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Social-Emotional Learning Intervention for K–1 Students at Risk for Emotional and Behavioral Disorders: Mediation Effects of Social-Emotional Learning on School Adjustment

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Abstract

Education researchers, policy makers, and practitioners have emphasized the role that social-emotional learning and self-regulation play in children's adjustment and connection to school, particularly as they transition from pre-school to kindergarten and the primary grades. A pretest–posttest cluster-randomized efficacy trial of the Social-Emotional Learning Foundations (SELF) curriculum for kindergarten–first-grade students found positive main effects on assessments of self-regulation, social-emotional learning, social-emotional vocabulary, and general behavioral functioning. This study is a secondary analysis using structural equation modeling to explore whether SELF effects on school adjustment were mediated by its effects on language and/or self-regulation–related outcomes. Findings replicated direct effects of treatment but did not support hypothesized mediators. In contrast, direct effects of treatment on measures of competent school functioning and internalizing behavior were mediated by outcome effects on a standardized measure of social-emotional learning competence. Study findings underscore the fundamental importance of social-emotional learning to school success and suggest related measurement issues in social-emotional learning and topics for further research.

Keywords

elementary age group, behavior disorders, emotional or behavioral disorders/disabilities, randomized trial experimental design, social-emotional learning interventions

An increasing number of researchers and education stakeholders emphasize the role social-emotional learning (SEL) plays in children's adjustment and connection to school, particularly at the critical transition from pre-school to kindergarten (K) and the primary grades (Atwell et al., 2021; Nix et al., 2013; Rademacher et al., 2021). As such, successful school adjustment requires the development of self-regulatory skills (i.e., emotion awareness, social problem solving, building positive relationships) underlying healthy social, emotional, and behavioral functioning (Blair & Diamond, 2008; Riggs et al., 2006; Savina, 2021). Self-regulatory skill development contributes significantly to a child's social-cognitive and behavioral functioning (Cumming et al., 2022; Greenberg et al., 2017; McClelland & Cameron, 2012), and when these processes are underdeveloped, children may exhibit a variety of maladaptive behaviors, interfering with successful functioning in the school setting and elsewhere (Tyler et al., 2019).

Social-emotional learning interventions have been linked to increased prosocial behavior, decreased substance use, increased emotional control, and less peer rejection (Durlak et al., 2011; Rogers, 2019). Interventions designed for primary grade students at risk for emotional and behavioral disorders (EBD), such as Early Risers (August et al., 2001), Incredible Years (Webster-Stratton, 2001; Webster-Stratton & Reid, 2018), and First Steps to Success (Walker et al., 1997), have evidenced positive effects on both academics and social-cognitive and behavioral functioning. Outcomes included reduction in externalizing behaviors (Nelson et al., 2009; Walker et al., 1997, 2009; Webster-Stratton & Reid, 2004), improved social relationships (August et al., 2002, 2003; Walker et al., 2009; Webster-Stratton & Reid, 2004), and more successful academic performance (August et al., 2002, 2003).

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Although social-emotional growth and academic learning are inextricably connected (Blair & Diamond, 2008; Darling-Hammond et al., 2020; Downer & Pianta, 2006), many school professionals continue to emphasize academic skills over growth in SEL (Bassok et al., 2016). Amid the current press to demonstrate continuous academic progress, a potential means of developing SEL is to integrate instruction into existing academic content areas such as English Language Arts. This integration enables teachers to address SEL and academics simultaneously and feasibly within the classroom setting.

Language Development and Emotional and Behavioral Self-Regulation

Beck and colleagues (2012) noted the demonstrated positive link between language development and emotion in children and the risk for poor social-emotional adjustment posed by early language problems, suggesting that early language interventions could potentially counteract emotional and social, as well as communicative difficulties. In addition, theorists have long considered the internalization of self-statements, or self-talk, to be fundamental to developing self-regulation (Mahoney, 1974; Meichenbaum, 1977). Use of self-talk requires SEL-related vocabulary to verbally identify and label emotions experienced. Enhancing children's SEL-related language and concomitantly their self-talk, therefore, can have a powerful effect on the ability to self-manage emotions and behavior (Greenberg et al., 2004). Moreover, Lemerise and Arsenio (2000) revealed the contribution of prior affective experiences to children's motivation and decision making in social or learning contexts, particularly in emotionally charged situations. Accordingly, opportunities to talk about emotional experiences help children use and internalize the SEL vocabulary essential to emotional and behavioral self-regulation (Domitrovich et al., 2007; Lochman et al., 1981).

The Social-Emotional Learning Foundations Intervention

The Social-Emotional Learning Foundations (SELF) Intervention is a K–Grade 1 curriculum for children at early risk for externalizing and internalizing behavior problems and ultimately, for receiving services for EBD (Daunic et al., 2013; Daunic, Corbett, Smith, Algina, et al., 2021). Through a carefully coordinated set of materials and pedagogy, SELF lessons promote children's use of SEL-related vocabulary, self-talk, and critical thinking through teacher modeling and language interactions (teacher–student and student–student) maximized in small-group instructional settings. Given the importance of social-emotional growth to school adjustment, the SELF curriculum helps provide a foundation for successful school-related outcomes with its emphasis on developing social-emotional language in support of emotional and behavioral self-regulation.

Daunic et al. (2013) reported a preliminary version of SELF improved executive function, internalizing behavior, and school-related competence assessed by teachers. In addition, in another pilot study, Santiago-Poventud and colleagues (2015) found positive effects of SELF on expressive and receptive vocabulary regardless of baseline language skills. Most recently, in a pretest–posttest cluster-randomized efficacy trial (Daunic, Corbett, Smith, Algina, et al., 2021), SELF evidenced a significant positive impact on multiple outcomes for 1,154 K–Grade 1 students at risk for EBD, including standardized measures of SEL-related competencies, self-regulation, and school adjustment, and a researcher designed measure of SEL-related vocabulary.

While SELF has demonstrated efficacy in prior studies, it is important to explore mechanisms contributing to its efficacy. Although many intervention studies discuss causal theory, few have conducted mediation analyses to test their proposed theoretical framework (Mercer et al., 2014). Mediation analyses would help identify mechanisms of change and thereby test theoretically derived hypotheses. Burns (2011) emphasized the importance of understanding underlying theory through explorations of mediating and moderating variables; this understanding broadens implications for both existing theories and future intervention development.

Building on positive direct effects reported for the SELF intervention, we wanted to test whether hypothesized theoretical mechanisms of change were instrumental in promoting intervention effects on outcome variables related to successful school adjustment. Specifically, the theory of change proposed by Daunic, Corbett, Smith, Algina, and colleagues (2021) and aligned with those of other researchers (see Eisenberg et al., 2010; Nix et al., 2013; Tyler et al., 2019) suggests improving language skills and/or skills involving self-regulatory competence promotes successful adjustment to school. The hypothesized connections between SELF intervention components, mechanisms of change (mediators), and outcome variables are illustrated in Figure 1.

Specifically, we asked the following research questions:

RQ1. Were intervention effects on social-emotional and school adjustment outcomes mediated through direct effects on language development and/or self-regulation?

RQ2. Were intervention effects indirectly mediated through language effects on self-regulation?

These questions were theory-driven, as illustrated in Figure 1, and examined using a structural equation modeling (SEM) framework.

In addition, to examine complex measurement structures such as those involved in our research questions, Asparouhov and Muthén (2009) and Marsh and colleagues (2014) suggested adding exploratory analyses. Therefore,

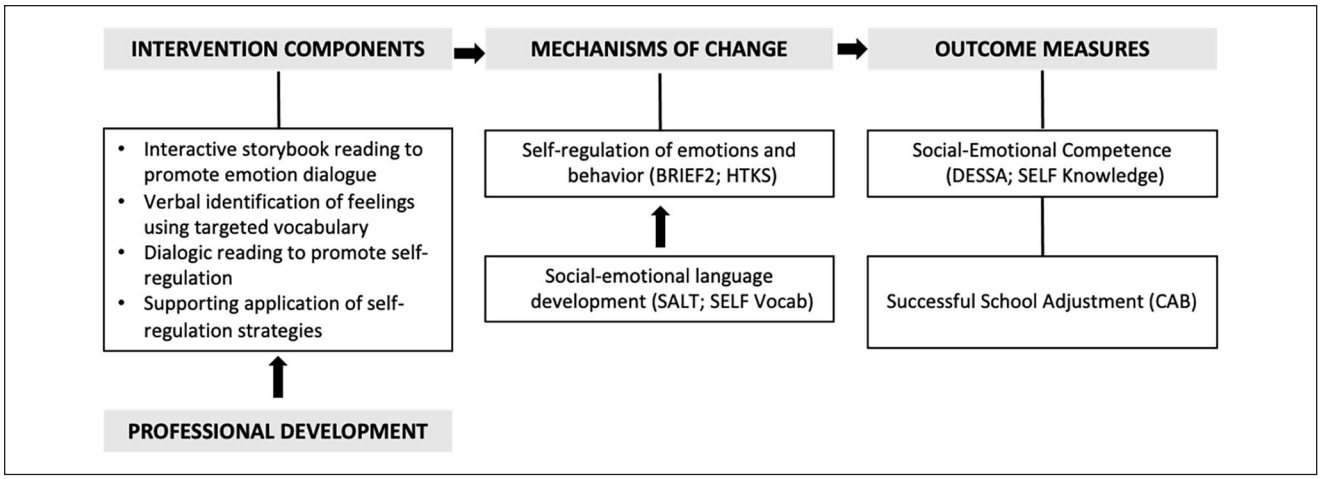

Figure 1. Theory of Change.
Note. BRIEF2 = Behavior Rating Inventory of Executive Function–Second Edition; HTKS = *Head-Toes-Knees-Shoulders* measure; SALT = Systematic Analysis of Language Transcripts; SELF Vocab = Social-Emotional Learning Foundations Vocabulary measure; DESSA = Devereux Student Strengths Assessment; SELF Knowledge = Social-Emotional Learning Foundations Knowledge measure; CAB = Clinical Assessment of Behavior.

Table 1. Student Demographic Characteristics for BAU and SELF Conditions.

	BAU		SELF	
Characteristic	*n*	%	*n*	%
Gender				
Male	319	62.9	350	61.5
Female	219	37.1	188	38.5
Receiving free or reduced-price lunch	371	81.0	416	82.4
English language learner	14	2.7	24	4.2
IEP or section 504 plan	107	21.1	110	19.3
Race				
White (non-Hispanic)	306	60.4	379	66.6
African American	114	22.5	103	18.1
Hispanic	48	9.5	51	9.9
Other race	39	7.7	36	6.3

Note. IEP = Individualized Education Program; BAU = business as usual; SELF = Social-Emotional Learning Foundations.

the following question was added: RQ3. Is there a better fitting mediation model to determine the indirect effect of the intervention on school adjustment outcomes? We examined this more general question using exploratory analyses.

Method

Participants

Over 3 years, researchers contacted administrators in 18 school districts via electronic mail and phone to recruit participants. Districts were within a 150-mile radius surrounding the southeastern U.S. state university in which the research project was located. We targeted elementary schools eligible for Title I funding (i.e., low-income families make up at least 40% of enrollment). Fifty-two schools within 11 school districts participated. These schools included 163 K and 141 first-grade classrooms, yielding a total of 1,154 students selected by teachers for study participation (627 K, 527 first grade). An average of 91.88% of selected participants across categories contributed to demographic data, presented in Table 1. To compare business as usual (BAU) and SELF intervention groups on demographic characteristics, we conducted chi-square tests. The tests were non-significant for all demographic variables (both with and without correction for clustering). An average of 5.85 K–Grade 1 teachers per school allowed for typical rates of attrition and ensured an adequate sample size for conducting mediation analyses.

Screening to Select Target Population. To select target students prior to random assignment, participating K–Grade 1

teachers screened children in their class for risk of developing emotional or behavioral difficulties, ruling out those with school-identified intellectual disabilities, using the Systematic Screening for Behavior Disorders, Second Edition (SSBD; Walker & Severson, 1992), a cost-effective, validated, multiple-stage procedure. The SSBD distinguishes among students with externalizing behaviors, internalizing behaviors, emotional disturbances, and those with typical development (e.g., Walker et al., 1994) with coefficient alphas above .90 for the standardization sample (Walker et al., 1990). Specifically, researchers used the descriptions of internalizing and externalizing behavior problems provided by Stage 1 of the SSBD as a guide to help teachers select students who might benefit most from SELF if the school were randomized to the treatment condition.

Parents of students in participating classrooms were provided an opportunity to opt-out of the initial class-wide screening, if desired, by signing and returning an information letter indicating their decision, a procedure approved by the university Institutional Review Board. A total of 246 students (approximately 4.5%) from 302 classrooms across 3 years of data collection opted out of the screening process. Teachers evaluated all students in their class (except for those whose parents opted out) and identified up to five students for internalizing and five for externalizing categories; teachers subsequently rank-ordered identified students based on the degree to which their behavior or characteristics aligned with the behavior profiles provided in Stage 2 of the SSBD and targeted the top three to four students in each category for possible inclusion in the participant sample. School and teacher participation was confirmed prior to randomization, and teachers and schools, regardless of group assignment, were compensated for their participation in the study. No school participated for more than 1 year.

Random Assignment and Consent Procedures. Each participating teacher obtained consent for at least two and no more than five students among those designated for possible study participation subsequent to screening. To comply with human participant protection, all teachers and research project staff involved in recruitment received training on the informed consent process. Following the consent process, schools were randomly assigned within districts to the SELF or BAU condition to ensure some schools in each district would be provided the SELF curriculum during their participation year; randomization at the school level addressed potential contamination between classrooms within schools. Random assignment was conducted using PROC PLAN in SAS 9.4 (SAS Institute, 2017). Personnel in schools assigned to BAU were informed they would be offered SELF, including professional development (PD) and related materials, following their year of participation in the study.

Intervention Description

SELF consists of 52 kindergarten lessons and 54 first-grade lessons lasting approximately 20 min each. Lessons for each grade are grouped within 17 SEL topics. The first 16 topics contain lessons using readily available children's storybooks selected for their SEL-related content. (Lessons in the 17th topic do not include a storybook but provide children opportunities to apply SEL vocabulary and strategies learned; see online Supplemental Appendix A for Scope & Sequence.) The topics are organized within five critical competencies identified by the Collaborative for Academic, Social, and Emotional Learning (CASEL): self-awareness, social awareness, self-management, relationship skills, and decision making (CASEL, 2021; Weissberg et al., 2015). SELF lesson strategies promote children's comprehension, use of SEL-related vocabulary, self-talk, critical thinking, and application of learned concepts to enable students at risk for EBD to engage actively in social problem solving. Structured as such, the SELF intervention provides an opportunity within the classroom setting to integrate SEL with K–1 literacy-related instruction.

Each of the first 16 topics includes three lessons. The teacher introduces a new SEL topic weekly, reading the associated storybook to the whole class, prompting discussion and incorporating conventions of social learning activities, such as "turn and talk" with a partner. The first lesson is delivered whole-group to introduce vocabulary and SEL concepts to all students in the classroom, providing a context within which the teacher can reinforce learning throughout the school day. The second and third lessons in each topic are taught in a small-group setting to students identified as at risk for EBD, maximizing opportunities for language interactions and teacher modeling to help build self-regulation skills.

In the second lesson of each topic, the teacher rereads the accompanying storybook using dialogic reading (DR), an interactive technique to enhance children's language and literacy skills (Whitehurst et al., 1994). DR provides a socially interactive context within which the teacher helps children learn and apply verbal and conceptual skills as they retell a story (Flynn, 2011). Teachers expand a child's response by rephrasing, adding information, and repeating the prompt. SELF lesson scripts integrate DR through teacher prompts asking children to (a) remember specific details or events related to feelings or behaviors, (b) respond using their own words, (c) relate story content to their experiences, and (d) consider the thoughts and feelings of others. The DR technique has been shown to increase vocabulary (Coogle et al., 2018; Opel et al., 2009) and expressive and receptive language skills (Simsek & Erdogan, 2015) and has been incorporated in individual, small-group, and whole-group instruction.

In the third lesson per topic, students in the small group are asked to demonstrate use of selected SEL vocabulary and apply social-emotional concepts and skills in social problem-solving situations using a progression of strategies focused on regulating emotions and behavior. Taught sequentially, the strategies are Choices and Consequences, Breathe and Think (BAT), and Steps for Problem Solving. In the Choices and Consequences strategy, explicit steps help students incorporate self-talk as they remember to (a) Stop before I say or do something, (b) Think about my choices, (c) Think about the consequences, and (d) Make a choice. Similarly, the BAT strategy reminds them to (a) Take a deep breath and blow out the (e.g., anger), (b) Think about my choices and consequences, and (c) Make a choice. In Topic 17, the steps in the first two strategies are combined in the Steps for Problem Solving, and children have opportunities to practice these steps across multiple lessons.

Prior to implementing SELF, all treatment teachers took part in two 6-hr days of PD during the fall of their participation year. The first included a description of SEL's conceptual foundations, and an introduction to SEL competencies and essential SELF lesson components. Day 2 was focused on curriculum implementation and pedagogical knowledge related to DR and targeted vocabulary instruction. Using video examples and discussion, teachers practiced each of the three lesson types (i.e., storybook reading with prompts, DR and vocabulary instruction, application activities). In addition to PD, research assistants visited treatment teachers' classrooms an average of once per week during SELF instruction to answer questions about lesson implementation and classroom management.

Instrumentation

The SELF Vocabulary Measure is a researcher-developed and individually administered measure to assess knowledge of SEL-related vocabulary (Santiago-Poventud et al., 2015). For each of 20 words assessed at each grade level, a member of the research team trained in administering the instrument asked student participants to (A) provide a definition, (B) use the word in an example, and (C) apply the word to answer a multiple-choice question with three options. Parts A and B were scored on a 3-point scale (2 = *correct*, 1 = *partially correct*, 0 = *incorrect*); Part C was scored as either 1 (*correct*) or 0 (*incorrect*). Cronbach's alphas derived from K–Grade 1 sample data at pretest were .802, .842, .734, and .918 for Parts A, B, C, and the total score, respectively.

The SELF Language Measure is a researcher-developed and individually administered instrument designed to assess (a) ability to use SEL related language and (b) language development as measured by mean length of utterance in words (MLU-w; Daunic, Corbett, & Smith, 2021). A higher MLU-w value suggests more sophisticated linguistic proficiency (i.e., better language development; Barnes, 2010). Moreover, in previous studies with preschool children, MLU was calculated to provide an indicator of emotion language (e.g., Denham et al., 1994). To administer the measure, we recruited primarily former teachers or other school-based personnel. Using a storybook related to SEL but not included in the SELF curriculum, assessors asked questions associated with SEL competencies. Assessors were masked to condition and participated in a half-day of training during which they were instructed to accept each child's responses as valid and encourage conversation with prompts. All conversations were audiotaped and transcribed; four speech and language graduate students trained by project consultants subsequently reformatted transcriptions to provide consistent communication units (see Hughes et al., 1997; Strong, 1998). The average agreement of speech/language graduate student coding with master (consultant) coding on a sample of five transcriptions was 99.1%. Finally, consultants used an R script to (a) count the words in each utterance to determine MLU-w and (b) count the SEL vocabulary words (including synonyms and derivatives) used in the language sample and taught in the SELF curriculum (R Core Team, 2020). The complete SELF Language Measure protocol is provided in Supplemental Appendix B.

Head-Toes-Knees-Shoulders (HTKS; Ponitz et al., 2008) is a direct measure of self-regulation for children ages 4 to 6 assessing how well they apply cognitive skills to their behavior. Trained assessors used a specified format, initially directing children to comply with instructions (e.g., "touch your head"). In subsequent trials, assessors direct participants to respond in an "opposite" way (e.g., to touch their head when directed to touch their toes), requiring children to pay attention, remember the rule, and inhibit the usual response. Students receive scores of 0 (*incorrect*), 1 (*self-correct*), or 2 (*correct*). Based on six practice opportunities (three for each part) and 20 trials, scores range from 0 to 52, with higher scores representing stronger abilities. The sample derived Cronbach's alpha for total HTKS scores at pretest was .949.

The Behavior Rating Inventory of Executive Function–Second Edition (Gioia et al., 2015) is a standardized teacher-report measure to evaluate emotional and behavioral self-regulation. It contains 86 items contributing to three groups of subscales: Behavioral Regulation Index (BRI), Cognitive Regulation Index (CRI), and the Emotion Regulation Index (ERI). The BRIEF assesses behavioral aspects of children's executive function (EF) relevant to self-regulation in the school environment; teachers score items on a scale of 1 to 3, with higher ratings indicating more risk for problem behavior. Sample-derived Cronbach's alphas for the BRI, CRI, and ERI were .957, .972, and .937, respectively, at pretest.

The Devereux Student Strengths Assessment (DESSA; LeBuffe et al., 2008) is a 72-item, standardized, norm-referenced, teacher-report behavior rating scale measuring

social-emotional competencies serving as protective factors for children in Grades K–8. Items indicating how often the student engaged in each designated behavior over the previous 4 weeks are rated on a 5-point scale ranging from 0 (*never*) to 4 (*very frequently*) and organized into eight conceptually derived scales corresponding to key social-emotional competencies, including five that correspond to those encompassed in SELF: Self-Awareness, Social Awareness, Self-Management, Relationship Skills, and Decision Making. Cronbach's alpha was .981 for the total score (sum of 8 scales) at pretest. Posttest DESSA scores had minimum and maximum values of 4 and 276, respectively, where a high score indicates low risk.

The Clinical Assessment of Behavior Teacher Rating Form (CAB-T; Bracken & Keith, 2004) is a behavior rating scale designed to aid in teachers' assessment of children who may need behavioral or educational intervention. The CAB-T consists of 70 questions used to produce scores for two clinical scales (internalizing behavior, externalizing behavior) and two adaptive scales (social skills, competence). The Internalizing scale assesses behaviors related to depression, anxiety, and somatization; Externalizing, problematic conduct directed toward others; Social Skills, interpersonal interactions with peers and adults such as being considerate or being annoying; and Competence, cognitive and language development affecting judgment and the ability to get needs met. Raters use a 5-point Likert-type scale to describe how often a student has recently engaged in a particular behavior, with a rating of 1 indicating *always or very frequently* and a rating of 5 indicating *never*. Current study sample derived Cronbach's alphas at pretest were .877, .970, .933, and .934 for the four subscales, respectively. Posttest minimum values for the four subscales were 21, 18, 20, and 18, whereas maximum values were 80, 90, 90, and 90, respectively. The internalizing and externalizing scores were reversed; for all four CAB-T subscales, therefore, a high score indicated low risk, similar to DESSA scores.

All teacher-report measures were collected only on students selected for small group instruction (target students) in both experimental conditions. Pre-assessments were completed in the late fall of the academic year in which a given school participated; post-assessments were completed following delivery of SELF lessons in the treatment group in the late spring. Following the same timeline, trained assessors administered all direct assessments for selected (target) students only in both SELF and BAU conditions.

Assessment of Treatment Fidelity and Dosage. To ensure implementation fidelity, researchers observed (in situ or through video) approximately 14% of lessons taught using researcher developed checklists of lesson components (adherence) and instructional quality (preparing the classroom for instruction, development of language to support self-regulation, quality of instructional delivery). For the latter, research assistants completed 4 to 6 hr of training and practice before conducting observations. The average percentage of instructional components taught across all lessons observed was 92.09%, and the mean instructional quality rating was 84%. Interobserver agreement (IOA) for adherence was 90.61% based on 110 lessons scored by two independent observers; IOA for instructional quality was 77.71% based on 100 independently rated observations.

To assess intervention dosage, SELF teachers recorded the students who were present for each small-group lesson taught. SELF lesson dosage was calculated as a percentage of lessons (52 for K; 54 for first grade) received by a target child. The mean percentage of SELF lessons received across both grade levels was 88.4%.

Business as Usual Group Description. To describe SEL instruction in BAU classrooms, teachers responded at the end of their participation year to surveys asking whether they used a specific SEL curriculum and the extent to which they used any of the same books to teach SEL concepts as those used in SELF instruction. Based on surveys completed by 93.75% of BAU teachers, only 15.50% reported using a SEL curriculum. In addition, only 5% of K and 14% of first-grade teachers in BAU used any of the SELF books for small group SEL instruction.

Design and Analyses

The present study consists of a secondary analysis using structural equation modeling to explore whether SELF effects on school adjustment were mediated by effects on language and/or self-regulation related outcomes. The design included one fixed between-subjects factor to compare the effects of the SELF curriculum with those of a BAU condition and two random factors: school and teacher. Randomization at the school level addressed potential contamination among classrooms within schools; teachers nested in schools comprised a second random factor.

Pre- and post-intervention data were merged across three cohorts, providing 365, 513, and 276 observations, respectively, for Years 1, 2, and 3. The data have a three-level nested structure; 1,154 student observations (Level 1) were nested in 318 classrooms/teachers (Level 2), and these classrooms/teachers were nested in 52 schools (Level 3). There were 26 schools, 158 teachers, and 613 students participating in the intervention condition, and 26 schools, 160 teachers, and 541 students participating in the BAU condition.

To answer research questions concerning direct and indirect mediation effects, we conducted three-level mediation analyses (e.g., Pituch et al., 2010) using Mplus 8.4. The first analysis incorporated a latent decomposition of the covariates; this model did not converge, most likely

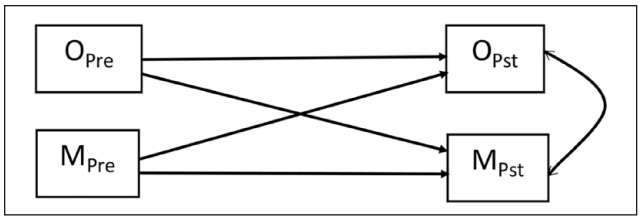

Figure 2. Level 1 and Level 2 aspects of the Mediation Model.

due to the small number of Level 3 units. We subsequently used an observed mean model. Pretest scores were centered around observed means (i.e., Level 1 scores were centered around the Level 2 cluster mean, Level 2 around the Level 3 cluster mean, and Level 3 around the grand mean, given that mediation of the intervention effect goes through the school-level component of the mediator). To address missing data, our attempts to use all available cases increased the number of parameters to be estimated and resulted in model warnings for the trustworthiness of standard errors. Thus, we reported results for complete cases as well as results for all available cases. The two sets of results were consistent, and the model estimation with complete cases terminated normally.

We conducted two sets of mediation analyses. In the first set, using a traditional SEM perspective, we tested whether language development indirectly mediated intervention effects on measures of social-emotional competence and successful school adjustment through its effect on self-regulation. The measure of language development was the total score on the SELF Vocabulary Measure, and the measure of self-regulation was the total score on the BRIEF. (We did not include the SELF Language Measure or the HTKS as potential mediators for language and self-regulation, respectively, because analyses did not support an intervention effect on these variables.) Social-emotional competence was measured by the DESSA subscales, and successful school adjustment was measured by four CAB subscales.

We conducted a second set of mediation analyses from an exploratory perspective (Asparouhov & Muthén, 2009; Marsh et al., 2014) to determine whether the SELF intervention indirectly affected school adjustment. Figure 2 depicts the Level 1 and Level 2 aspects, and Figure 3 depicts the Level 3 aspect of the exploratory model.

The notations O and M denote an outcome and a mediator, respectively, and pre- and post-subscripts indicate time of measurement. Exploratory approaches to models of casual ordering are shown to be more flexible compared with traditional SEM, and they are expected to generate better solutions in terms of model fit (Marsh et al., 2014). Consistent with the recommendation by Marsh and colleagues (2014), we conducted the second set of mediation analyses to explore whether a better model fit existed compared with the a priori, theory-driven model. This alternative approach incorporates the best elements from exploratory and confirmatory analyses to overcome data-model-fit challenges (van Zyl & Ten Klooster, 2022).

Results

Descriptive statistics and missing data information are reported in Tables 2 and 3 for pretest and posttest assessments, respectively. Missing data rates ranged from 2.1% to 4.1% at pretest and from 12.1% to 12.5% at posttest.

Tests of Hypothesized Mediators Using Traditional SEM Analyses

Tables 4 and 5 present estimated coefficients, standard errors, and p values along with the standardized root mean square residual (SRMR) for each level as an indicator of the model fit. In Table 4, we report estimated coefficients, standard errors, and p values for nine different outcomes (i.e., five DESSA and four CAB-T subscales). None of the mediation effects examined were statistically significant except for a marginally significant indirect intervention effect on the competence subscale of the CAB-T. Our analyses did show significant direct effects of treatment on CAB-T and DESSA subscales, consistent with prior results (Daunic, Corbett, Smith, Algina, et al., 2021). For all of the models reported in Table 4, the SRMR values indicated lack of model fit was due to Level 3 components.

Results of Exploratory Analyses

Table 5 presents the results for a second set of analyses exploring other possible mediation effects. Again, consistent with previously reported findings (Daunic, Corbett, Smith, Algina, et al., 2021), the analyses yielded statistically significant direct effects of the intervention on the four CAB subscale scores, with direct effect estimates of 4.30, 5.11, 4.29, and 5.50 for competence, externalizing behavior, internalizing behavior, and social skills variables, respectively ($p < .01$). Results of exploratory analyses also indicated the DESSA total score mediated the treatment effect on both the Competence and Internalizing subscales of the CAB-T, a measure of school adjustment. Indirect effect estimates were 2.36 for competence, with $p < .01$, and 1.00 for internalizing behavior, with $p = .03$. The SRMR values indicated acceptable fit for all levels.

Discussion

Tests of Hypothesized Mediators

Researchers over time have documented the mediation effects of vocabulary and oral comprehension on language/emergent literacy skills and learning engagement (Nix

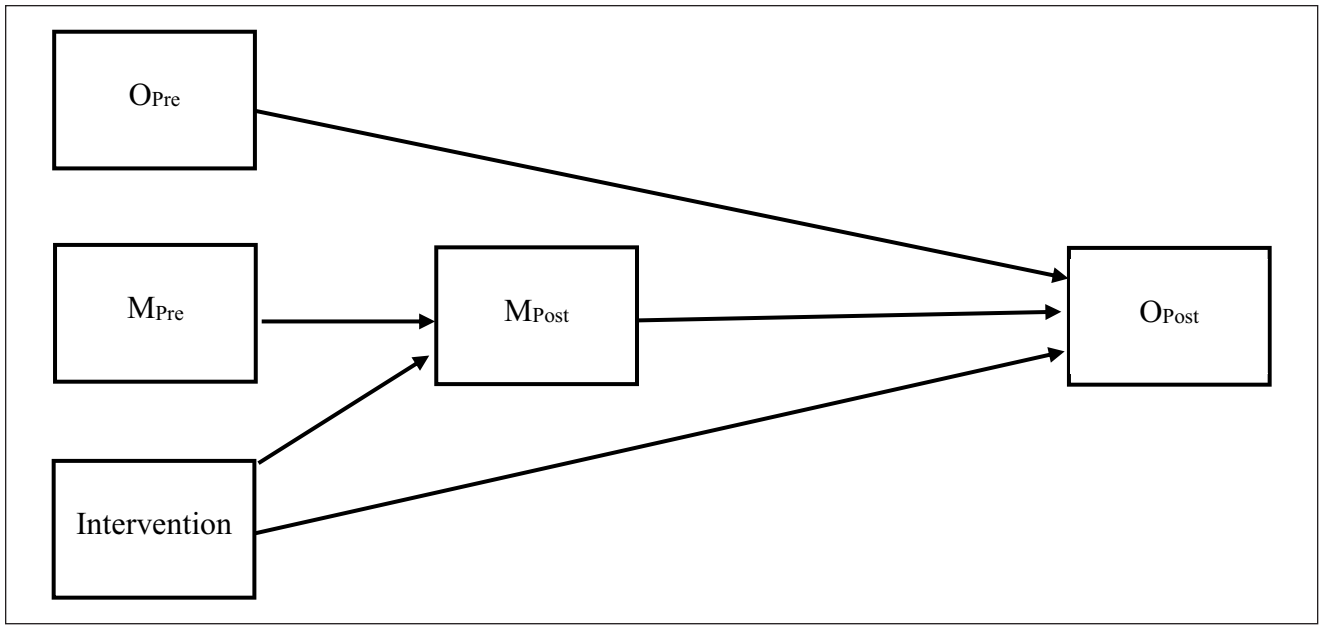

Figure 3. Level 3 aspect of the Mediation Model.

Table 2. Descriptive Statistics by Condition for Pretest Assessments.

Statistic	Condition	BRIEF	SELF	INT	EXT	SOC	COM	DM	RS	SAW	SM	SOA	DT
N	BAU	532	528	532	532	532	532	532	532	532	532	532	532
	Self	580	602	580	580	580	580	574	574	574	574	574	574
Missing	BAU	9	13	9	9	9	9	9	9	9	9	9	7
	Self	33	11	33	33	33	33	39	39	39	39	39	38
M	BAU	117.86	38.23	53.85	62.70	57.00	53.09	16.27	20.94	12.75	21.22	18.19	141.38
	Self	121.31	39.22	52.33	61.96	55.03	51.40	15.11	18.81	11.21	20.04	16.94	129.59
SD	BAU	30.84	17.82	12.13	19.54	14.46	15.33	6.53	8.07	5.61	8.19	6.82	50.84
	Self	29.52	18.21	11.48	19.11	14.06	14.70	5.69	7.17	5.09	7.33	5.90	43.09

Note. BAU = business as usual; BRIEF2 = Behavior Rating Inventory of Executive Function–Second Edition; SELF = Social-Emotional Learning Foundations; INT = Internalizing; EXT = Externalizing; SOC = Social Skills; COM = Competence; DM = Decision Making; RS = Relation Skills; SAW = Self-Awareness; SM = Self-Management; SOA = Social Awareness; DT = DESSA Total.

Table 3. Descriptive Statistics by Condition for Posttest Assessments.

Statistic	Condition	BRIEF	SELF	INT	EXT	SOC	COM	DM	RS	SAW	SM	SOA	DT
N	BAU	480	486	480	480	480	480	479	479	479	479	479	479
	Self	533	528	533	533	533	533	531	531	530	530	531	529
Missing	BAU	61	55	61	61	61	61	62	62	62	62	62	60
	Self	80	85	80	80	80	80	82	82	83	83	82	83
M	BAU	110.74	43.35	56.42	64.80	59.58	57.00	17.99	23.23	14.52	24.00	20.05	158.82
	Self	104.19	51.31	59.84	68.98	63.64	60.81	20.04	25.74	16.78	26.70	22.27	177.16
SD	BAU	32.02	17.61	12.05	19.32	14.95	16.10	7.04	8.80	5.92	9.15	7.54	57.56
	Self	30.44	19.63	11.35	17.90	14.42	15.30	6.69	8.30	5.71	8.86	7.15	54.41

Note. BAU = business as usual; BRIEF2 = Behavior Rating Inventory of Executive Function–Second Edition; INT = Internalizing; EXT = Externalizing; SOC = Social Skills; COM = Competence; DM = Decision Making; RS = Relation Skills; SAW = Self-Awareness; SM = Self-Management; SOA = Social Awareness; DT= DESSA Total.

Table 4. First Set of Mediation Analyses.

	Complete cases								All available cases[a]				
	SRMR				Direct effect		Indirect effect			Direct effect		Indirect effect	
Variable	*n*	L1	L2	L3	Est. (*SE*)	*p*	Est. (*SE*)	*p*	*n*	Est. (*SE*)	*p*	Est. (*SE*)	*p*
Competence	1,013	.00	.01	.13	2.58 (0.78)	.00*	1.12 (.56)	.05	1,154	2.60 (0.79)	.00*	1.15 (.58)	.05
External	1,013	.00	.01	.15	3.28 (0.68)	.00*	0.41 (.38)	.28	1,154	3.29 (0.68)	.00*	0.44 (.39)	.26
Internal	1,013	.00	.01	.13	2.93 (0.55)	.00*	0.33 (.31)	.28	1,154	2.91 (0.55)	.00*	0.38 (.31)	.22
Social skills	1,013	.00	.02	.15	3.83 (0.70)	.00*	0.39 (.36)	.28	1,154	3.87 (0.70)	.00*	0.42 (.37)	.26
Dec. making	1,007	.00	.01	.14	1.73 (0.42)	.00*	0.39 (.26)	.12	1,154	1.74 (0.44)	.00*	0.44 (.28)	.11
Rel. skills	1,007	.00	.01	.15	3.25 (0.55)	.00*	0.15 (.17)	.36	1,154	3.30 (0.55)	.00*	0.17 (.18)	.34
Self-Awa	1,007	.00	.01	.12	2.77 (0.33)	.00*	0.26 (.16)	.12	1,154	2.74 (0.33)	.00*	0.29 (.18)	.10
Self-Mng	1,007	.00	.01	.13	1.99 (0.55)	.00*	0.51 (.33)	.13	1,154	2.01 (0.56)	.00*	0.55 (.35)	.11
Social Awa	1,007	.00	.01	.14	1.89 (0.48)	.00*	0.38 (.24)	.12	1,154	1.88 (0.48)	.00*	0.42 (.26)	.10

Note. SRMR = standardized root mean square residual; *n* = number of observations; L = level; Est. = estimate; Variable = measure subscale; Dec = Decision; Rel = Relationship; Awa = Awareness; Mng = Management.
[a]This model resulted in warnings on the trustworthiness of the standard errors.
*$p < .05$.

Table 5. Second Set of Mediation Analyses.

	Complete cases								All available cases[a]				
	SRMR				Direct effect		Indirect effect			Direct effect		Indirect effect	
CAB subscale	*n*	L1	L2	L3	Est. (*SE*)	*p*	Est. (*SE*)	*P*	*n*	Est. (*SE*)	*p*	Est. (*SE*)	*p*
Competence	1007	.00	.00	.01	4.30 (0.76)	.00*	2.36 (0.78)	.00*	1,146	4.29 (0.76)	.00*	2.35 (0.78)	.00*
Externalizing	1,007	.00	.01	.01	5.11 (0.83)	.00*	0.35 (0.59)	.55	1,146	5.13 (0.82)	.00*	0.36 (0.59)	.55
Internalizing	1,007	.00	.00	.05	4.29 (0.66)	.00*	1.00 (0.47)	.03*	1,146	4.26 (0.66)	.00*	1.01 (0.47)	.03*
Social skills	1,007	.00	.01	.01	5.50 (0.78)	.00*	0.86 (0.60)	.15	1,146	5.51 (0.78)	.00*	0.87 (0.60)	.15

Note. CAB = Clinical Assessment of Behavior; SRMR = standardized root mean square residual; *n* = number of observations; L = level; Est. = estimate.
[a]This model resulted in warnings on the trustworthiness of the standard errors.
*$p < .05$.

et al., 2013; Wasik et al., 2006; Whitehurst et al., 1994). In addition, researchers have also found an inverse relation between effortful control, a component of self-regulation, and externalizing and internalizing behaviors in studies of school-age children (see Eisenberg et al., 2010). Although our findings support direct effects of the SELF intervention on measures of social-emotional learning and school adjustment, the findings do not show SELF treatment effects were mediated by either language or self-regulation.

Social Emotional Learning Language Use. We found no treatment effects on the use of social-emotional vocabulary taught in SELF. We did not, therefore, use the SELF Language Measure to examine mediation of treatment effects by language development. We hypothesize that despite assessor training, assessor personality characteristics and perceived role could have influenced their administration style (see Zeman et al., 2007) and consequently minimized treatment effects. For example, assessors may have engaged in varying degrees of formality in conversing with child participants, such as strictly adhering to prompts versus having more spontaneous conversations, and/or offering varying degrees of encouragement as children responded.

In addition, due to the large number of transcriptions, we designed a scoring program to capture specific, quantifiable outcomes to indicate potential differences between SELF and BAU conditions. Consequently, scoring for MLU-w and number of SELF vocabulary words participants actually used may not have adequately captured children's SEL conversation or contextualized use of vocabulary taught in SELF.

In contrast to the lack of effects on the language measure, there were direct intervention effects on the vocabulary measure. This instrument, however, captured vocabulary growth and did not focus on pragmatic language (i.e., conversational skills, interpreting and expressing emotions, problem solving). Because pragmatic language is a critical aspect of language development affecting the internalization of self-talk,

the vocabulary measure was likely insufficient for examining language as a possible mediator of treatment effects on school adjustment related outcomes.

Self-Regulation. As mentioned, scores on the HTKS direct measure of self-regulation evidenced no intervention effect. Although the HTKS has demonstrated strong reliability and has predicted school achievement (McClelland & Cameron, 2012), the typical development of executive function and associated self-regulation occurring during K and first grade may have overshadowed SELF intervention effects on these processes.

We also used the BRIEF2 teacher report to assess whether self-regulation mediated treatment effects on school adjustment, as hypothesized. The BRIEF2 is widely used as a measure of contextualized executive function (i.e., self-regulation), but in fact, it may measure somewhat different constructs than those measured by direct assessments, as Toplak and colleagues (2013) suggested. Correlations between direct measures of executive function and teacher reported assessments are not typically strong. For example, Cumming and colleagues (2023) reported relatively weak correlations between HTKS and BRIEF2 CRI scores [−.142 to −.229] and non-significant correlations between HTKS and both BRI and ERI scores on the BRIEF2. As such, a direct measure of self-regulation might have been more appropriate for testing the hypothesized mediation of treatment effects on school adjustment.

Intervention Intensity. An additional explanation for a lack of evidence that language and/or self-regulation were instrumental in promoting SELF outcomes could be that SELF was not adequately intensive to achieve the hypothesized mediation effects (i.e., mediation through language development and/or self-regulation). Although students participated in SELF small-groups twice a week for approximately 20 min per session, this instruction may not have allowed children to internalize SEL vocabulary sufficiently during self-talk.

Implications of Exploratory Analyses

The exploratory mediation analyses used to test whether language and/or self-regulation mediated school adjustment outcomes showed that SELF intervention effects on school adjustment (Competence and Internalizing subscales of the CAB-T) were mediated by effects on social-emotional competence (DESSA total score). While not surprising, given extensive literature suggesting SEL competence is critical to children's adjustment to school (Durlak et al., 2011; McClelland et al., 2006), this finding is nevertheless both important and interesting.

The Competence subscale of the CAB-T assesses skills related to cognitive and language development affecting children's adjustment to school, such as emotion regulation (e.g., perspective taking, empathy), judgment (e.g., positive decision making, willingness to compromise), and knowing how to get needs met. Our results suggest the importance of strengthening competencies delineated by CASEL (2021) and assessed by the DESSA to improving overall school adjustment. Given SELF lesson topics are aligned with CASEL competencies, the DESSA score's mediational effect on the CAB-T Competence subscale supports the importance of teaching SEL in preschool and the early grades, as others have suggested (Blair & Diamond, 2008; Denham & Brown, 2010; Graziano et al., 2007).

Equally important is the mediation effect on the Internalizing Behavior subscale of the CAB-T by the DESSA total score. The SELF curriculum had positive direct effects on measures of SEL competence and on measures of school adjustment (i.e., Internalizing, Externalizing, Social Skills, Competence subscales of the CAB-T) regardless of whether students were identified by teachers as having risk for externalizing or internalizing behavior problems (Daunic, Corbett, Smith, Algina, et al., 2021). Effective school-based programming for children with internalizing problems is critical, because they are often overlooked by teachers, even though their needs are just as great as those who exhibit externalizing behaviors (Weist et al., 2018). The DESSA-mediated intervention effect on internalizing behavior found in the current study underscores the importance of effective SEL programming for students with internalizing problems, specifically, for long-term school success. In sum, the mediation of outcomes related to school adjustment by children's overall social-emotional competence highlights the importance of educational programming that focuses on emotional awareness and regulation, as well as behavioral regulation, for developing students' ability to meet the academic and social challenges of school.

Limitations

The researchers hired assessors with education backgrounds who understood the purpose of the language use measure and had experience working with children in K–1. Nevertheless, these assessors interacted with child participants only during pre- and post-assessment sessions, which involved a brief greeting and introduction before administering the SEL language measure protocol. Asking children to interact with adults relatively unfamiliar to them may have limited the resulting adult–child conversations. In addition, the measure incorporated specific assessor prompts to elicit SEL-related child responses and to minimize assessor influence. This design may have constrained spontaneous (authentic) child responses that would have provided a more accurate picture of ability to use SEL-related language in conversation.

Similarly, the SELF Vocabulary Measure, designed to assess understanding of SEL-related words taught in SELF,

revealed positive intervention effects on children's knowledge of SEL vocabulary and ability to use words appropriately. We were unable to determine, however, whether children internalized the learned vocabulary and applied it in social problem-solving situations, as described above. As such, the vocabulary assessment alone was likely insufficient as the sole language measure for determining the hypothesized mediation effect.

Future Research

The lack of significant findings related to the language assessment suggests areas to be explored in future research. Both the procedural protocols and the scoring methods used in this study for transcribed conversations could be explored to better determine whether interventions like SELF, designed to enhance language-supported self-regulation, achieve desired outcomes indirectly through SEL language development. In future studies, researchers should consider integrating more holistic methods to capture the complexity of social-emotional language represented in adult–child conversations. Focusing on the interactions within the adult–child dyad, for example, may better enable researchers to quantify the child's language development *and* identify instances of pragmatic language use, such as identifying a problem, generating and evaluating responses, and selecting a solution (Fenning et al., 2011).

Relatedly, researchers have demonstrated important associations between parent–child conversations about emotion and children's independent social cognition (Fenning et al., 2011). Johnston (2001) noted that the level of familiarity between the child and the adult could have a considerable effect on the level of syntactic complexity of a child's language production. Researchers should thus consider recruiting adults familiar to the child as assessors of contextualized language use. These assessors could be parents or teachers who can relate conversations to the child's experiences and be more likely to elicit language related to social problem solving. An additional avenue to explore in future research is the potential benefit of coaching teachers to help students, particularly students at risk for EBD, apply SEL vocabulary in labeling emotions and making responsible decisions. Identifying instructional opportunities in which teachers can promote and model SEL language in solving social problems could be included as an aspect of PD or in coaching sessions that occur throughout the school year.

Finally, in addition to the analysis and measurement of social-emotional language development, researchers could explore the discrepancy between teacher report measures and direct assessments of self-regulation skills. It appears there are few direct measures of self-regulation free from variance irrelevant to the construct (McCoy, 2019). The fact that SELF and BAU students did not differ at posttest on the *Head-Toes-Knees-Shoulders* assessment suggests a need to explore how reports from teachers, or respondents such as parents or other school personnel, differ from direct assessments.

Conclusion

In sum, findings from studies to date indicate the SELF intervention, and others focused explicitly on social-emotional vocabulary along with SEL-related competencies, may offer a proactive approach to fostering successful school adjustment, especially for children at risk for internalizing behavioral issues. In addition, current study findings from mediation analyses suggest areas for future research, including (a) how to measure constructs in key areas such as self-regulation and language use to enhance the understanding of change mechanisms in SEL interventions, and (b) how gains in social-emotional competence affect long-term success in school. Such studies can contribute to more effective and efficient services for students with social-emotional needs.

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