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Among underserved children, behavioral self-regulation most consistently predicts early elementary teachers' ratings of overall social–emotional learning

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The need for strengths-based perspectives on how children develop social–emotional learning (SEL) is especially pronounced in the context of research conducted with communities challenged by few resources and a history of oppression. This study included 313 underserved, primarily Black children who were assessed with several SEL building block measures at kindergarten entry. Specifically, we asked which SEL building blocks contributed to longitudinal teacher ratings of overall SEL on the Devereux Strengths and Skills Assessment (DESSA), collected four times during kindergarten and first grade. In separate models accounting for classroom membership, multiple kindergarten-entry SEL building blocks, including theory of mind, emotion, and situational knowledge, explained variance in teacher perceptions of children's overall SEL at various time points after controlling for working memory and expressive vocabulary. In a single model that included all kindergarten-entry SEL building blocks, behavioral self-regulation most consistently predicted teachers' overall SEL ratings over time. Even so, other SEL building blocks including theory of mind and emotion and situational knowledge should not be discounted because they also predicted variance in teacher-rated SEL at individual time points. A major implication of this study points to the importance of directly assessing building blocks of SEL at kindergarten entry, especially behavioral self-regulation, to effectively support children from underserved communities.

KEYWORDS

socioemotional learning, school readiness, behavioral self-regulation, emotion knowledge, theory of mind, underserved children, DESSA

Introduction

Understanding children's strengths is increasingly recognized as part of supporting development, including a successful transition to formal schooling (Harvey, 2014). Emphasizing strengths and protective processes is especially critical in changing the deficit narrative in research among children of color from underserved communities (Climie and Henley, 2016; Doromal et al., 2019). Strengths-based approaches complement research on the genuine challenges that poverty contexts pose to children's healthy development, and can illuminate different policy solutions and counter stigma (Frankenhuis and Nettle, 2020). For instance, individuals may develop unique strengths in particular skill areas as a result of responsive adaptations to their socio-cultural contexts that are important for practitioners, like teachers, to understand (Miller-Cotto et al., 2022).

Children's social–emotional learning (SEL) is especially important for promoting their well-being, positive development, and academic learning over time (Durlak et al., 2015; Immordino-Yang et al., 2019; Darling-Hammond et al., 2020). Young people with strong overall SEL form closer relationships with teachers, get along better with their peers, have lower rates of externalizing and internalizing behaviors, and achieve at higher levels (Jones and Kahn, 2017). Many elementary school systems use parent or teacher survey measures to learn about children's social, emotional, and behavioral functioning. But, schools can benefit from having earlier guidance on which specific building block skills contribute to overall SEL over time. Research-based information on the building blocks of children's SEL at kindergarten entry can supplement practitioners' efforts in providing support throughout the multi-year transition to formal schooling (Raver, 2002; Denham, 2006; Duncan et al., 2007; Denham et al., 2012; Rosanbalm, 2021). The aim of this study was to understand which building blocks of SEL, timed at the kindergarten transition, are associated with kindergarten and first grade teachers' ratings of children's overall SEL in an underserved community. This work adds to the research base on school-entry predictors of overall SEL in early elementary school, and provides useful insight for practitioners to effectively target relational and social supports during children's school transition.

Children's social and emotional learning skills

Young children need to be supported in developing a broad set of skills, beyond academic skills, to be successful in school and beyond. Social and emotional skills have been linked to numerous positive outcomes, including learning, prosocial behaviors, and reduced criminal behavior (Durlak et al., 2011; Jones and Kahn, 2017). Similar to other definitions [e.g., the Collaborative for Social and Emotional Learning (CASEL)s framework], this study defines SEL as a process through which children and adults discern and use emotional information to manage self, relationships, and situations. SEL is multifaceted and is made up of broad, interrelated domain areas, including self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (Weissberg et al., 2015). Children who demonstrate strong SEL are able to recognize and understand their own emotions and thoughts and how they affect behaviors; regulate these emotions and related behaviors in different settings; take others' perspectives including empathizing with others from different backgrounds and cultures, and connect and communicate effectively with other people; and make safe, healthy, and constructive choices that benefit their own and others' well-being (Denham et al., 2010; Greenberg, 2017). We use the term "overall SEL" to refer to multiple inter-related domains measured as a set.

Building block skills that contribute to overall SEL

SEL relies on multiple building blocks that indirectly or directly set the foundation for SEL development early in life (McKown et al., 2009). These building blocks are numerous; in this study, we include key contributors to SEL based on prior research, namely children's behavioral self-regulation, delay of gratification, emotion and situational knowledge, and theory of mind. Through one commonly used lens, these four building blocks share the feature of being "hot" constructs; that is, entailing social–emotional and/or motivational consequences (Fernández García et al., 2021). In a systematic review, Fernández García et al. found that hot tasks were less commonly studied than so-called "cool" tasks that carry relatively less emotional or motivational weight, while also noting the overlap and inter-relatedness of hot and cool assessments (Zelazo and Carlson, 2012).

Behavioral self-regulation

Children use behavioral self-regulation to manage their attention and behavior, and this skill is involved in making decisions, setting goals, and controlling or modifying impulses. Effective behavioral self-regulation draws from the set of cognitive processes known as *executive function* (EF), which has been proposed as a "top-down" set of cognitive processes involving deliberate attention and intentional redirection of impulses to align with one's goals (Zelazo and Carlson, 2012; Blair and Raver, 2015). Three primary EF processes include inhibitory control, working memory, and switching (Miyake et al., 2000; Garon et al., 2008). Here, we conceptualize behavioral self-regulation as applying multiple cognitive processes to regulate one's gross motor behavior or "EF in context." Some propose that, together with the temperament construct of effortful control, EF falls under the larger umbrella of self-regulation (Bailey and Jones, 2019; Schmidt et al., 2022). In this study, we define *behavioral self-regulation* as multiple EFs

operating together in a real-life situation (McClelland and Cameron, 2012; McClelland et al., 2014).

While much of the literature on children's behavioral self-regulation and EF has focused on establishing links with academic outcomes such as achievement and engagement (McClelland et al., 2006; Blair and Razza, 2007; Rimm-Kaufman et al., 2009), these constructs exist within a larger framework where attention and emotional reactivity develop together within social and relational contexts that either support or discourage the emergence of a child's ability to override short-term impulses and make deliberate choices whose benefits unfold only over the long-term (Rudasill and Konold, 2008; Olson et al., 2011; Spilt et al., 2012; Blair and Raver, 2015; Russell et al., 2016; Housman, 2017). Especially for children experiencing poverty, the development of EF and behavioral self-regulation has serious implications for school performance in part due to the reciprocal associations between these processes and effective emotional regulation and social relationship formation (Calkins, 2007; Hughes and Ensor, 2011; Raver, 2012; Blair and Ku, 2022).

A few studies with a range of samples have shown positive associations where children rated by parents or teachers with stronger behavioral self-regulation—or the related construct of effortful control—were judged as more socially adept (McClelland et al., 2000, 2006; Rudasill and Konold, 2008; McKown et al., 2009). Studies directly measuring behavioral self-regulation have shown mixed results; Montroy et al. (2014) found that preschoolers with better behavioral self-regulation earned higher teacher ratings of social skills. In contrast, in another study using data from two sites, kindergarteners' directly assessed fall behavioral self-regulation was *not* associated with end-of-year teacher-rated interpersonal skills (Cameron Ponitz et al., 2009). Both these study samples included children from relatively educated families. How children's behavioral self-regulation when it is directly assessed at the start of formal schooling may contribute to teacher-reported overall SEL in early elementary school needs to be clarified and systematically studied, especially for children living in poverty and in different socio-cultural contexts.

Delay of gratification

Delay of gratification is a type of inhibitory control related to decision-making, specifically pertaining to forgoing a smaller reward immediately for the chance of a larger reward later. In deciding to delay, children must understand the consequences of their choice and overcome the strong inclination for immediate satisfaction (Diamond, 2016). Long-term thinking is most apparent in individuals with stronger ability to delay gratification (Göllner et al., 2017). Blair and Raver note that in the context of poverty, the prevalence of uncertainty about the future–in income, housing, or social relationships–and relatedly, high levels of trauma, change how EF and self-regulation develop (Blair and Raver, 2012, 2015). In resource-scarce contexts, the deliberate practice, attention, and considered choice-making that are required for EF development under optimal conditions are not as important as making choices for the immediate situation to ensure basic needs are met (Miller-Cotto et al., 2022). Thus, impulsiveness—not delaying gratification—becomes adaptive, at least in the short term.

Historically, most studies have shown positive associations between delay tasks and school-related outcomes (Shoda et al., 1990; Watts et al., 2018): that is, children who can (or who choose to) wait for a small reward has better learning and life outcomes than those who cannot. But context matters for delay of gratification, and laboratory studies show children are capable of using information from the context to decide whether to delay or not (Lee and Carlson, 2015). In one such study, 4.5-year-old children opted not to delay or delayed for a shorter time when the adult who promised a reward had just proven themselves untrustworthy (Kidd et al., 2013). In a correlational study, children in impoverished settings who chose *not* to delay actually had higher behavioral self-regulation, academic skills, and fewer teacher-rated problem behaviors, relative to children who consistently waited for a series of small rewards (Duran and Grissmer, 2020). Findings about context-dependent delay skills urge researchers to clarify how children's delay of gratification is associated with teacher-rated SEL in historically oppressed communities (Miller-Cotto et al., 2022).

Emotion and situational knowledge

Emotion and situational knowledge, which includes familiarity with emotion words and facial expressions; and an understanding of which emotions or facial expressions are likely in certain situations, combine to form another key building block that undergirds SEL (Denham, 2006). When children are aware of and can label strong feelings—of themselves and others—they are better equipped to navigate emotion-rich social situations. Both correlational and experimental research conducted with children from oppressed backgrounds near the school transition confirms this connection, where those with better emotion knowledge have better SEL outcomes including less aggression and withdrawal; and greater peer relationship, cooperation, and learning skills (Schultz et al., 2001; Miller et al., 2005; Izard et al., 2008). Furthermore, Denham et al. found that preschoolers with more adept knowledge of emotion situations were rated by their kindergarten teachers as having greater social competence (Denham et al., 2003). Similar associations have been found in cross-sectional studies (McKown et al., 2009; Brock et al., 2019b). In this study, we examined how and whether kindergarten-entry emotion and situational knowledge is associated with teacher-rated SEL during kindergarten and first grade.

Theory of mind

Theory of mind develops over the early childhood period and refers to children's understanding that other people have different knowledge, beliefs, desires, and emotions than they themselves do (Wellman and Liu, 2004; Wang, 2015). The application of one's theories of mind is likely to depend on context cues, such as the specific people involved, a social script such as getting ready to go home for the day, or other aspects of a given situation (Hughes and Devine, 2015). In their meta-analytic review that included mostly White middle-class children, researchers reported a small but consistent association between theory of mind and prosocial behavior (Imuta et al., 2016). In contrast, Olson et al. (2011) reported that preschoolers' theory of mind was not associated with their observed aggressive behavior, after controlling for self-regulation.

Other studies that include low-income or historically marginalized populations have shown that children with more developed theory of mind before kindergarten entry have better school success, including achievement, teacher-reported socioemotional skills, more closeness within the teacher-child relationship, and fewer behavioral difficulties, even after controlling for EF, verbal ability, and emotion knowledge (Razza and Blair, 2003; Caputi et al., 2012; Brock et al., 2019a,b). One explanation for a lack of association between theory of mind and SEL after accounting for self-regulation is that knowing the mental state of other people is not as important as being able to control one's impulses during interactions (Olson et al., 2011). On the other hand, exercising theory of mind may itself draw on regulatory processes, including working memory and inhibitory control during social situations (Brock et al., 2019b). Inconsistencies in the research leave questions about what skill or skills are most important for schools to assess at the transition to kindergarten. An inquiry to disentangle whether theory of mind as a kindergarten-entry SEL building block is associated with kindergarten and first grade teacher-rated SEL, while controlling for other SEL building blocks in an impoverished sample, is needed.

Rationale and research questions for the present study

Given the intertwined nature of early cognitive, academic, and SEL development (Jones and Kahn, 2017; Cameron et al., 2019) and the way that poverty affects all of these (Raver, 2012), the goal of this study is to explore which building blocks and at what point are important for the development of children's SEL. The findings from this study have the potential to provide practitioners working in historically oppressed communities with a more holistic picture of children when they begin school, as well as how best to promote healthy social, emotional, and academic development for underserved children. In addition, this study can provide empirical evidence of the associations between cognitive, academic, and SEL processes rather than assuming associations that may be accepted as normative because they have been established with more privileged populations (Frankenhuis and Nettle, 2020; Miller-Cotto et al., 2022).

The combination of measures with social–emotional implications that are available in this study is especially unusual in an underserved community comprised primarily of children of color. Research has established that children's skills in self-regulatory and academic domains develop concurrently over the school transition (Cameron et al., 2019), and that some skill components explain academic outcomes better than other skill components (McClelland et al., 2014). Fewer studies have examined how different SEL building blocks contribute, uniquely and jointly, to early elementary teachers' ratings of overall SEL measured over the school transition. Information about which early SEL building blocks are most strongly associated with teacher perceptions of children's SEL is important to gather as SEL learning standards become more common across the United States (Blad, 2016) and as government and private sponsors of research prioritize early education and holistic assessment, beyond traditional academic skills, in the wake of COVID-19 school shutdowns (Ghosh, 2021; The White House, 2021). To fill these gaps and inform education for 21st century learning, of which SEL is a critical element, we pose the following research questions and hypotheses:

1. *Which of children's SEL building blocks, assessed directly at kindergarten entry, explain their overall SEL reported by kindergarten and first grade teachers during the transition to elementary school?*

Given the complexity of the SEL construct, and the diversity of domains that comprise SEL strengths measures (Doromal et al., 2019), we expected that each of the building blocks would show individual positive associations with teachers' perceptions of children's overall SEL; with stronger associations at earlier time points.

2. *When examining all SEL building blocks measured at kindergarten entry together, which components uniquely contribute to teacher ratings of overall SEL during the school transition?*

Based on previous work that included two or more of the SEL building blocks in the same model (Blair and Razza, 2007; McKown et al., 2009), we expected that behavioral self-regulation, theory of mind, and emotion and situational knowledge would show independent or unique associations with overall SEL at multiple times, even when included in the same model.

Materials and methods

This study was part of a larger mixed methods evaluation using a randomized controlled trial (RCT) design on the

effects of an existing after-school SEL program operating in a highly impoverished area of a Southeast U.S. state (Brock et al., 2018). The University of Virginia IRB and the IRB at an institution in the city where data were collected approved all study procedures. Families provided signed informed consent to signal their interest in the program and agreed to participate in a lottery prior to kindergarten entry, such that random assignment determined whether a child could attend the after-school SEL program. Participating children in the larger study were recruited in 3 consecutive years and each of these three cohorts followed over a 3-year period (i.e., through the end of second grade). All children initially attended one of four schools local to the area; one school closed during the study period. As such, teachers who provided reports of children's overall SEL were also employed at one of these four schools. In this sample, 71% of teachers reported their race or ethnicity as Caucasian/White, and 24% reported African American/Black. Teachers' ages ranged from 23 to 62 years old.

This study included children with a valid baseline measure of teacher-reported SEL, which yielded an analytic sample of 313 children. The sample represented the community, and was characterized as high-poverty and high-risk: just over 96% of children received free or reduced-price lunch, and 29% of caregivers reported less than a high school degree as their highest level of education. Ninety-one percent of children's caregivers reported their race as Black or African American, and the remaining groups included White (3%), Hispanic and/or Latinx (5%), Asian (<1%), or other race (<1%). Just over half (55%) of children were female.

Procedure

This study included data collected directly from children the summer and fall of kindergarten entry, and from children's teachers during the fall and spring of kindergarten and first grade. Each summer before children entered kindergarten, the study hosted a week-long summer camp to provide childcare for the entire sample and to administer assessments. Research assistants with experience working in the community administered all assessments in two separate batteries lasting 30–45 min each. About two-thirds of children in each cohort were assessed at the summer camps while the remaining third were assessed at school, within the first few months of their kindergarten year. In each fall and spring, kindergarten and first grade teachers rated children on their overall SEL.

Measures

Social–emotional learning building block assessments were collected before or very shortly after random assignment. Teachers did not know children's assignment to the RCT condition of attending the after-school program or not, and we also controlled for treatment status in analyses.

Teacher reports of children's overall SEL

We used the Devereaux Student Strengths Assessment (DESSA; LeBuffe et al., 2018) to capture teachers' reports of children's overall SEL at kindergarten entry, our primary dependent variable for the study. The DESSA is an empirically sound, widely used, strength-based behavioral rating scale that assesses social and emotional strengths of children that promote positive development (LeBuffe et al., 2018). Each positively-worded item is rated on a five-point scale (1 = "never" to 5 = "very frequently"). This measure is not developmentally normed because SEL domains are generally not expected to improve with development but instead are context-dependent.

We used an adapted version covering five subscales that align with our definition of social–emotional learning: self-awareness (seven items), social awareness (nine items), responsible decision-making (eight items), self-management (11 items), and relationship skills (10 items). Scores for each subscale were computed as the average of all items associated with that subscale. We then created an overall SEL composite by averaging all the subscale scores. Validity of scores and the use of the SEL composite derived from this adapted version of the DESSA among low-income kindergarten samples has been established in prior studies (Doromal et al., 2019), and within the present study sample, items demonstrated high internal consistency ($\alpha \geq 0.90$).

Kindergarten-entry SEL building blocks

Assessments of SEL building blocks were directly administered the summer before and fall of kindergarten entry, and served as independent variables.

Behavioral self-regulation

Children's behavioral self-regulation was assessed using the Head-Toes-Knees-Shoulders task (HTKS; Cameron Ponitz et al., 2009; McClelland et al., 2014), which is informed by the Head-Feet task (McCabe et al., 2004) originally designed as a culturally-responsive, game-based measure (Miller-Cotto et al., 2022) that could be given in home or school settings. The HTKS begins by having children practice doing "the opposite," and then they are told to touch their head when told to touch toes and vice versa (Part I); two later parts (Parts II and III) add complexity for more advanced scorers. Feedback, including positive praise for correct answers, is given during practice but not test items. Studies using different samples indicate that the HTKS requires inhibitory control, working memory, and switching (Cameron Ponitz et al., 2009; McClelland et al., 2014; Gonzales et al., 2021). The version of the HTKS used in this study was the three-part version, and consistent with current author recommendations all 17 practice and 30 test items were included in the final score. Each item was scored 0, 1, or 2 (incorrect, self-corrected, or correct response),

and a composite score was computed by summing across all scored items. The 47 items demonstrated high internal consistency for our sample ($\alpha = 0.93$).

Choice delay of gratification

The choice delay of gratification task presented children with multiple choices of stickers or candies. The task began with the research assistant modeling an immediate gratification behavior and a delay of gratification behavior. In six trials, children could choose one sticker/candy now; and either two, four, or six of the desired items later, which were placed in a plastic bag and sent home in the child's backpack. Scores were calculated by summing the number of times the child delayed; a higher score indicated greater delay of gratification. Internal reliability in the present sample was $\alpha = 0.83$; a separate published factor analysis also found a single factor and strong psychometric properties (Duran and Grissmer, 2020).

Theory of mind

To measure theory of mind—the ability to understand mental functions and others' point of views, we used the eponymous subtest from the NEuroPSYchological (NEPSY-II, Korkman et al., 2007) which is considered a comprehensive assessment because it measures multiple aspects of theory of mind (Beaudoin et al., 2020). This subtest involved two parts, verbal and contextual. The verbal task consisted of 15 items that measures children's understanding of someone else's thoughts, ideas, and feelings (e.g., "When Andre opened the cookie box, he saw spaghetti in there… His brother came in and saw the cookie box. What did his brother think was in the box?"). The contextual task included six items that assess children's ability to relate emotion to social context. For instance, children were shown drawings of scenarios that happen to Julia, as well as four photographs of Julia's face, and they had to identify which one of the photographs showed how Julia feels. All 21 items were summed ($\alpha = 0.83$), and raw scores were used in analyses.

Emotion and situational knowledge

To measure emotion and situational knowledge, we drew from two established measures, the Emotion Matching Task (Morgan et al., 2009) and the Assessment of Children's Emotion Skills (Schultz et al., 2004). For the larger longitudinal study, the research team created a combined measure called the EMT-ACES, which used 48 items from the EMT and 18 items from the ACES. We developed this combined measure, validated in a prior study (Brock et al., 2019b), to avoid ceiling effects that piloting indicated would occur with the EMT; and to avoid floor effects had we administered the ACES alone. The first cohort did not receive ACES items if they did not score at least 50% on one of the four EMT parts. This study's combined EMT-ACES measure showed internal reliability for this sample ($\alpha = 0.93$); EMT-only items were $\alpha = 0.83$, and ACES-only items were $\alpha = 0.96$.

The EMT assessed emotion knowledge with four sets of 12 items, which were all retained in the composite measure. In part 1, matching expressions, the researcher said, "show me which one of these children feels the same way as this one" while displaying elementary-school children's faces in a set of four photos. In part 2, expression-matching situation, the researcher asked children to match one of four facial expressions with situations and causes. For example, children are shown four photos and asked "show me the one whose mom is sick and has to go to the hospital." In part 3, expression labeling, the researcher displayed a single photo and asked children to say a word that expresses how that person feels. In part 4, expression-labeling matching, the researcher asked children to match emotion expressions to emotion labels (e.g., "show me the one who feels happy").

The ACES assessed children's emotion attribution accuracy and anger attribution tendencies. ACES include sections concerning facial expressions, social behaviors, and social situations. Because EMT also includes facial expression items, the present study omitted ACES facial expression items. In the ACES social behaviors section (10 items in the present study), children listened to 1–3 sentence items that describe a child's behavior (such as sitting alone, or being hit) and then labeled the protagonist's feeling by choosing happy, sad, mad, scared, or no feeling. In the ACES social situations section (eight items in the present study), children listened to 1–3 sentence items describing an emotion-eliciting situation, such as not getting to go to the park, and were asked to label the protagonist's feeling by choosing happy, sad, mad, scared, or no feeling. Each item has a correct score associated with the most common responses from adults in prior research (Schultz and Izard, 1998), and total scores were summed.

Control variables

Consistent with other studies using these project data (Brock et al., 2019b), we controlled for treatment status (0 = control group; 1 = treatment group), caregiver's education (0 = did not complete HS; 1 = high school diploma or greater), financial strain (three items on a five-point scale with higher ratings indicating more strain; Vinokur et al., 1996), children's preschool attendance (0 = did not attend preschool; 1 = attended preschool), and age. Following prior research, our analyses also controlled for general language and working memory which is a "cool" aspect of EF (Fernández García et al., 2021) and the one most closely related to IQ (Fukuda et al., 2010). Controlling for each of these skills helps ensure that associations could not be explained by an understanding (or lack of understanding) of the tasks given.

Expressive language

We used the Differential Ability Scales II (DAS; Elliott, 2007) Naming Vocabulary subtest to assess children's expressive language with 34 items of increasing difficulty. The researcher displayed a colorful picture of an item in a flipbook and asked the child to identify it verbally. Children had to avoid more than three incorrect scores to move to the next section. Items demonstrated adequate internal consistency for this sample ($\alpha = 0.81$).

Working memory

We used the Differential Ability Scales II (DAS; Elliott, 2007) Recall of Sequential Order subtest to assess children's working memory. Across a series of 32 items ($\alpha = 0.89$) increasing in complexity, the researcher asked children to engage in short-term recall of verbal and pictorial information. Specifically, the researcher stated body parts in random order (such as elbow, ankle, and neck), and children had to remember and restate a progressively longer list of body parts from highest to lowest. Items demonstrated adequate internal consistency for this sample ($\alpha = 0.78$).

Analytic strategy

We first examined descriptive statistics, correlations, and the percentage of missing data for all study variables. We then examined associations using multi-level linear modeling, which accounted for the nested structure of children within classrooms. Analyses were conducted using SPSS 27.0 (IBM Corp, 2021) and Stata 16.0 (StataCorp, 2019). The option "vce(cluster *idvar*)" was used in Stata to produce clustered standard errors at the classroom level to account for potential heteroskedasticity.

The primary aims of this study were to understand which of children's directly assessed SEL building blocks individually and jointly predicted kindergarten and first grade teachers' rating of children's concurrent and later overall SEL. Modeling these associations required consideration of the nested structure of the data, specifically, outcomes for children in the same classroom were reported by the same teacher, and these potential rater effects were likely to explain variance in outcomes (Mashburn et al., 2006). As expected, in our data, intraclass correlation coefficients (ICCs), which represent the amount of variance at the teacher as opposed to child level, ranged from 0.11 to 0.34 across outcomes.

To account for these concerns, we estimated all associations using a two-level hierarchical linear modeling framework, using the "mixed" command in Stata. Because we were not interested in interactions across levels, we tested a random-intercept, fixed slope model. All predictor variables were grand-mean centered for ease of interpretation, and continuous variables were transformed to standard-deviation units.

The model equations are:

Level 1:

$$Y_{ij} = \beta_{0j} + \beta_1 \left(SELBlock\right)_i + \boldsymbol{X_i} + e_{ij}$$

Level 2:

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

In this model, we regressed teachers' DESSA ratings Y_{ij} on each SEL building block $\left(SELBlock\right)_i$ as well as the set of covariates $\boldsymbol{X_i}$. Here, β_1 represents the association between a single SEL building block and the teacher-reported SEL composite. Level 2 did not introduce new predictor variables (because all variables are at the child level), but it did include a teacher-level random effect. The error term e_{ij}, which represents the variation between children within the same teacher, was assumed to be independent and normally distributed with mean 0 and variance σ^2. Similarly, the error term u_{0j} is the variation between teachers and was assumed normally distributed with mean 0 and variance σ^2.

To address the first research question, we ran four similar models ("Separate Predictor Models") predicting teacher-rated overall SEL with each individual SEL building block entered separately (behavioral self-regulation, emotion knowledge, theory of mind, and choice delay) while controlling for working memory and expressive language. We ran 16 total models (four SEL building blocks predicting teacher-rated overall SEL at four different time points). To account for familywise error rates, we used Bonferroni correction methods to account for multiple comparisons across models grouped by the SEL building block (i.e., we examined results across four models within each SEL building block and applied a threshold of $p = 0.05/4 = 0.0125$ for reporting statistical significance).

To address the second research question, we ran a single model with all four SEL building blocks and two controls included simultaneously as predictor variables of teacher-rated overall SEL at four time points. Given that these SEL building blocks develop concurrently over the formal school transition, this approach (the "Comprehensive Model") considered how these skills jointly predict teacher reports of children's overall SEL and indicated whether any single skill was responsible for more of the variance. Here we ran four models total, one model for each of four time points for teacher-rated overall SEL. We applied adjustments for multiple comparisons when assessing statistical significance of the results across models.

Missing data

After construction of the analytic sample, all participants had complete data on the first time point of the DESSA. Attrition over time appeared to be the biggest contributor to missing data, with more than one third of children missing first grade DESSA scores; there were far lower missingness rates among baseline demographic variables. To assess whether missingness was systematically associated with child characteristics, we conducted a set of logistic regressions where a dichotomous indicator for missing data was regressed on available demographic characteristics. This analysis revealed that observable baseline characteristics did not predict missingness in teacher reports of overall SEL at future time points. Missing data were multiply imputed using chained equations in Stata 16, and all estimates were combined across 20 imputed datasets (von Hippel, 2007).

TABLE 1 Summary statistics for study variables (N=313).

	% missing	Mean	SD	Min	Max
Demographic Characteristics					
Child age in years	0%	5.48	0.31	4.40	6.18
Child is female	0%	0.55			
Child race/ethnicity	10%				
African American/Black		0.90			
Hispanic/Latino		0.05			
Caucasian/White/Other		0.04			
Caregiver has high school degree or higher	12%	0.71			
Financial strain (baseline)	10%	2.01	0.91	1	5
Treatment status	0%	0.58			
Child participated in Pre-K	10%	0.90			
Expressive vocabulary (baseline)	1%	20.03	3.41	9	26
Working memory (baseline)	1%	1.20	2.26	0	14
SEL Building Blocks at Kindergarten Entry					
Behavioral self-regulation	1%	29.67	26.97	0	88
Choice delay of gratification	1%	3.14	2.22	0	6
Theory of mind	1%	10.88	4.06	3	21
Emotion and situation knowledge	1%	40.94	9.16	16	59
Teacher-Rated Overall SEL (DESSA)					
Kindergarten, fall	0%	3.63	0.73	1.19	4.98
Kindergarten, spring	3%	3.67	0.72	1.92	5
Grade 1, fall	34%	3.57	0.79	1.72	5
Grade 1, spring	38%	3.72	0.78	1.62	5

Demographic characteristics and SEL building blocks were measured at baseline (in the summer or early fall of kindergarten entry). DESSA, Devereux Student Strengths Assessment; SD, standard deviation.

Results

We report means and standard deviations for all study variables in Table 1. We note that, consistent with the developers' intentions, children's SEL ratings on the DESSA were relatively stable, rather than increasing, over time. We also examined correlations among all study variables, shown in Table 2. Here, we highlight only those correlations above $r = 0.30$ (all $ps < 0.01$): Children with stronger behavioral self-regulation scored higher on emotion situation knowledge ($r = 0.38$) and working memory ($r = 0.46$). Children with higher scores on theory of mind had higher working memory ($r = 0.32$) and emotion and situational knowledge ($r = 0.35$), and those with higher emotion and situational knowledge scored higher on theory of mind ($r = 0.35$) and expressive language ($r = 0.44$). Across time points, teacher ratings were positively correlated across a relatively wide range from $r = 0.24$–0.67. Additionally, children with higher choice delay scores had *lower* scores on most variables, but these correlations were relatively weak (below $r = 0.20$).

RQ1: Results from separate predictor models

Table 3 shows all results from the Separate Predictor Models, but we organize our findings by SEL building block. For example, the first row in Table 3 shows results where the direct measure of behavioral self-regulation was used to predict overall SEL at four time points (one in each column). Similarly, the second through fourth rows of Table 3 present results using choice delay, theory of mind, and emotion and situational knowledge as predictor variables, respectively.

Behavioral self-regulation

Children with higher kindergarten-entry behavioral self-regulation received significantly higher ratings on teacher-reported overall SEL at the three later time points. These positive associations with outcomes at all time points except for fall kindergarten held even after adjusting for several characteristics, including children's fall kindergarten overall SEL.

Choice delay of gratification

Lower scores on choice delay were associated with *higher* teacher ratings on overall SEL at the start of kindergarten; however, after accounting for multiple comparison adjustments, we could not conclude this association was statistically different from zero.

Theory of mind

For theory of mind, children with higher theory of mind at kindergarten entry earned higher teacher ratings of overall SEL at fall of kindergarten, but this association was not significant at any of the later time points.

Emotion and situational knowledge

Finally, children with better kindergarten-entry emotion and situational knowledge received significantly higher teacher reports of overall SEL, at the later three time points.

TABLE 2 Correlations using FIML between all continuous study variables (N=313).

		1	2	3	4	5	6	7	8	9	10	11	12
1	Child age (k.entry)	–	0.04	0.17	0.08	0.08	0.05	0.17	0.17	0.14	0.11	−0.04	0.04
2	Financial strain		–	−0.08	−0.05	−0.10	0.08	−0.04	−0.03	−0.15	−0.16	−0.04	−0.13
3	Expressive language (k.entry)			–	0.29	0.28	−0.10	0.26	0.44	0.18	0.18	0.17	0.11
4	Working memory (k.entry)				–	0.46	−0.12	0.32	0.27	0.18	0.21	0.20	0.22
5	Behavioral self-reg. (k.entry)					–	−0.23	0.29	0.38	0.19	0.31	0.35	0.37
6	Choice delay (k.entry)						–	−0.05	−0.12	−0.16	0.27	−0.10	−0.13
7	Theory of mind (k.entry)							–	0.35	0.22	0.27	0.18	0.26
8	Emotion sit. Know. (k.entry)								–	0.17	0.28	0.26	0.25
9	Teacher-rated SEL (fall k)									–	0.59	0.24	0.40
10	Teacher-rated SEL (spring k)										–	0.54	0.54
11	Teacher-rated SEL (fall first)											–	0.67
12	Teacher-rated SEL (spring first)												–

Regardless of sign, all correlations of magnitude above 0.10 were statistically significant at $p \leq 0.05$. Correlations of magnitude above 0.14 were statistically significant at $p \leq 0.01$.

Covariates had consistent associations in each of these models (not shown in Table 3): teachers rated girls with higher overall SEL at each time point; teachers rated children with higher working memory and lower financial strain with better overall SEL at fall kindergarten; and in the choice delay model only, first grade teachers rated children with better working memory with higher overall SEL in spring.

RQ2: Results from the comprehensive model

In Table 4, we present results from examining SEL building blocks comprehensively. Because predictor variables were standardized, we can interpret coefficients roughly as effect sizes and thus compare magnitudes across predictors to understand which building block measures are more strongly related to teachers' ratings of overall SEL. Using this approach, children with stronger school entry behavioral self-regulation earned higher ratings of overall SEL from their first grade teachers at both fall and spring. There were no other SEL building blocks that explained variance in overall SEL.

Regarding covariates, the strongest predictor of overall SEL at the later three time points was fall overall SEL. Gender remained a consistent predictor in the comprehensive model with girls advantaged at both spring time points. After adjusting for multiple comparisons, no other variables helped explain overall SEL ratings.

Discussion

Typically, research including children living in poverty takes a deficit perspective to describe how poverty and the surrounding contexts may lead to negative social and cognitive outcomes. Less often considered are the many strengths that children develop as a consequence of coping with the challenges in their lives (Frankenhuis and Nettle, 2020). This study takes a strengths-based approach by examining associations between several building blocks of SEL and teacher-rated overall SEL across 2 transition years, kindergarten and first grade, in a sample of mostly Black children living in an underserved urban area of the Southeast

TABLE 3 Results from separate multi-level models predicting teacher-rated SEL outcomes with SEL building blocks (*N*=313).

	Fall K teacher-rated SEL (std.)		Spring K teacher-rated SEL (std.)		Fall first teacher-rated SEL (std.)		Spring first teacher-rated SEL (std.)	
	Coef.	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Behavioral self-regulation (k.entry) (std.)	0.11	0.06	0.16*	0.05	0.25*	0.08	0.26*	0.08
Choice delay (k.entry) (std.)	−0.12⁺	0.05	−0.05	0.05	−0.03	0.07	−0.02	0.05
Theory of mind (k.entry) (std.)	0.16*	0.06	0.09	0.05	0.04	0.07	0.15	0.08
Emotion sit. Know. (k. entry) (std.)	0.12	0.06	0.15*	0.06	0.21*	0.07	0.22*	0.06

Table summarizes results from 16 model specifications (each time point as the outcome, columns, with SEL building blocks input individually, rows). Standard errors are clustered at the classroom level. Covariates included in each model were child age, treatment status, female, attended pre-K, mother had HS degree, financial strain, expressive language, and working memory. Models predicting teacher-rated SEL beyond the fall K time point also include fall K teacher-rated SEL as a covariate. Coef., coefficient; std., standardized variable.
*denotes coefficients that are statistically significant at the 5% level after adjusting for multiple comparisons across models with the same SEL building block predictor.
⁺denotes coefficients that were initially statistically significant at the 5% level but are no longer significant after multiple comparison adjustments.

U.S. We highlight two findings of note: First, on their own, multiple building block SEL measures, plus controls, explained how teachers rated children's overall SEL as kindergarten and first graders. Second, when included in a single model, a measure of behavioral self-regulation, the Head-Toes-Knees-Shoulders (HTKS) task, was the best (and only) predictor, and in first grade only. While previous studies have shown the importance of behavioral self-regulation generally (McClelland et al., 2006; Moffitt et al., 2011), and the HTKS specifically (McClelland et al., 2014) for achievement, this study aligns with others suggesting that behavioral self-regulation also underlies some children's SEL (McKown et al., 2009).

Separately, multiple SEL building blocks explained variance in teacher ratings

The pattern of results for separate building blocks at the fall of kindergarten showed first, that teachers perceived those children who entered kindergarten with strong behavioral self-regulation—that is, able to remember instructions and work with information, switch rules, *and* control their impulses—as having the strongest overall SEL. This finding is important because we controlled for working memory and expressive language, which are also associated with classroom functioning and affected when children are exposed to adverse experiences, including living in poverty. Our results show that for mostly Black children from impoverished backgrounds, applying multiple executive function processes to behavioral actions may be more critical for a successful school transition than knowing vocabulary words and the more constrained ability to keep track of and work with information.

Results also imply a particularly important role for early theory of mind apparent at formal school entry, and for early emotion and situational knowledge that is apparent only later. Prior research (Brock et al., 2019b) found that theory of mind is a robust predictor of SEL skills and transition difficulty among impoverished children. Specifically, they reported that theory of mind acts as a mediator that connects other school readiness indicators, including behavioral self-regulation, vocabulary, and emotion and situational knowledge; to children's overall kindergarten adjustment. These and our results point to the importance of how well children can understand the subtleties associated with the various social contexts of school. Early theory of mind being strongly coupled with stronger SEL ratings at the start of kindergarten contradicts a research summary with mostly advantaged children that suggested that theory of mind's contribution to social skills may be more protracted than we found in the present study (Hughes and Devine, 2015). In oppressed communities, where resources are scarce and heightened responsivity to changing environmental conditions is advantageous (Miller-Cotto et al., 2022), children who can quickly intuit the mental and emotional states of others may develop the most successful relationships early in the school transition.

Interestingly, emotion and situational knowledge at school entry explained variance only later—but not at the fall of kindergarten. We posit that as school progresses, settings pose different challenges, which may change how children's initial strengths are perceived by their different teachers. The first 2 years of formal schooling have been described as a type of critical period. First grade in particular increases academic demands on children and first grade teachers have heightened expectations for children compared to kindergarten teachers. Kindergarten teachers, especially when school begins, may expect wide individual differences in children's emotion knowledge and familiarity with the emotions implicated by different situations, which may translate into a lack of association between children's emotion and situational knowledge and their initial kindergarten teacher ratings of overall SEL. As children prepare to enter first

TABLE 4 Multi-level model results from a single analysis predicting teacher-rated overall SEL with all building block measures (*N*=313).

	Fall K teacher-rated SEL (std.)		Spring K teacher-rated SEL (std.)		Fall 1st teacher-rated SEL (std.)		Spring 1st teacher-rated SEL (std.)	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Behavioral self-regulation (k.entry) (std.)	0.05	0.06	0.12^{+}	0.06	0.22*	0.08	0.23*	0.09
Choice delay (k.entry) (std.)	−0.11^{+}	0.05	−0.03	0.05	0.02	0.07	0.02	0.05
Theory of mind (k.entry) (std.)	0.14^{+}	0.06	0.06	0.06	−0.02	0.08	0.10	0.08
Emotion sit. Know. (k.entry) (std.)	0.06	0.06	0.11	0.07	0.16^{+}	0.08	0.15^{+}	0.07
Covariates								
Teacher-rated SEL (Fall K) (std.)			0.56*	0.05	0.20*	0.06	0.31*	0.06
Child age (std.)	0.07	0.05	−0.01	0.05	−0.10	0.07	−0.05	0.06
Treatment status	0.02	0.04	0.01	0.04	0.05	0.06	0.04	0.05
Female (Female = 1)	0.12^{+}	0.05	0.11*	0.04	0.14^{+}	0.06	0.15*	0.05
Pre-K attendance (Yes = 1)	0.02	0.05	−0.05	0.05	−0.08	0.07	−0.11	0.06
Caregiver's education (HS or more = 1)	0.04	0.05	−0.07	0.05	0.00	0.07	−0.06	0.07
Financial strain (std.)	−0.10^{+}	0.05	−0.04	0.05	0.03	0.06	−0.05	0.06
Expressive vocabulary (std.)	0.04	0.07	−0.03	0.06	0.02	0.08	−0.10	0.08
Working memory (std.)	0.11	0.06	−0.00	0.06	0.04	0.08	0.04	0.08

Table presents results from four model specifications (each time point as the outcome, columns, with SEL building blocks input simultaneously). Standard errors are clustered at the classroom level. Coef., coefficient; std., standardized variable.

*denotes coefficients that are statistically significant at the 5% level after adjusting for multiple comparisons across models with the same SEL building block predictor.

$^{+}$denotes coefficients that were originally statistically significant at the 5% level but were no longer significant after multiple comparison adjustments.

grade however, and as demands and teacher expectations increase, individual differences in kindergarten-entry emotion and situational knowledge may turn out to be important to overall SEL. Children who entered school able to infer emotional states, identify emotions, and understand how situations produce different emotions in different people may have had more success and friendships as time went on, which could in turn be perceived by teachers as better overall SEL.

Children with early strengths in behavioral self-regulation were perceived with better overall SEL in first grade

For perhaps similar reasons, early behavioral self-regulation was also the best, and only, predictor of first grade teacher ratings of overall SEL in the most robust models. Behavioral self-regulation is implicated in multiple domains of SEL, including self-management and responsible decision-making. Behavioral self-regulation is more complex than self-control or working memory as isolated skills, and requires children to remember information and switch their attention and responses, along with inhibiting a strong inclination (Schmidt et al., 2022). These processes indicate attentional skills and the ability to keep track of information and *then apply it* to one's behavior. We note that the HTKS is the only measure that required children's gross motor responses, as opposed to verbal or pointing responses. Regulating large body movements may be important to teachers, and Black children who have this skill may be perceived as better conforming to classroom expectations (Miller-Cotto et al., 2022).

In a previous study of mostly economically advantaged kindergarteners, children's scores on the HTKS were positively associated with teacher reports of children's classroom self-regulatory behaviors, but not their interpersonal skills (Cameron Ponitz et al., 2009). In contrast, our study's findings align with study of Montroy et al. (2014), where preschoolers with stronger behavioral self-regulation were rated with better social skills—which include not only interpersonal skills but also decision-making and self-control. It is possible that children with strong behavioral self-regulation are better able to manage the numerous and often changing demands of the early elementary classroom context because they can keep track of teacher instructions and then make decisions to align with those instructions, rather than their impulses. The strong predictive power of kindergarten-entry behavioral self-regulation for first grade teacher perceptions of children's overall SEL illuminates the intertwined nature of emotion regulation, attention, and behavior over the school transition in this underserved sample.

Limitations and future directions

This study includes several limitations. First, while a notable strength of this study was to examine which building blocks at kindergarten entry predicted teachers' ratings of overall SEL, we could not examine how the SEL building blocks themselves were developing over time. Because this co-development may be useful for understanding how building blocks contribute to overall SEL at different time points, future research should consider how the development of the building blocks might affect the development of overall SEL. Second, the design of this study was correlational; therefore, causal conclusions cannot be inferred. While we employed a rich set of covariates to account for many potential correlates of both children's direct assessments and teachers' ratings of overall SEL, we cannot fully account for potential other factors. Third, this sample reveals the associations among building blocks and overall SEL during the formal school transition among Black children from historically marginalized communities, but associations may not necessarily translate to other underserved communities with different socio-cultural contexts. In addition, while teacher ratings are a robust indicator of children's future functioning in school, more comprehensive assessment of children's SEL, such as with naturalistic observations or direct assessment of SEL domains, could shed light on the portion of ratings due to teacher factors as opposed to child factors. For example, we did not assess the extent to which teacher-child racial match might have explained teacher perceptions of children's overall SEL. Additionally, directly assessing one or more of the five SEL domains could illuminate which building blocks are important for which domain; our DESSA measure which shows a one-factor solution (Doromal et al., 2019) unfortunately does not allow us to disentangle this issue. The study is strengthened by looking at two school years, incorporating information from both kindergarten and first grade teachers, and points to several future directions as well.

Implications for research and practice

This study suggests several implications for research and practice. What school systems choose to assess informs what teachers choose to emphasize during classroom time. Strengths-based approaches, including direct assessment, can illuminate SEL building blocks in which to invest resources for kindergarten entry screening and classroom support (Frankenhuis and Nettle, 2020). Surveys are commonly used to assess children's social and behavioral skills, but may be biased by the reporter's prior knowledge of the child or community, or not provide actionable information when it is needed. Crucially, behavioral self-regulation and executive function are malleable (Diamond and Lee, 2011), and the HTKS measure specifically is sensitive to intervention, including among underserved groups (Schmitt et al., 2015). Still, few direct measures of this SEL building block exist that are accessible for school systems. This study suggests that adding behavioral self-regulation to school readiness batteries may be a good investment. Meanwhile, other SEL building blocks were associated with teacher-rated SEL skill at different time points, so the complexity and nuance of SEL should also be communicated to teachers and schools – similar to how language and literacy skills are conceptualized and supported in a highly detailed and sub-skill-specific way (National Institute of Child Health & Human Development and National Reading Panel, 2000; Denham et al., 2010). By understanding these associations for a sample of children underserved communities, we were able to identify the unique strengths and needs of these children, rather than focusing on population averages or making normative comparisons to children living in other community contexts. In turn, our findings inform interventions and investments that are most likely to benefit these communities specifically.

In addition, more attention is needed around developing measures that limit cultural bias and are appropriate for the population of interest. Such measures should be able to capture the full variability among individual children, without floor effects, to help identify strength and growth areas. Tablet-based assessment systems are one example that can be designed to address these issues and relieve teacher assessment burdens, assess skills directly, and are able to incorporate many readiness skills, including self-regulation and emotion knowledge (Tripathy et al., 2020). Assessment interpretations provided to teachers should emphasize that children develop skills along a continuum and that all children have room to improve in a given skill area, which can address teacher misconceptions or bias about children's innate or fixed capacities.

Conclusion

The COVID-19 pandemic and the international Black Lives Matter movement have illuminated the many social disparities the Black, Indigenous, and People of Color (BIPOC) individuals endure. These globally relevant issues have also created more urgency in schools, teachers, and families being able to attend to learning processes other than academic achievement. Ongoing discussion of pandemic-related learning loss must occur within a conversation of how to holistically support children as they enter school contexts, which affect them unequally depending on their socio-demographic characteristics. Social–emotional learning (SEL) skill is foundational to well-being, for all individuals and all social groups including in classrooms serving young children of color. School readiness batteries can support children by considering the complexity of SEL and the multiple building blocks that are associated with how teachers perceive their SEL. In a historically oppressed community, this study highlights the unique importance of children's early behavioral self-regulation

for how their teachers perceive them, socially, throughout first grade.

Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: data are not available for public use. Requests to access these datasets should be directed to JD, justin_doromal@brown.edu.

Ethics statement

The studies involving human participants were reviewed and approved by University of Virginia and the IRB at an institution in the community where the data were collected.

Author contributions

CC conceptualized the manuscript, conducted the literature review, and drafted the introduction, method, and discussion, and performed correlation analysis. HK conceptualized the manuscript, provided substantive writing in the introduction and literature review and discussion, and provided substantive edits to the entire manuscript. JD designed and conducted the main analyses, wrote the results section and created tables, helped to write and refine the method, and provided substantive edits to the entire manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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