously reinforced behavioral discipline and ensured continuity of instructional goals. This demonstrates that engagement does not end with participation alone, but requires consolidation through affective acknowledgement and a structured closing of the interaction.

Importantly, not all forms of engagement can be immediately verbalized. Delayed embodied responses, such as L1's movement synchronized with the cicada's dance, resonate with theories of embodied cognition (Gallagher, 2005; Gennari & Valentini, 2023; Glenberg, 2008; Wang & Hu, 2024). These underscore that learning extends beyond linguistic interaction unfolding in sensorimotor expressions and internal processing. Thus, engagement must be recognized as multimodal, situated, and embodied, requiring teachers to respond flexibly to diverse expressions of learners. Taken together, the three dimensions of engagement, behavioral, emotional, and cognitive, were deeply interwoven rather than discrete. Behavioral engagement was evident in learners' posture, gaze, and movement; emotional engagement was demonstrated through humor, affirmation, and enthusiasm; and cognitive engagement was shown through analogies, critical questioning, and real-world connections. However, these modes consistently overlapped. For example, L4's forward-leaning posture (behavioral) was tied to attentional focus (cognitive) and eagerness (emotional). Similarly, dancing (behavioral) embodied joy (emotional) while simultaneously reinforcing narrative comprehension (cognitive). This interplay reflects Norris' (2004) Multimodal (Inter)action Analysis, which conceptualizes engagement as socially co-constructed through interconnected semiotic resources.

The significance of this overlap lies in how multimodal teaching directly shapes the behavioral, emotional, and cognitive dimensions of engagement, thereby contributing to sustained learning. Multimodal studies emphasize that gestures, gaze, posture, and body orientation are not supplementary but central to meaning-making (Kendon, 2004; Müller, 2004; Norris, 2004) and pedagogy (Kress et al., 2005; Jewitt, 2008; Peng, 2019; Qin & Wang, 2021). Through the interplay of these modes, teachers guide attention, evoke emotional involvement, and scaffold cognitive processing. The success of classroom interaction thus depends largely on teachers' strategic orchestration of communicative modes such as their construction of multimodal ensembles serving specific pedagogic purposes (Qin & Wang, 2021). Although Qin and Wang (2021) used the term "lead-in," it parallels the concept of multimodal inputs in this study, which we refer to as the integrated verbal and embodied cues that stimulate learner engagement. When learners become accustomed to multimodal teaching, they may also actively reframe and extend their learning using various modes (Kwak, 2023). Even with limited linguistic proficiency, young learners can demonstrate understanding and participation through behavioral (e.g., hand-raising, gaze following), emotional (sustained attention, facial expressions), and cognitive (interpreting gestures or images) means.

The findings in this study not only support existing literature on these engagement manifestations but also extend it by showing how multimodal inputs simultaneously scaffold all three dimensions of engagement. This reinforces the view that engagement is a socially embedded, multimodally enacted, and holistic phenomenon crucial for fostering active participation in early language classrooms.

While the study offers valuable insights, its limitations must be acknowledged. Conducted in a single international school under COVID-19 restrictions with a smaller class size, the findings may not generalize to larger or more diverse contexts. Future research should investigate engagement in public schools in Thailand, where class sizes and instructional conditions differ significantly, as well as in post-pandemic settings where natural interaction can resume. Comparative studies across these contexts may reveal how multimodal engagement adapts to varying social and institutional constraints.

CONCLUSION

This study concludes that learner engagement in early childhood education is dynamic, multifaceted, and a temporal process. Multimodal cues and social interactions within the classroom have a profound influence on it. Instructional inputs significantly shape the dimensions of engagement, which are manifested in an overlapping and interconnected interplay of behavioral, emotional, and cognitive forms. The research highlights the critical role of multimodal strategies, such as gestures, gaze, and embodied actions, in inviting participation to create a rich learning environment. The variability in how learners engage underscores the necessity for differentiated instruction that is attuned to individual preferences and fosters active participation rather than passive learning.

Author Contributions

D. Parohinog: Conceptualization, Data curation, Writing – Original Draft, Writing – Review & Editing, Methodology; **W. Trakulkasemsuk:** Conceptualization, Supervision, Validation; **S. Vungthong:** Conceptualization, Supervision, Validation.

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Ethical Approval

King Mongkut's University of Technology Thonburi (KMUTT-IRB-COA-2021-026). Informed consent was obtained from all the participants involved in this study.

Competing interest

The authors declare no conflicts of interest.

Data Availability

Data will be made available by the corresponding author on request.

Declaration of Artificial Intelligence Use

In this work, the authors utilized AI tools (ChatGPT Open AI) for language editing only. The content is originally composed by the authors. The authors take full responsibility for the published content.

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