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Exploring Features Within Organizational and Cognitive Factors That Predict Variability in Estimates of Classwide Active Engagement

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Abstract

Adopting an "act-in-context" approach is helpful to researchers investigating situational variability in children's active engagement in preschool classrooms. Aligned with this approach, we propose an empirical pathway and a conceptual model to support examinations of contextual factors hypothesized to impact active engagement as well as the means by which adults promote it. We defined two overarching factors—cognitive and organizational—and explored the predictive nature of seven features within them. With video recordings from 31 classrooms (inclusive and self-contained) of three instructional routines on three different occasions, we derived averages for classwide active engagement during each observation. A series of linear mixed effects models revealed that instructional routines significantly predicted variability in classwide active engagement as did interactions of other contextual features with instructional routines. These findings provide a foundation for continued, systematic examinations of situational factors and conceptualizations of engagement within carefully specified pathways for improving active engagement.

Keywords

engagement, preschool, classroom context, learning opportunities, instructional routines

Engagement has been a long-standing interest of educators, researchers, and policy makers given that learning does not occur without it (e.g., Fredricks et al., 2004). Variations in learning and developmental outcomes for children are often attributed to differences in children's developmental skills and the interaction between those skills and the delivery of learning opportunities that promote varied forms of engagement (Fredricks et al., 2004). In fact, there are several empirical demonstrations of the direct associations between learning opportunities that promote active engagement and young children's progress on education plans as well as social, academic, school readiness, and developmental outcomes (e.g., Mashburn et al., 2008; Williford et al., 2013). For young children with developmental delays or disabilities, policy statements amplify the importance of these research findings. They underscore that the delivery of learning opportunities needs to be optimized to promote active forms of engagement so that *all* children are fully participating in *all* routines in *all* types of preschool classrooms (National Association for the Education of Young Children [NAEYC], 2020; U.S. Department of Health and Human Services & U.S. Department of Education, 2015).

As researchers examine ways to actualize this objective, adopting an "act-in-context" approach may be helpful (Hayes et al., 2012). It presents a unique opportunity to consider and study the actionable variables and causal mechanisms related to child active engagement and the developmental outcomes of children with delays or disabilities. In this approach, attention to the contextual influences on children's engagement within and across the array of early childhood programs becomes paramount and useful, as the child behavior (i.e., engagement) is never disconnected from the context in which it occurs (Hayes et al., 2012).

Exploring a Pathway to Enhancing Engagement and Improving Outcomes

Consistent with an "act-in-context" approach (Hayes et al., 2012), Figure 1 (see top panel) offers an example of an empirically testable causal pathway that guides our exploration of contextual influences on children's

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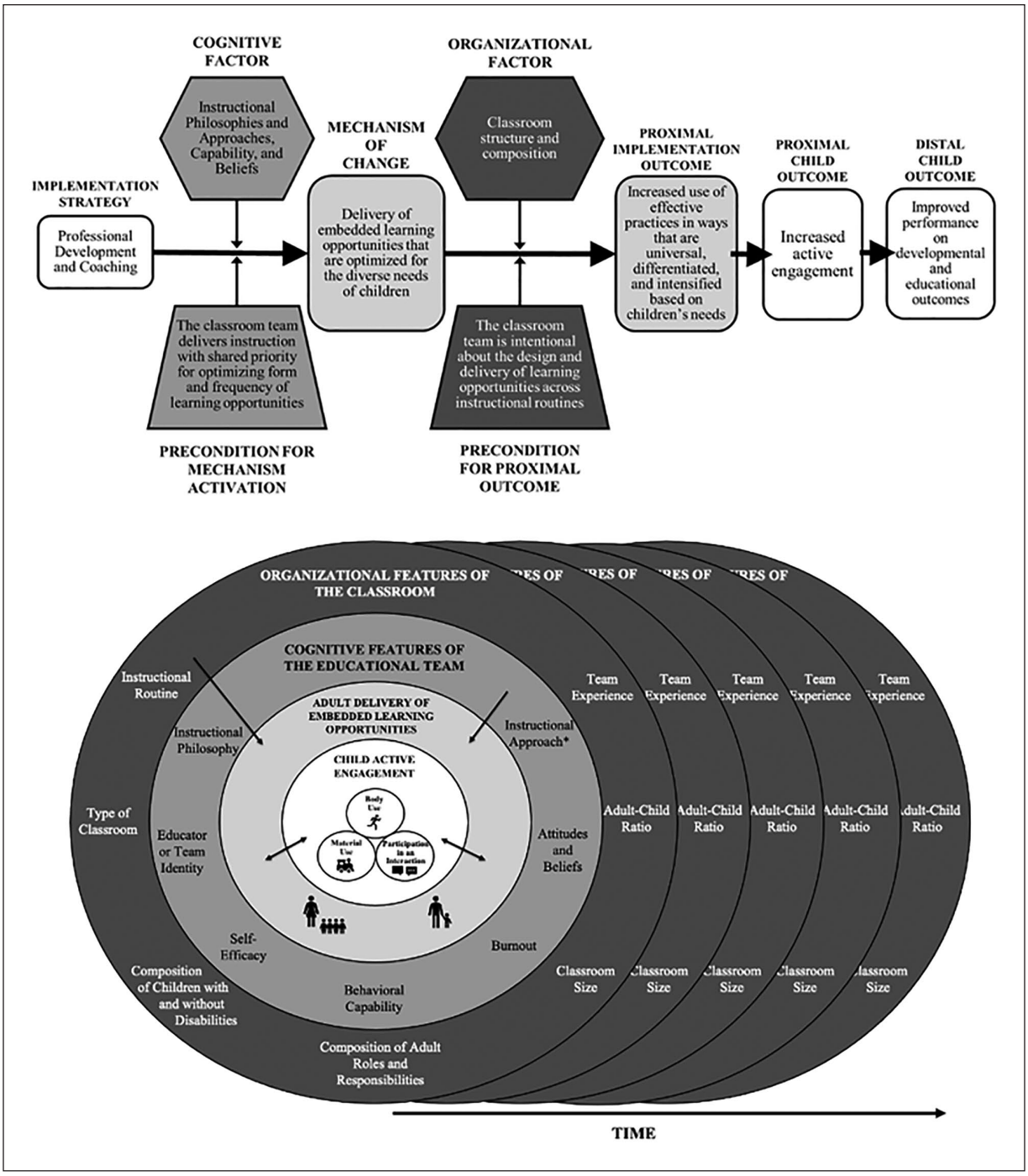

Figure 1. Causal pathway (top) and conceptual model (bottom) to guide exploration of contextual and situational influences on adult practice use, active engagement, and child outcomes.

engagement. We situate this work within implementation efforts that support preschool educational teams in producing meaningful impact on children's developmental outcomes (Lewis et al., 2018) through embedding learning opportunities into their classrooms' natural routines (e.g., Snyder et al., 2018). In presenting this work, it is important to acknowledge that there are existing empirical examinations of contextual influences within preschool classrooms (e.g., Coelho et al., 2019; Kook & Greenfield, 2020). Although the discussion of these influences may not seem new, implementation efforts to date have produced suboptimal outcomes for children with disabilities and delays in

routine practice (e.g., Early Childhood Technical Assistance Center & Center for IDEA Early Childhood Data Systems, 2020; Merrill et al., 2020). From an implementation science perspective, explicitly defined causal pathways provide testable opportunities to predict outcomes and test implementation strategies meant to influence the mechanisms that bring about change in those outcomes (Lewis et al., 2018). This approach to defining causal pathways within a theoretical or conceptual model is a necessary next step for bringing about meaningful, broad scale improvement in outcomes for children through learning opportunities created by preschool classrooms.

In the causal pathway presented in Figure 1, educators' delivery of embedded learning opportunities is a critical mechanism in the learning process (Snyder et al., 2018), as it represents a process through which outcomes are achieved (Lewis et al., 2018). To support the range of child ability levels and needs, the delivery of these learning opportunities can take on different forms and functions when embedded in routine preschool activities and environments (Horn & Banerjee, 2009). For example, as educators work to promote active engagement for children with disabilities, they can increasingly differentiate (e.g., visual support with a verbally provided opportunity to respond; MacSuga-Gage, & Simonsen, 2015) and intensify (e.g., increased frequency and intentional use across routines; Fuchs et al., 2017) to optimize impact.

Like child engagement itself, the use of certain practices to deliver learning opportunities does not occur in a vacuum. Rather, it occurs within the dynamic nature of preschool learning environments. Features within these preschool contexts need to be empirically examined, given their potential influence on key mechanisms of change and relations to children's outcomes (Hayes et al., 2012; Vitiello et al., 2012). In studying these factors that contribute to the contextual and situational variability in practice use, it is helpful to consider the potential contribution from both a conceptual perspective (Pianta & Hamre, 2009) and a measurement perspective (Kane, 2013). The factors in this pathway assume different forms, exert different influences relative to the mechanism of change and outcomes, and present different opportunities to consider how they facilitate or hinder achieving a greater impact on children's outcomes.

In exploring the causal pathway presented in Figure 1 (top panel), we first conceptualize cognitive factors, such as the classroom pedagogy or predominant instructional philosophy, which may influence educator teams as they make decisions about how to arrange their instruction and what specific practices to use as part of a learning process (Phillips et al., 2020). Those decisions manifest in the observable forms that learning opportunities take as a mechanism for promoting children's engagement. Following those decisions, organizational factors may exert an influence on how learning opportunities are delivered within the classroom's natural routines. Organizational features of the classroom, such as the type (e.g., inclusion vs. self-contained) and composition (e.g., percentage of children with Individualized Education Programs [IEP]) of the classroom, influence how instructional practices are used to meet children's differentiated and intensified needs (Mashburn et al., 2008; Pianta et al., 2009). Given the empirical importance of these factors within this casual pathway, we further hypothesize that these two factors—cognitive and organizational—can have a cascading effect influencing educator practice selection and use, which in turn influences children's engagement across classrooms' natural routines. With this premise, our team conceptualized and explored specific features of the preschool context relative to child engagement to provide a foundation for future examinations of causal mechanisms associated with actionable opportunities for change.

Importance of Preschool Classroom Context Relative to Child Engagement

Because child engagement is a complex, multifaceted, and dynamic construct, there are variations in how it is, and any potential influencing factors are conceptualized, operationalized, sampled, and measured by researchers (Appleton et al., 2008; Fredricks et al., 2004). Inferences about the role of engagement in relation to child outcomes are predicated on the specific goals and various methodological decisions researchers make in their treatment of contextual features that envelop engagement as well as engagement itself. As a first step in organizing the empirical work that is necessary to understanding how to optimize preschool classroom learning environments to bring about positive impact on outcomes for *all* children, we provide a conceptual model within the bottom panel of Figure 1.

A Conceptual Model to Guide "Act-in-Context" Exploratory Efforts

The proposed conceptual model is not exhaustive or complete. Rather, informed by the theoretical and empirical foundations provided by implementation scientists (e.g., Damschroder, 2020), the intent of this model is to offer a conceptualization to guide empirical examination of classroom contextual features as a precursor to efforts designed to promote sustained, routine use of efficacious practices in preschool environments. Furthermore, this model is explicit in recognizing the dynamic nature of preschool classrooms and calling for empirical examinations of cognitive and organizational features that may change over time within and across natural daily routines (Booren et al., 2012). Early

conceptualizations of how different factors have varying effects based on histories of reinforcement (Baum, 2002), and more contemporary recognition that substantial variance in classrooms may be attributed to the situations from which observational samples were drawn (Pianta & Hamre, 2009), highlighting the importance of considering time relative to inferences about child engagement.

We place active engagement in the center of the model. As described by Fredricks et al. (2004), there are three forms of engagement that are often represented in the literature—behavioral, emotional, and cognitive—that interact in dynamic ways to facilitate learning. For children with developmental delays or disabilities, a focus on observable behaviors associated with acquiring skills, indicators of connection and affect during opportunities for learning, and signs that learning is taking place may help to explain why some children make developmental advances while others do not (Williford et al., 2013). Therefore, measurement of components that reflect active and observable forms of engagement demonstrated through children's (a) use of their body to participate in activities and tasks, (b) manipulation of materials, and (c) participation in social interactions with their classroom peers and adults in ways that align with the expectations and demands of the preschool classroom (Bailey & Wolery, 1992; McWilliam & Casey, 2008; Vitiello et al., 2012) may enhance our explanatory power relative to other, more distal learning outcomes. With the intent to promote developmentally appropriate participation behaviors by children during learning opportunities embedded within classroom routines, *active engagement* is our key outcome as opposed to passive forms of engagement often characterized by body orientation, watching, and on-looking (e.g., Kemp et al., 2013). Moving out from the center is adult delivery of embedded learning opportunities, a key mechanism for producing changes in children's engagement within our causal pathway. Consistent with transactional theories of development (Sameroff, 2009), both the child's (or children's) engagement and adult delivery of learning opportunities are continually impacting one another (depicted with a double arrow). Furthermore, when the focus is on promotion of active forms of engagement, greater importance is also given to the actions adults may take to facilitate children's active engagement within a dynamic learning context. When the goal is to more precisely examine the classroom context in relation to children's engagement, this type of situational variance (Pianta & Hamre, 2009) that unfolds over time highlights the importance of examining cognitive and organizational features through systematic sampling across a school day (e.g., different types of classroom routines) and across days (e.g., a specific classroom routine on different days).

Cognitive features. Cognitive features are placed within the first level of this model to emphasize features that may influence decisions educators make as part of their selection and delivery of instructional practices. That is, these features may contribute to the situational variations in what individual educators do to facilitate engagement within and across instructional routines and time. To operationalize features that may be relevant at this level, our team drew heavily on two literature bases. First, we reviewed behavior change models, such as the theory of planned behavior (Ajzen, 1985) and social cognitive theory (Bandura, 1986), that supported our inclusion of three features: attitudes/beliefs, self-efficacy, and behavioral capability. Second, we sought out investigations that explored cognitive features associated with educator–child interactions (Ansari & Pianta, 2018) to capture additional features previously associated with and more proximal to the types of practices adults use in classrooms to promote children's engagement. This informed the addition of four more features to the conceptual model: instructional philosophy (Yu et al., 2018), educator or team identity (Arndt et al., 2018), burnout (e.g., Sandilos et al., 2020), and instructional approach (e.g., adult or child-centered; Pianta et al., 2009).

Organizational features. Organizational features are placed in the final level of this model to represent elements that are generally easy to observe or report as the classroom characteristics (Burchinal, 2018). These features likely create a context for how educators deliver learning opportunities that are further differentiated and intensified as part of a learning process that fosters children's active engagement (Fuchs et al., 2017; MacSuga-Gage, & Simonsen, 2015). Grounded in the literature on structural elements of early childhood classrooms (Mashburn et al., 2008; Pianta et al., 2009), we hypothesize that these features include but are not limited to the instructional routine, the classroom type, the composition of adult roles and responsibilities (e.g., special educators, assistants), the composition of children with and without disabilities, number of children in the classroom, adult–child ratio, and experience as a team. Although empirical examinations of these organizational features exist (e.g., Booren et al., 2012; Powell et al., 2008; Vitiello et al., 2012), conceptualizing them within the model displayed in Figure 1 informs systematic examinations of the degree to which these features create a classroom context that is uniquely predictive of children's active engagement.

Purpose

An important precursor to examining the effects of specific mechanisms on children's engagement, particularly for children with developmental delays and disabilities who participate in a broad array of learning environments, is an understanding of the context in which those mechanisms might exist within classrooms. Features of preschool classrooms may predict variability in children's active

Table 1. Summary of the Overarching Factors and Individual Features Examined and Their Measurement.

Factors and features	Categories	Measurement	Method
Cognitive features			
Instructional approach	1. Mostly adult-directed: adults' goals drive the instruction 2. Mostly child-directed: children's interest and attention drive instruction 3. Balanced between adult-directed and child-directed	Classroom	Classroom enrollment form[a]
Organizational features			
Instructional routine	1. Large group: A routine with the whole class that an adult is leading 2. Small group: A routine with a subset of children that adult is leading 3. Exploratory play: A routine with the whole class, wherein children direct their participation and freely choosing from the activities	Session	Identification by the lead educator
Classroom type	1. Inclusive: Includes children with and without disabilities 2. Self-contained: Includes only children with disabilities	Classroom	Classroom enrollment form[a]
Classroom size	1. Small (n = 2–8 children) 2. Medium (n = 9–15 children) 3. Large (n = 16–20 children)	Session	Review of video recording[b]
Adult–child ratio	1. <1:4 2. 1:4 to <1:2 3. 1:2 to <1:1 4. 1:1 5. >1:1	Session	Review of video recording[b]
Percentage of children with disabilities	1. Few: 25% or less 2. Many: more than 25% but <100% 3. All: 100%	Classroom	Child enrollment form[a]
Team experience	1. Novel: Most of the team worked together for <3 years 2. Mixed experience: Some team members worked together for <3 years and others worked together for 3 or more years 3. Experienced: Most of the team worked together for 3 or more years	Classroom	Classroom enrollment form[a]

[a]The lead teacher completed two enrollment forms. One provided information about classroom characteristics (e.g., classroom type, instructional approach, and team experience), and one provided information about the child (e.g., gender, age, race, ethnicity, and disability). [b] When reviewing session video recording to determine class size and adult–child ratio, a research assistant paused a video recording at 3 min, counted the number of children and number of adults seen on the video, and recorded it on a spreadsheet.

engagement in ways that could determine the degree to which certain mechanisms (i.e., embedded learning opportunities) may be effective. Rather than treat these features as things to be statistically controlled, this study seeks to explore the dynamic ways in which classroom features may explain variability in engagement such that instructional practices may be more effectively designed, delivered, and supported for all children. Therefore, the following research question guided our exploratory work: In a sample of preschool classrooms, how do one potential *cognitive feature of the educational team*, (a) instructional approach, and other potential *organizational features of the classroom*, (b) instructional routine, (c) classroom type, (d) classroom size, (e) adult-child ratio, (f) percentage of children with disabilities, and (g) classroom team experience meaningfully, predict variability to estimates of classwide child engagement?

Method

Participants

This study took place across 31 publicly funded preschool classrooms, within 12 early childhood sites, in 5 school districts in a midwestern U.S. state. Of the 31 classrooms, 15 were classified as self-contained, serving only children with disabilities (n = 65 children). These classrooms ranged in size from 2 to 11 children (M = 5.6, SD = 2.0) with adult–child ratios ranging from >1:1 to <1:4 (M = 1:1.8). In terms of the classroom team experience, nine were novel and six were mixed experience (see Table 1). The other 16 participating classrooms were classified as inclusive, serving children with and without disabilities (n = 243 children). These classrooms ranged in size from 4 to 20 children (M = 14.3, SD = 3.1) with adult–child ratios ranging from <1:1 (i.e.,

one adult for every 1–2 children) to <1:4 (i.e., one adult for more than four children; M = 1:4.4). The team experience was more variable, with five reporting novel experience, seven reporting mixed, and four reporting experienced. Overall, most classrooms reported that they adopted a balance of adult-directed and child-directed instructional approaches (n = 16 inclusive; n = 8 self-contained); three self-contained classrooms reported they were mostly adult-directed and four self-contained classrooms mostly child-directed.

Across these classrooms, a total of 308 children and 79 adults participated in this investigation. Children ranged in age from 3 to 6 years (M = 3.9, SD = 0.7). Broken down by sex, 122 (39.2%) were female and 186 (60.8%) were male. Of the 293 children whose parents provided demographic information on race, two (0.7%) were American Indian, 20 (6.8%) were multiracial, 27 (9.2%) were Asian, 36 (12.3%) were Black, and 208 (71.0%) were White. Twenty-four children were of Hispanic or Latino ethnicity (8.2%). In this sample, 121 (39.2%) children received special education services and had an IEP. For the adults, one identified as male, and 78 identified as female. In terms of race, one adult identified as Asian, one adult identified as bi-/multiracial, and 74 adults identified as White. Adults held a range of professional roles, including general education teacher (n = 10), general education teaching assistant (n = 10), special educator (n = 17), special education teaching assistant (n = 30), speech–language pathologist (n = 11), and occupational therapist (n = 1). Most adults (n = 66) reported involvement in most (i.e., 2–3 routines most days) or all the instructional routines, while only nine adults indicated more limited involvement (i.e., 1–2 instructional routines per day).

Measures

Cognitive and organizational features as the predictor variables. Table 1 provides a detailed description of the categories, the level of measurement, and the measurement method for each feature that was included as a predictor variable. We examined seven classroom features: *one cognitive* (i.e., instructional approach) and *six organizational* (i.e., instructional routine, classroom type, classroom size, adult–child ratio, percentage of children with disabilities, and team experience). For this exploratory study, our examination was constrained to only those seven features, given the broader research project in which this work is situated. All features were broken into two to five mutually exclusive categories and measured at the classroom or observation session level.

Classwide active engagement as the outcome variable. Classwide active engagement, or the percentage of students actively engaged during each observation occasion, served as the outcome variable in our analyses. Our team worked with the premise that children's opportunities to demonstrate engagement through skill use (e.g., using objects in ways aligned to the activity, demonstrating motor responses, participating in an interaction) are important mediators of learning (Bailey & Wolery, 1992; McWilliam & Casey, 2008; Vitiello et al., 2012). Therefore, our measurement focused on active rather than passive forms of engagement (e.g., Kemp et al., 2013). We developed a decision guide for observers assessing active engagement at 1-min. intervals. Using the decision guide, observers identified if a child was *not* actively engaged, as this approach minimized error attributable to observers needing to make inferences about the universe of child behaviors that may represent active engagement. The main aspects of the guide include (a) did an adult establish a learning context for active participation, *and* (b) was the child's body use aligned with the learning context, *and* (c) was the child's material use aligned with the learning context *or* was the child participating in an interaction? Our team developed each aspect of the decision guide with definitions that allowed for variability in the form of a child's behavior, based on either the child's developmental skills or aspects of the instructional routine (complete coding manual available from the first author). With this guide, at 1-min intervals, observers completed a scan of the entire classroom to determine how many children were *not* actively engaged to ensure we captured all observable forms of active engagement showing developmentally appropriate skill use. We subtracted the number of children identified as not actively engaged from the total number present to derive the percentage of children actively engaged during each classwide scan for the duration of the observation. For our analyses, the classroom outcome variable represented an average of all classwide scans for all coders across all occasions.

Data Collection Procedures

The University Institutional Review Board approved all study procedures before we enrolled adults and children. We invited and provided a consent form to all adults working in the classroom and parents of all children enrolled in each classroom. We also provided all adults and children in the classroom with large, colored stickers to wear during video recording to facilitate later video processing and coding. We provided any individual who did not consent to participate with a red sticker to wear during the observation so that we could blur their image before any coding or review by the research team. If any staff member or parent expressed concern about the video gathering procedures during the consent process or if <50% of families consented, we excluded the classroom from the study. We excluded nine classrooms based on these criteria.

The procedures we used to collect classroom-level data for each predictor variable varied by the factor and the features within it (see Table 1). At the onset of the video collection, the classroom lead educator and parents of participating children completed study enrollment forms. For each observation session, the lead educator verified the instructional routine being video recorded and a researcher recorded the number of children present for the routine.

To collect video needed to facilitate coding of classwide engagement, our six-person data collection team used Swivl™, a robot and software system that uses a tethered iPad® to capture high-definition video and audio using microphones worn by each consented member of the classroom team. We intentionally gathered video during three types of instructional routines: adult-directed large group (LG), adult-directed small group (SG), and child-directed exploratory play (EP). These routines represent the daily instructional context in which learning opportunities are often embedded as part of naturalistic instruction within preschool classrooms (NAEYC, 2020) and facilitate examinations of situational variance within a single day of instruction. For each classroom, we attempted to video record up to 15 minutes from the beginning of the routine and at three different time points (approximately once per week across 3 weeks). Across our sample, 87% ($n = 27$) of classrooms participated in all nine observations (three instructional routines and three occasions each). One classroom did not conduct a routine that met our definition of SG and a second did not conduct a routine that met our definition of EP (see Table 1 for definitions), so data are not available for these routines in these classrooms. Furthermore, within each routine, there was one classroom that only provided two occasions. Across all video recordings of instructional routines, for EP, we obtained 92 video recordings with a mean duration of 13.93 min ($SD = 2.38$, range 6.55–16.15). For LG, we obtained 89 video recordings with a mean duration of 12.96 min ($SD = 3.52$, range 3.03–16.08). For SG, we obtained 89 video recordings with a mean duration of 14.68 min ($SD = 1.07$, range 8.07–15.33).

The second author trained and supervised the video collection team to implement specific procedures for conducting video observations to facilitate later coding of classwide active engagement. First, to obtain as naturalistic a sample as possible, our team did not provide any specific instructions to the adults before video collection aside from asking them to position themselves and interact as they "normally do." We provided stickers for all adults and all children to wear during the observations, which were practiced before video recording to reduce novelty. Second, to standardize the classwide engagement scans within each routine, at each interval a member of the research team focused the camera on each natural grouping of children, remaining on the group for at least one second per child before moving to the next natural grouping. We repeated this procedure until we captured all children in the classroom on video. A second member of the research team was present for each observation to prompt and verify the accurate completion of scans at each interval for the session's duration.

Following video capture, one of two research assistants reviewed each video. They (a) confirmed the integrity of each engagement scan for coding and indicated if a specific scan should be excluded from coding due to low video or audio quality and (b) indicated which adults or children in the classroom required image blurring before any additional coding and use of the video. We collected this information on a form, which our video processors used to blur images and make audio and video adjustments to each video before coding. Our video coders then used the form to know which engagement scans to exclude from coding to reduce measurement error attributable to factors beyond the targets of measurement and the coders. This process, combined with unequal session durations due to classroom variations, contributed to the unequal number of engagement scans by routine. Aggregated across all occasions within a routine, our team conducted an average of 13.29 ($SD = 2.84$) engagement scans per video, with range from 2 to 15 for LG; an average of 10.38 ($SD = 3.89$) scans per video, with range from 1 to 15 for SG; and an average of 12.29 ($SD = 3.57$) scans per video, with range from 2 to 15 for EP.

Engagement Coder Training and Agreement

The first author and a research assistant trained three bachelor's-level video coders with previous research experience to code all sessions for all classrooms. The coder training process began with an extended coding manual development phase. We used portions of the gathered videos to inform the definitions of each aspect of the decision guide (i.e., learning context, body use, and material use/participation in an interaction), with examples and nonexamples representing each instructional routine. Simultaneously, we trained coders to use a new, web-based observation system developed by our team, ENGAGE, to record the number of children not actively engaged based on the decision guide. When using ENGAGE, for the purpose of this study, the system was set to automatically prompt coders to conduct a classwide scan at 1-min intervals (e.g., a 15-min observation included 15 classwide scans). During each scan, coders tapped a button on the screen to record if a child was not actively engaged. During training, we also explained procedures for visually scanning the classroom during each classwide scan, which also varied slightly by instructional routine. When coding videos from LG, all children were visible in the full camera frame, so coders began their scan with the child located in the top center of the screen and visually moved clockwise around the group, tapping a button on the screen as they scanned the group to record each child that was not actively engaged. This procedure varied

slightly for videos of SG and EP routines in that the camera focused on natural groupings of children as they were distributed around the classroom. Coders used the same clockwise visual scan and recording procedures within each grouping until all groupings were scanned. Coders allotted approximately 1-s per child during the scan such that each classwide scan lasted approximately 10 to 25 s. This scanning and recording process was repeated at 1-min intervals for the duration of the observation.

Once our team reached a consensus about definitions and procedures, all videos were grouped by instructional routine (i.e., LG, SG, and EP) so that the coding process was completed for all videos of one routine at a time. This approach allowed for a brief training and recalibration at the onset of coding all videos for a specific instructional routine. The ENGAGE system's output provided the total number of children not actively engaged for each scan and the total number of children present for the session. We used these data to evaluate coder agreement at the scan and sessionlevels based on the percentage of children engaged. During the training process, we designated one primary coder such that agreement across all coders was relative to the primary. All coders demonstrated a minimum of 80% exact agreement at the session level at the end of each training and recalibration phase. For engagement data used in subsequent analyses, agreement across all three coders at the sessionlevel was moderate to high based on interpretive guidance from Koo and Li (2016). Specifically, we calculated intraclass correlations (ICC; two-way random effects, consistency in means model) for all data generated by each possible coder pairings for each routine, producing correlations that ranged from .80 to .86; .57 to .90; and .71 to .90 for the LG, SG, and EP routines, respectively.

Data Analysis

To start, we computed overall descriptive statistics and then descriptive statistics by predictor variable. Our descriptive analysis revealed substantial variability in classwide active engagement between instructional routines. This finding led us to examine the summary statistics for the other six features by routine and not solely in aggregate. From there, to determine the appropriate statistical models for our data, we conducted a visual analysis of classwide active engagement overall and for each level of each predictor variable separately. The visual analysis of classwide engagement revealed slight negative skew in the SG and EP routines (with most students in most classrooms actively engaged) and positive skew in the LG routine (most students in most classrooms were not engaged). When examining the residuals from fitted models that assumed normality (see below for model details), however, we observed symmetry in the residual distribution. We did not consider nonlinear models further.

To separately test the effects of each predictor on classwide active engagement, we fit a series of linear mixed-effects models. In each model, the percentage of children actively engaged for the observation session was the dependent variable. First, we fit a fully unconditional model to the data, where only the random effects of classroom, observation occasion, and coder were included. The ICC for classrooms = .02 and all other ICCs < .001 (occasion and coder). Despite the low variance, the random effects were left in the models to accurately reflect the study design. Second, because the descriptive analysis revealed substantial between routine variability in classwide active engagement, we fit a conditional model including a fixed effect for instructional routine. Finally, for the other six predictors (all but instructional routine), we fit an additional model that included the predictor variable and an interaction term between the predictor variable and instructional routine. Informed by both the literature that suggested variation by routine (e.g., Kemp et al., 2013; Powell et al., 2008) and our descriptive data, we found it necessary to fit models for the six predictors with instructional routine as an interaction.

We treated all predictor variables as fixed effects and dummy coded for use in the models. In all models, EP was treated as the reference group (represented as the intercept in each model provided in the supplementary materials) given that classwide engagement was consistently high. For the other six features, we treated the following category as the reference group: (a) *balanced classrooms* for instructional approach, (b) *self-contained classrooms* for classroom type, (c) *large classrooms* for class size, (d) *adult–child ratio <1:4* for adult–child ratio, (e) *all students (100%)* for percentage of children with disabilities, and (f) *experienced team* for classroom team experience. We used the lme4 package in R Studio (R Core Team, 2015) to fit the models, and parameters were estimated using full maximum likelihood. Given that models contained random effects, we assessed statistical significance via a set of nested deviance tests.

Results

Across all classrooms, observations, and coders in our sample, the average percentage of classwide active engagement was 70.76% (*SD* = 32.74%) and ranged from 0% to 100%. Organized by the seventh predictor—instructional routine—given the significant differences between the routines, Table 2 provides a summary of the descriptive statistics for classwide active engagement relative to the six other predictor variables we explored. We will highlight the descriptive statistics and statistically significant results from the conditional models for each of the features next. We provide full results for each model in the supplemental materials.

Table 2. Descriptive Statistics for Classwide Active Engagement by Predictor Variable and Routine.

		Adult-directed large group		Adult-directed small group		Child-directed exploratory play	
Predictor Variable	*n*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Overall	31	28.70	16.59	90.87	13.24	93.62	7.26
Instructional approach							
Balanced	24	30.88	16.97	94.22	9.59	95.16	4.27
Mostly adult-directed	3	21.26	9.82	82.26	10.98	84.35	12.90
Mostly child-directed	4	20.74	14.12	74.89	19.88	91.07	10.12
Classroom type							
Inclusive	16	28.90	15.55	96.42	5.59	95.35	3.60
Self-contained	15	28.48	17.69	85.37	16.07	91.63	9.58
Classroom size[a]							
Small (*n* = 2–8)	16	29.57	18.85	86.26	15.55	90.61	9.97
Medium (*n* = 9–15)	18	26.83	13.32	94.15	10.55	95.42	3.63
Large (16–20)	8	30.18	16.62	96.55	4.47	96.02	3.28
Adult–child ratio[a]							
<1:4	13	30.50	15.80	96.92	3.83	95.11	3.79
1:4 to <1:2	18	27.52	13.40	92.45	12.60	95.90	3.34
1:2 to <1:1	15	29.48	18.71	85.75	15.76	91.55	8.68
1:1	4	22.26	23.31	97.28	1.25	88.37	14.91
>1:1	2	15.00	13.33	90.04	7.87	81.25	13.01
Percentage of children with disabilities							
Few (<25%)	9	31.88	15.64	96.72	3.64	94.97	3.58
Many (25%–99%)	7	25.21	14.73	96.09	7.17	95.79	3.61
All (100%)	15	28.48	17.69	85.37	16.07	91.63	9.58
Team experience							
Novel	14	25.33	14.31	87.57	15.91	91.54	9.45
Mixed experienced	13	33.74	18.72	93.39	9.59	95.30	4.02
Experienced	4	24.22	12.28	94.94	9.23	95.56	3.88

[a]Classroom size and adult-child ratio varied by occasion (i.e., time-varying covariates). As such, the number of classrooms sums to >31 for those two variables.

Cognitive Feature

Instructional approach. On average and across all instructional routines, the classrooms that used a balanced instructional approach had the highest overall classwide active engagement. Across all instructional approaches, classwide engagement varied in similar ways by routine such that it was consistently highest during EP and lowest during LG. Inferential analyses showed that, during SG, the classrooms that used a mostly child-directed approach had lower classwide engagement than the balanced classrooms ($\beta = -14.35$, $SE = 3.03$, $p < .001$). Furthermore, during EP, classrooms that used a mostly adult-directed approach had lower classwide engagement than balanced classrooms ($\beta = -11.09$, $SE = 3.33$, $p = .001$).

Organizational Features

Instructional routine. As described in our methods, we repeatedly sampled from three different instructional routines within each classroom to allow for an examination of classwide active engagement between and within each routine. For our team, this sampling approach was intentional to facilitate our consideration of how other features may relate to engagement, particularly when adopting a situational decision-making lens around the delivery of learning opportunities.

Classwide active engagement was consistently the highest during EP, followed closely by SG before dropping substantially during LG. Visual analyses revealed different distributions of classwide active engagement by instructional routine. Both EP and SG were negatively skewed with a relatively high average percentage of classwide engagement at 93.6% and 90.9%, respectively. In contrast, the distribution of classwide engagement in LG was positively skewed, with a relatively low average percentage of classwide engagement at 28.7%. Furthermore, the amount of variability in the percentage of classwide engagement varied across routines, with EP showing the least amount of variability ($SD = 7.26\%$), followed by SG ($SD = 13.24\%$), and LG where the most variability was observed ($SD = 16.59\%$). These descriptive differences were reinforced by

inferential analyses that revealed a small but statistically significant difference in classwide active engagement between EP and SG (β = −2.48, *SE* = 1.01, *p* = .015) and a large statistically significant difference between EP and LG (β = −64.74, *SE* = 1.01, *p* < .001).

Classroom type. Classwide active engagement was slightly higher in inclusive classrooms than in self-contained classrooms across all routines, although inferential analyses do not support the main effect of classroom type on classwide engagement. Classwide engagement levels decreased in the expected ways, with EP having the highest levels of classwide engagement and LG having the lowest for both classroom types. Inferential analyses revealed that classroom type predicted differences within SG only, with inclusive classrooms having higher classroom engagement than self-contained classrooms (β = 8.00, *SE* = 2.00, *p* < .001).

Classroom size. On average and across all routines, classwide active engagement was higher in large rather than in small- or medium-sized classrooms. Yet, inferential analyses showed that classroom size only predicted differences in engagement during SG. More specifically, during SG, small classrooms demonstrated lower levels of classwide engagement than large classrooms (β = −6.44, *SE* = 2.82, *p* = .023). From a practical perspective, however, classwide engagement in SG was still relatively high at 86% for small classrooms and 96% for large classrooms.

Adult–child ratio. There appeared to be a somewhat mixed relation between classwide active engagement and adult–child ratio. Generally, as the adult–child ratio increased such that there were more adults present relative to each child, classwide engagement appeared to decrease across all instructional routines. However, inferential analyses revealed that adult–child ratios did not predict differences in classwide engagement during EP or LG. On the contrary, the number of adults relative to the number of children predicted differences during SG. Classrooms that were categorized within our middle categories of 1:4 to <1:2 and 1:2 to <1:1, indicating generally fewer children relative to the number of adults when compared to larger classrooms with more children relative to the number of adults (i.e., <1:4), had statistically significant lower classwide active engagement (β = −5.75, *SE* = 2.70, *p* = .034 and β = −8.02, *SE* = 2.67, *p* = .003, respectively). Furthermore, levels of active engagement were more varied in relation to variability observed for other classrooms, with 12.60% and 15.76%, respectively.

Percentage of children with disabilities. For the effect of the percentage of students in the classroom with disabilities on classwide engagement, the descriptive results were again mixed. Although there appeared to be a general trend in which classwide active engagement increased as the percentage of students with disabilities decreased, inferential analyses revealed caveats about the degree to which there was a predictive relation. Inferential analyses showed small differences in classwide engagement between the three categories of the percentage of children with disabilities during EP, though pragmatically, the differences are between classwide engagement of 91.63% at the lowest and 95.8% at the highest. However, for classrooms in which all students had disabilities, though classwide engagement followed similar distributions as with other classrooms, these classrooms were differentiated during SG, with the lowest and most varied levels of active engagement when compared to classrooms with only a few students with disabilities (β = 8.65, *SE* = 2.37, *p* < .001) and the classrooms with many (β = 7.17, *SE* = 2.47, *p* = .004). Interestingly, during LG, differences in classwide active engagement was predicted for classrooms in which many, 25% to 99%, of the children had disabilities (β = −6.76, *SE* = 2.46, *p* = .006). Statistically, this may reflect the slightly more consistent lower levels of classwide engagement for these classrooms, but these differences may hold little pragmatic value when classwide engagement is below 32% for all classrooms irrespective of the number of children present with disabilities.

Classroom team experience. Like the other features, the relations between team experience and classwide engagement appear mixed. In general, greater team experience seemed to be associated with higher average classwide active engagement for SG and EP. The statistical analyses, however, do not support an inference that different levels of team experience meaningfully predict differences in classwide engagement during those instructional routines. In contrast, though no clear descriptive pattern emerged for LG, inferential results showed that classrooms of mixed experience teams (β = 9.27, *SE* = 3.11, *p* = .003) had higher average classwide engagement than experienced teams.

Discussion

With children's active engagement situated as a key outcome, our goal was to provide an empirical examination of several features that are not only present but also dynamically interact to shape the learning context of preschool classrooms. To further efforts designed to understand a process through which these dynamic contexts determine levels of active engagement for children, we proposed a conceptual model and causal pathway that situates embedded learning opportunities as a key mechanism in this process. Consistent with Hayes et al. (2012) assertions that our understandings of behavior should be informed by a situational context that unfolds over time, our examination of cognitive features of the educational team and organizational features of the

classroom provides an important foundation for future study of the mechanisms through which educators foster children's engagement. Furthermore, our approach to measuring children's engagement by focusing on children's *active, observable* behaviors within and across specific instructional routines offers a new lens on efforts to enhance a mechanism that is central in our proposed pathway—adult decision-making about and delivery of various forms and frequencies of learning opportunities within these dynamic contexts.

In this investigation, we observed higher classwide active engagement in child-directed EP, when compared to the adult-directed activities of SG and LG. Given previous investigations (e.g., Kemp et al., 2013; Powell et al., 2008) and knowledge that different contexts afford different opportunities for engagement (e.g., Kook & Greenfield, 2020), our finding of differences with respect to the instructional routine may not be all that surprising, as they do add to existing converging evidence. Unique within our study, however, was our finding that the situational context is quite stable over multiple observations of each routine. Although one might expect there to be variability in the form and frequency of the interactions adults and children have, there appear to be organizational features of classrooms that do not vary across multiple observations and predict a consistent influence on children's engagement. Hence, it is important for researchers to continue to explore features within each routine that may produce differences in classwide active engagement to become more effective in optimizing children's learning. From this lens, we offer several considerations based on the instructional routines we examined.

Child-directed EP, a learning context in which children can freely choose the materials, activities, and interactions in which they participate, was consistently associated with the highest levels of classwide active engagement. Given the nature of this routine, we suspect that the majority of children are participating in activities that are of interest and motivating, which in turn supports and sustains their active engagement (e.g., Vitiello et al., 2012). It is also possible that EP occasions a different role for adults (i.e., another organizational element in Figure 1) that further promotes active engagement. That is, adults have been observed to adopt a more passive, on-looking role, as they follow the child's lead and guide more peer-to-peer interactions while relinquishing the more directive, instructional role that has been observed to reduce active engagement (Ivrendi, 2020; Powell et al., 2008). When coupled with the broader instructional approach of the classroom, this thinking is further supported by our own findings that classrooms with a balanced approach (i.e., adults' goals and children's interests drive instruction) had higher levels of classwide active engagement than those with an adult-directed approach. Practically, this suggests these features have implications for the kinds of instructional practices and learning opportunities educators deliver during this routine to promote engagement (NAEYC, 2020).

Small group learning contexts, often described as offering important opportunities for educators to individualize and intensify learning opportunities to meet children's unique developmental needs (Booren et al., 2012; Powell et al., 2008), were associated with the most varied findings. This greater variability relative to specific cognitive and organizational features, such as adult–child ratios and composition of children with disabilities, suggests that not all children may experience learning opportunities that are optimized to promote active engagement (e.g., verbally prompting children to complete a task without visual support or first modeling the skill). As such, there are opportunities to work with educational teams to enhance how they more consistently tailor learning opportunities to facilitate high levels of children's active engagement during SG. For example, clarity of roles (Booren et al., 2012), shared understandings about targeted learning objectives for individual children (Horn & Banerjee, 2009), and greater knowledge of ways to differentiate learning within a shared activity (NAEYC, 2020) may empower individual educators within the SG learning context to know how to more effectively, and consistently, facilitate enhanced active engagement, irrespective of the number of adults and the developmental skills of children. Our findings relative to the classroom instructional approach and the effects of balanced instruction further reinforce the benefit of empowering individual educators as they make in situ decisions about their strategy use within classwide instruction.

When compared to EP and SG, adult-directed LG routines were statistically, pragmatically, and consistently associated with far lower levels of classwide active engagement. Some researchers describe LG routines as being important contexts for high-quality instructional interactions, given the opportunity afforded to educators to deliver specific instructional content (e.g., Kook & Greenfield, 2020). Findings from our study, however, highlight the importance of factoring levels of children's active engagement into determinations as to whether high-quality instructional interactions are occurring. For all children, though especially those with disabilities and developmental delays, there is a clear need to move beyond assumptions that passive forms of engagement are sufficient for learning to occur in these routines; a call that echoes long-term concerns of early childhood researchers (Carta et al., 1990; Powell et al., 2008). Practically, this assertion implies that re-envisioning how to support high-quality delivery of embedded learning opportunities within LG, which in turn promote more active, developmentally appropriate engagement and participation—particularly within the context of the array of cognitive and organizational features—is a necessary next step.

Limitations and Future Directions

This was an exploratory study examining predictive features of the classroom and educational team as a means for informing contextual features needing consideration as part of future examinations of causal mechanisms that may be acted on to improve children's engagement. Therefore, no conclusions about the causal relations between any features were drawn in this study. Furthermore, we did not approach our sampling of participants with the intent to make generalizable claims, given the geographic, racial, and socioeconomic homogeneity of our participating population. Therefore, combined with the generally limited demographic information gathered, given the aims of this study and the sometimes less than full participation of all children within a classroom, we encourage caution with making any conclusions that may extend beyond those already stated. Despite these limitations, these results provide an important springboard for replication and a necessary foundation for expanding our understanding of situational features that may impact how we optimize active engagement for all children.

Substantive attention has been given to structural and process-oriented approaches intended to enhance children's engagement, broadly defined, through universal and targeted instruction and intervention within and across classroom instructional routines (e.g., Williford et al., 2013). Given the variability in child outcomes in relation to those efforts, particularly for children with disabilities (Kemp et al., 2013), it is also important to understand how different conceptualizations of what it means for children "to be engaged" may relate to differential impact. That is, decisions about what features to measure, how to operationalize them, and how to measure them are often driven by the intended goals of the investigation, all of which are researcher-defined (Kane, 2013; Pianta & Hamre, 2009). In this study, given our intent to contribute to understandings of how to make embedded learning opportunities more effective for all children, though especially for those with delays or disabilities, our definition and measurement of engagement emphasize aspects of active engagement rather than passive engagement (Kemp et al., 2013). Simply understanding the implications of different definitions of engagement on how we understand what works, for whom, and under what conditions requires not only further examination but also commitment on the part of researchers to explicitly communicate about potential differences that may be attributable to definitional differences. In our work, by defining engagement as the active behaviors children may perform to show evidence of their ability to participate in and learn from the instructional context created by adults, we see an opportunity to elevate the importance of each adult in the classroom taking an active role in facilitating meaningful learning opportunities for each child within a classroom. Future research that examines this premise and extends findings of other researchers exploring how different adults within educational teams contribute to the frequency (Phillips et al., 2020), as well as quality and form (Kook & Greenfield, 2020), of adult–child interactions is necessary to create actionable knowledge on a pathway to improved outcomes for children.

To again reinforce that the moment-to-moment interactions that adults have with children to promote active engagement occur within a situational context that is nested within a classroom context, further work is also needed to specify what features may be most influential. For this study, we explicitly focused on examining how certain features of the educational team and classroom predicted active engagement relative to different instructional routines, but there are other important ways to consider examining these features. For example, given our sampling approach, this study included a balance of inclusion and self-contained classrooms. Although we examined classroom type as a predictive feature, there was likely a high degree of shared variance between classroom type and other features, such as classroom composition, adult–child ratio, and classroom instructional approach. Further examinations of classroom types, or other variables, that help to better define and understand profiles of classrooms—as they relate to situational variations in children's active engagement—could prove helpful to informing the work that is necessary to promote optimized learning opportunities for all children in all classrooms.

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Supplemental Material

Supplementary material for this article is available on the *Topics in Early Childhood Special Education* website at https://tecse.sagepub.com.

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