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REVIEW ARTICLE

Classroom-Wide School Interventions for Preschoolers' Social-Emotional Learning: A Systematic Review of Evidence-Based Programs

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Abstract

Social–emotional skills are essential for preschool children's mental health and later school success. Considering the variety of school-based interventions aiming to target SEL development, it remains unclear what programs can be considered evidence-based, and what features characterize well-established programs. Hence, the current systematic review aimed (1) to classify classroom-wide SEL programs according to the criteria for evidence-based interventions; (2) to synthesize studies of programs categorized as well-established; and (3) to analyze study-level and overall risk of bias. Interventions were assessed for inclusion, and corresponding studies were systematically searched. A total of 81 studies corresponding to 38 programs were identified, and 24 studies corresponding to four programs classified as well-established were further analyzed. The results indicated that (1) a limited number of classroom-wide interventions (10.5%) meet the criteria for well-established interventions; (2) program implementation is associated with significant improvement in social–emotional competence, reduced risk of emotional, and behavioral problems, as well as with emerging evidence of positive effects on executive functions or school readiness; and (3) outcomes are reported in the context of mainly rigorously conducted experimental research, which could explain the low risk bias ratings for random assignment, baseline equivalence, or attrition. Taken together, these findings suggest that well-established classroom-based interventions could be promoted as examples of best practices which can be systematically implemented within schools. However, more research is needed to identify key ingredients of program effectiveness, as well as to understand the contextual school-related factors, which enable successful transfer from research to large-scale implementation of classroom-wide SEL practices.

Keywords Social-emotional skills · Preschoolers · Classroom curriculum · School-based interventions · Evidence-based

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Introduction

A significant amount of empirical evidence has accumulated over the past decades supporting the importance of social–emotional learning (SEL). SEL refers to a set of interpersonal and intrapersonal skills including the ability to understand and express emotions in contextually appropriate ways, to respond empathically to others, as well as to make responsible decisions (Collaborative for Academic, Social, Emotional Learning [CASEL], (2013); O'Conner et al., 2017). Research conducted in young children has uncovered that social–emotional skills have important implications for well-being, as they promote adequate problem solving and prosocial behaviors, considered key ingredients of peer acceptance, and positive teacher–child relationship (Downer et al., 2010; Herndon et al., 2013). In addition, long-term positive consequences of improved social adjustment have been associated with children's higher learning engagement and school performance (Denham et al., 2012), as well as decreased risk of conduct problems, substance abuse, or juvenile delinquency (Jones et al., 2015; Moffitt et al., 2011).

Given these positive outcomes, consistent interest has been devoted toward designing intervention frameworks providing support for developing social–emotional skills. A considerable proportion of SEL programs are delivered in schools as universal interventions for all children, or as indicated and selective interventions, intended to serve the needs of children at risk for mental health problems (i.e., high scores on measures of externalizing/internalizing problems) or those at risk due to exposure to contextual factors (i.e., low socio-economic status, high criminality rates, etc.) (Carta & Young, 2019; Durlak et al., 2011). A meta-analysis conducted by Durlak et al. (2011) evaluating 213 SEL programs found that participation was associated with increased social–emotional competence and academic skills, providing empirical support for adopting these practices within schools. Also, by the age of 3, children start spending more time in structured educational settings, in which teaching about SEL skills can be easily embedded within daily interactions in order to create an emotionally safe classroom climate, improve learning, as well as the quality of peer and teacher–child interactions (Domitrovich et al., 2017; Mahoney et al., 2020).

Relevance of School-Based SEL Interventions for Preschoolers

Implementing SEL practices in schools requires careful consideration, especially when tailoring interventions to correspond to children's developmental stage and learning skills (Bierman & Motamedi, 2015; Denham, 2018; Mahoney et al., 2020). Preschool children exhibit increased emotional awareness, transition from adult support in regulating emotions to more self-regulation strategies, and engage in more complex play interactions with same-age peers requiring the ability to effectively solve conflicts (Huber et al., 2019; Murray et al., 2016; Widen & Russell, 2011). In addition, gains in cognitive skills such as executive functions, language, or theory of mind play an important role in the processing of social information and increased self-control, thereby helping children to be more proficient in

understanding emotions, intentions, or socially acceptable behaviors (Imuta et al., 2016; Liew, 2012). Thus, the unique features of this developmental stage may provide the optimal context for implementing school-based SEL interventions aiming to enhance children's well-being and reduce the risk of emotional and behavioral problems (EBP). In fact, a meta-analysis conducted by January et al. (2011) found evidence suggesting that school-based interventions were more efficacious for younger children. More recently, several meta-analyses reported mean effect sizes Hedge's $g = 0.32$ to 0.50 for enhancing social–emotional skills and Hedge's $g =$—0.30 to—0.50 for reducing risk for externalizing/internalizing problems (Luo et al., 2020; Murano et al., 2020), while also showing that preschoolers' participation in SEL programs was associated with an average gain of 12 to 18 percentile points. In other words, a member of the control group scoring at the 50th percentile would exhibit 12–18% percentile rank increases in social–emotional skills, as well as similar reductions in challenging behaviors, if they had participated in the SEL programs.

Components of Classroom-Based Interventions for Preschool Children

Effectively addressing SEL requires careful consideration of both child-related factors (i.e., social–emotional competence development, risk of EBP) and environmental influences. Interactions with teachers and parents are particularly important since they have the potential to shape children's learning experiences, because preschoolers are largely reliant on external support (Bernier et al., 2010). A core feature in many school-based programs is the delivery of classroom curricula comprising lessons targeting the development of children's social–emotional competence through systematic instruction. Classroom-wide delivered interventions share several common features: (1) provide training for different types of SEL skills; (2) include explicit learning goals; (3) offer children ample opportunities and sufficient time to practice the targeted skills; and (4) employ active forms of learning (e.g., modeling, role play, guided learning, etc.) (Bierman & Motamedi, 2015; Durlak et al., 2011).

The intervention agents mostly responsible for delivering the lessons' content are teachers, who are strongly encouraged to incorporate SEL practices as part of their classroom routines. Hence, programs including "teach-the-teacher" approaches recognize the significant role that teachers play in developing safe and supportive environments for social–emotional development through training regarding the use of curriculum resources, ways to improve classroom climate, and coaching to support classroom delivery of program content (Bierman et al., 2016; Weissberg et al., 2015). Explicit focus on preparing teachers to implement SEL programs appropriately has been associated with children's skill development and reductions in risk of maladjustment (McCabe & Altamura, 2011; McLeod et al., 2017).

In some cases, school-based programs recognize that the quality of parent–child interactions is critical for optimizing SEL. Approaches to parent involvement vary from informing parents about specific SEL activities conducted in the classroom (Bierman & Motamedi, 2015) to actively teaching parents about behavioral management strategies for children's misbehavior and coaching strategies for stimulating

children's social–emotional development (Carr et al., 2017; Humphrey, 2013). The added value of parental involvement is supported by the results of a recent meta-analysis suggesting that home-based activities play a significant role in improving social–emotional skills and reducing EBP (Smith et al., 2020).

Previous Reviews on SEL Interventions

Systematic reviews combined with meta-analyses have documented the effectiveness of classroom-based SEL programs in the context of universal and selective/indicated interventions for preschoolers (Blewitt et al., 2018; Luo et al., 2020; Murano et al., 2020). These studies employed aggregated measures of effect sizes across relevant studies to assess the overall effects of SEL programs. While Luo et al. (2020) and Murano et al. (2020) found evidence of effects on social–emotional skills and challenging behaviors, the work of Blewitt et al. (2018) added effectiveness findings for classroom-wide interventions on self-regulation and learning behaviors. Conversely, several systematic reviews were more specifically aimed at exploring the evidence base supporting the effectiveness of a particular classroom-wide SEL program: Pathways to Alternative Thinking Strategies (Stanley, 2019), Second Step (Moy et al., 2018), Friends (Higgins & O'Sullivan, 2015), or the Incredible Years (Pidano & Allen, 2015). However, none of these reviews addressed effectiveness outcomes for preschoolers, and except for the review conducted on the Friends program (Higgins & O'Sullivan, 2015), none considered exclusively peer-reviewed articles reporting on effectiveness outcomes in comparison with a control group. In addition, it is noteworthy that a major limitation of systematic reviews including less rigorous scientific findings (i.e., lack of control group) is related to difficulties in establishing whether the interventions are, in fact, responsible for the observed effects (Corcoran et al., 2018).

Given the need to adequately assess interventions and the supporting empirical data, some attempts have been made to establish criteria for assessing the quality of the studies supporting SEL effectiveness. Employing these criteria would enable researchers to recommend adoption of evidence-based practices in educational settings (CASEL, 2013; Lawson et al., 2019). For instance, the CASEL criteria focused on evaluating the intervention (i.e., program targeting CASEL competencies, provision of practice opportunities, support for implementation), the study's design (i.e., inclusion of a comparison group), and the reported outcomes (i.e., report of at least one positive outcome related to SEL) (Lawson et al., 2019). However, this review included only programs delivered in primary schools and considered the abovementioned quality criteria limited to SEL interventions, whose core components corresponded to the CASEL framework for classifying social–emotional competencies.

Conversely, other reviews conceptualized program quality taking into account implementation fidelity, treatment generalization, social validity, as well as replication across settings and intervention groups (Barton et al., 2014; Joseph & Strain, 2003). However, these narrative reviews covered both classroom-wide interventions and parenting interventions with no school-based component. In addition, outcomes were analyzed based on the inclusion of 1–2 peer-reviewed studies comparing the

SEL intervention to a control group, thus not considering the entire evidence base supporting the effectiveness of a given program.

A classifying system, which sets standards for assessing all effectiveness studies related to a program is represented by the Evidence Base Updates from the *Journal of Clinical Child and Adolescent Psychology (JCAPP)* (Southam-Gerow & Prinstein, 2014). Quality indicators related to the validity of the research and implementation methods, the strength of the research design, the number of effectiveness studies, and replications by independent research teams are applied to evaluate each study reporting evidence on the effectiveness of an intervention. The JCAPP system classifies programs into one of five categories depending on the strength of the scientific evidence supporting its effectiveness. A description of the classification criteria is provided in Supplemental Table 1. To our knowledge this approach was not previously employed for assessing SEL programs, and only two reviews regarding psychosocial interventions for traumatic and anxiety treatments for children and adolescents classified interventions according to the JCAPP criteria (Dorsey et al., 2017; Higa-McMillan et al., 2016). However, it should be noted that Bierman and Motamedi (2015) attempted to classify SEL programs based on criteria such as the use of experimental designs and replications by independent research teams as markers of a robust evidence base. Still, no systematic search of relevant SEL interventions was carried out and only five programs were classified as either programs "that work" or promising.

The Current Study

Albeit previously conducted reviews adopted strategies to assess program quality, their focus was on broad categories of SEL interventions ranging from classroom-wide interventions to parent trainings with limited interest in preschoolers and with limited in-depth evaluation of supporting empirical evidence across all effectiveness studies corresponding to specific programs. In order to address this gap, we first aimed to categorize SEL interventions targeting preschool children against the JCAPP Evidence Base Updates criteria (Southam-Gerow & Prinstein, 2014) by attempting to identify all available empirical evidence from peer-reviewed articles supporting the efficacious delivery of each SEL intervention. More specifically, in the current study we were interested to classify classroom-wide interventions delivered in the form of a curriculum of activities aimed at developing children's social–emotional competencies as part of universal interventions (i.e., for all children) or indicated/targeted interventions (i.e., children considered at risk) (Luo et al., 2020; Murano et al., 2020). Consequently, implicit approaches encompassing only teacher and/or parent trainings were considered only if they were coupled with a classroom-delivered intervention to ensure a specific focus of the current review.

Systematic reviews and meta-analytical studies are concerned with uncovering effectiveness of specific SEL interventions by aggregating study-level effects (Luo et al., 2020; Murano et al., 2020). In contrast, other systematic reviews synthesize program-level evidence supporting the effectiveness of specific classroom-based interventions (Moy et al., 2018; Pidano & Allen, 2015; Stanley, 2019). The current

study aimed to expand this latter type of program-level synthesis by summarizing the empirical evidence supporting the effectiveness of all SEL programs from the well-established category considering sample characteristics, intervention delivery, reported outcomes, and effect sizes. Such an approach provides the opportunity (1) to conduct an in-depth assessment of classroom-delivered SEL interventions by analyzing effectiveness studies corresponding to each well-established program; therefore, changing the focus to program-level effects could result in an increased accuracy in identifying relevant studies and extracting information about characteristics of interventions sharing similar quality criteria, which are more likely to be unavailable when the unit of analysis is the study level; and (2) to compare well-established classroom-wide SEL programs and distil common features related to their effectiveness, which are informative for future research and policymakers. Focus on well-established programs is of particular interest considering that these interventions adhere to the highest quality criteria, and may be promoted as examples of best practice to be considered for large-scale use in educational settings.

As previously noted, many systematic reviews include a wide range of study designs which do not rely on rigorous experimental approaches, thus raising questions regarding the adequacy of the provided interpretations regarding program effectiveness (Corcoran et al., 2018). Furthermore, even previously published meta-analyses revealed that study-level bias is high, considering selective reporting, lack of procedural fidelity, and excessive reliance on outcomes reported by non-blinded participants (Djamnezhad et al., 2021; Luo et al., 2020). Given such concerns, and the fact that synthesized evidence in this study relies on experimental/quasi-experimental designs, it would be interesting to establish potential similarities or dissimilarities between the risk of bias assessed for SEL programs classified as well-established compared to those reported in previous meta-analytical studies of SEL programs.

Summarizing, the objectives of the current study were (1) to identify classroom-based SEL programs and categorize them depending on the criteria for evidence-based interventions; (2) to analyze the program-level evidence base of well-established classroom-wide SEL programs with emphasis on sample characteristics, intervention delivery, reported outcomes, and effect sizes; and (3) to assess study level as well as program-level risk of bias for well-established programs.

Method

Search Strategy

First, a search was conducted within the latest systematic reviews and meta-analyses on SEL interventions delivered in classroom settings for preschool children (Blewitt et al., 2018, 2019; Luo et al., 2020; Mondi et al., 2021; Murano et al., 2020). After compiling a list of the programs identified in these secondary sources, a screening was conducted in order to determine whether programs (1) included a curriculum of SEL activities delivered by teachers or mental health professionals in the classroom as part of a stand-alone intervention focused exclusively on improving

social–emotional competencies or as part of a multi-component approach; (2) were delivered for all children in the classroom (universal interventions) or children who were deemed at risk (targeted or indicated interventions); and (3) were sufficiently well described to extract information regarding the content of the intervention. Programs relying on implicit SEL teaching through teacher/parent training alone were excluded. Similar steps were taken if programs were exclusively delivered for children with diagnosed mental health problems or were not obtained for group comparisons (i.e., single-subject experiment), or were insufficiently well described to understand which SEL components were targeted.

In the next step, programs identified as fitting the inclusion criteria were systematically searched to identify empirical evidence supporting their effectiveness. Database searches in PsycINFO, Educational Resource Information Center (ERIC), Academic Search Premier (EBSCO), PubMed, and Scopus were initially conducted in April, 2021, and were followed by a second search in August–September, 2021, for potential updates. The following keywords were employed: the program's name (e.g., "Incredible Years," "PATHS," "Al's Pals," etc.) AND ("preschool") AND ("prevention" OR "program"). In several cases, programs which were not referred to by name were searched employing a snowball procedure, in which keywords describing the intervention were employed instead of the programs name (e.g., "social-emotional program" instead of "Peace Education Social-Emotional Program" or "primary prevention with children" instead of "A Life Long Approach to Self-Determination"). For each program, articles were included based on the following criteria: (1) the study reported findings which included children aged 3–6; (2) the intervention included a SEL curriculum as a stand-alone intervention or in combination with a teacher/parent training delivered for typically developing preschoolers or preschoolers considered at risk (i.e., low SES) or exhibiting some degree of risk for EBP; interventions which included only teacher/parent trainings, or were delivered for clinical samples and/or children enrolled in special education were not considered; (3) the intervention was classroom based, not another setting (i.e., community centers); (4) the study's design included either a randomized-controlled trial comparing the intervention to a waitlist or control group, or a quasi-experimental approach in which participants were not randomly assigned to either the intervention or control group; studies which did not include a control group or did not provide data on effectiveness (i.e., reviews about the program) were not included; (5) the study reported findings on pre- to post-intervention/follow-up outcomes; if the studies reported data from the same sample (duplicate) or focused only on follow-up outcomes of previously reported effectiveness outcomes, they were excluded; (6) the study was published in a peer-reviewed journal, which meant excluding sources such as doctoral theses/dissertations or reports; exclusion of gray literature was decided considering that reviews classifying programs according to the JCAPP Evidence Base criteria selected peer-reviewed publications (Dorsey et al., 2017; Higa-McMillan et al., 2016); (7) the study was published between 1980 and 2021, since previously published reviews mainly relied on searches covering the last 30–40 years (Durlak et al., 2011; Luo et al., 2020; Murano et al., 2020); and (7) the study was written in English.

Selection of Programs and Studies

The list of programs identified for potential inclusion was separately compiled by two of the authors in order to ensure that no interventions listed in the original sources were mistakenly excluded. The list was divided into two equally large categories and each category of programs was screened independently by the second and third author. Concurrently, the first author assessed all programs and the list of included programs and agreement between coders was 100%.

After conducting the systematic search and excluding duplicates, the remaining references were examined separately by all three authors in a two-step procedure: first, titles and abstracts were screened to eliminate records which did not meet inclusion criteria, and second, potentially eligible studies were subject to full-text examination. Disagreements between assessments were discussed and resolved.

Coding Criteria

A coding form and a manual, which are available upon request from the first author, were developed to guide procedures required for summarizing the extant empirical evidence for classroom-based SEL programs. First, articles corresponding to each intervention program were assessed employing criteria from the Evidence Base Updates in the JCAPP (Southam-Gerow & Prinstein, 2014). Depending on the quality of the methods employed, the type of design (i.e., experimental or quasi-experimental), and whether the intervention was conducted by the program developers or an independent research team, each program was classified into one of the five categories of evidence-based interventions (i.e., well-established, probably efficacious, possibly efficacious, experimental, questionable efficacy). Interrater agreement regarding classification criteria was Cohen $\kappa = 0.97$.

In the next step, programs identified as level 1 (*well-established interventions*) were analyzed at the study level. Study-level criteria were related to (1) sample characteristics referring to the number of children included in the study, as well as in the intervention and control groups, study location, and the type of sample for which the intervention was delivered (i.e., universal, indicated, selective); (2) type of design employed in the study (experimental vs. quasi-experimental); (3) intervention characteristics such as details pertaining to the delivery of the intervention components (i.e., classroom curriculum, teacher training, parent training); (4) intervention outcomes including reported program effects, effect sizes for significant results, type of measure (i.e., social competence (SC)/emotional competence (EC), EBP, executive function (EF), school readiness (SR)), and source of study outcomes (i.e., child, parent/teacher report, or independent observation); considering that measures of effect sizes varied across studies, we estimated a single indicator, namely Hedges' g, which includes a bias correction for small sample sizes (Hedges & Olkin, 1985); if information about means, standard deviations, or sample sizes was unavailable, the study's first author was contacted and requested to share the missing data; and (5) mediator/moderator effects of intervention effectiveness.

In addition, each study was assessed employing the Cochrane's risk of bias tool for RCTs (Higgins & Altman, 2008; Higgins et al., 2011) and its extension for non-randomized studies (Reeves et al., 2013). Each risk domain (i.e., sequence generation, allocation concealment, blinding of participants/personnel, etc.) was assessed for potential levels of bias (low, high, and unclear). The risk of bias was evaluated independently by all authors for all studies, and interrater agreement was computed (Cohen $\kappa = 0.94$). Additionally, a synthesis of risk of bias was computed for all studies based on the average percentage of low, moderate, and high risk corresponding to each of the nine evaluated domains of bias.

Results

A list of 69 SEL programs was extracted from previously conducted reviews. A detailed presentation of all screened programs and reasons for exclusion is provided in Supplemental Table 2. After screening, the 38 universal and indicated SEL classroom-based programs were systematically searched based on the abovementioned inclusion criteria. A total of 16,509 potentially relevant abstracts were identified, and after deduplication 16,137 were screened. Full texts were retrieved for 371 articles, out of which 81 were deemed eligible based on inclusion/exclusion criteria. A full description of the selection process together with reasons for exclusion is depicted in Fig. 1 based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Categorization of Classroom SEL Interventions According to the JCAPP Evidence Base Criteria

Articles found for each of the 38 SEL classroom-based intervention programs were analyzed considering the criteria regarding the quality of methods and evidence proposed by Southam-Gerrow and Prinstein (2014). A summary of the extent to which each program met the criteria is provided in Supplemental Table 3. Based on these criteria, the distribution of programs across the 5-level classification system indicated that four programs (10.5%) were well-established, eight (21.1%) were probably efficacious, thirteen (34.2%) were possibly efficacious, thirteen (34.2%) were experimental, and none of the programs was of questionable efficacy. A presentation of the classified programs can be found in Supplemental Table 4.

Characteristics of Well-Established Classroom-Based SEL Programs

I Can Problem Solve Program (ICPS)

A total of six studies were identified to report on the effectiveness of the ICPS program, and their analysis is synthesized in Table 1. The total sample size reported in these studies was $N = 584$ preschoolers with the majority of studies conducted in the USA (83.3%). In terms of sample characteristics: two studies (33.3%) reported

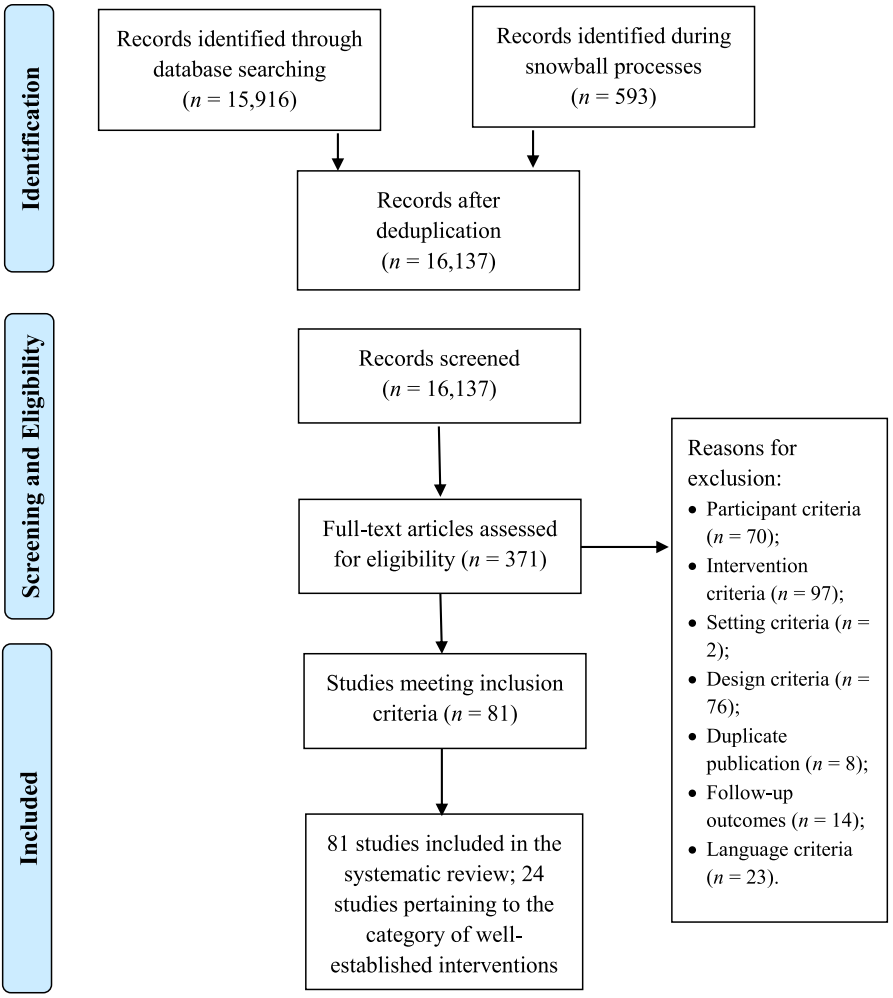

Fig. 1 PRISMA flow diagram of study inclusion

findings from the ICPS delivered as a universal intervention (Anliak & Sahin, 2010; Ciancio et al., 2001), and four studies (66.7%) were carried out as selective interventions (Boyle & Hassett-Walker, 2008; Feis & Simons, 1985; Shure & Spivak, 1980; Vestal & Jones, 2004). In addition, four out of six studies (66.6%) included experimental designs (Anliak & Sahin, 2010; Boyle & Hassett-Walker, 2008; Feis & Simons, 1985; Vestal & Jones, 2004). Procedures related to implementation suggest variations in the length of the classroom curriculum ranging from 16 to 83 daily lessons, and half of these studies report about teacher training procedures (Boyle & Hassett-Walker, 2008; Feis & Simons, 1985; Vestal & Jones, 2004).

Related to effectiveness outcomes, ICPS participation was associated with improvement in children's social competence ($g = 0.050$ to 1.52), reductions in EBP

Table 1 Study-level characteristics and findings for the I Can Problem-Solve Program

First author	Sample		D	Intervention	Outcomes		Mediators/ moderators
	Size/location	Type			Intervention effects	Measure	
Shure and Spivack (1980)	$N=106$ (USA) I: $n=35$ C: $n=27$	TDC at risk EBP (100% minority)	QE	CC: 20 min/day (3 months) TT: nr	PIPS alternative solutions: $F_{(1,58)}=35.11$, $p < 0.001$ ($g=1.52$); WHNG consequential thinking: $F_{(1,57)}=24.44$, $p < 0.001$ ($g=1.26$); causal thinking: ns inhibition: $\chi^2_{(1)}=12.36$, $p < 0.05$ ($g=-0.60$); impulsivity: $\chi^2_{(1)}=5.33$, $p < 0.05$ ($g=-0.67$)	SC/C EBP/T	Mediator: intervention—alternative solutions and consequential thinking—inhibition/impulsivity
Feis and Simons (1985)	$N=29$ (Y1), 30 (Y2), 35 (Y3) (USA) I: $n=15, 15, 15$ C: $n=14, 15, 18$	TDC low income	E	CC: 20 min/day (3 months) TT: 1-day training, 2 booster 3-h sessions	PIPS solutions: $F=5.58$, $p < 0.05$ ($g=0.88$) (Y1), $F=6.67$, $p < 0.01$ ($g=0.94$) (Y2), $F=14.78$, $p < 0.05$ ($g=1.34$) (Y3); PIPS solution categories: $F=7.60$, $p < 0.01$ ($g=1.03$) (Y1), $F=17.07$, $p < 0.01$ ($g=1.51$) (Y2), $F=6.30$, $p < 0.05$ ($g=.87$) (Y3) PBQ total negative behaviors: $F=5.81$, $p < 0.05$ ($g=-.83$) (Y3)	SC/C EBP/T	NA

Table 1 (continued)

First author	Sample		D	Intervention	Outcomes		Mediators/ moderators
	Size/location	Type			Intervention effects	Measure	
Ciancio et al. (2001)	$N=70$ (USA) $I_{Cognitive}$: $n=2$ classrooms C_{ICPS}: $n=2$ classrooms	TDC	E	CC: 15 min/day (4 months) TT: nr	Oddity/inserting objects/ McCarthy Scales: $I_{Cognitive} > C_{ICPS}$ PIPS solution relevance: $t(69)=2.96$, $p < 0.001$ ($g=0.70$)	CA + MS + SR/C SC/C	NA
Vestal and Jones (2004)	$N=64$ (USA) I: $n=6$ classrooms (37 children) C: $n=5$ classrooms (27 children)	TDC at risk neighborhood (80% minority)	QE	CC: 64 lessons TT: 13 sessions (40 h)	PIPS solutions: $F_{(1,62)}=4.08$, $p < 0.05$ ($g=0.50$); PIPS solution relevance: $F_{(1,62)}=5.12$, $p < 0.05$ ($g=.57$), PIPS force ratio: $F_{(1,62)}=8.42$, $p < 0.05$ ($g=.73$)	SC/C	NA
Boyle and Hasset-Walker (2008)	$N=226$ (USA) I_1: $n=96$ (2-year training) I_2: $n=106$ (1-year training) C: $n=24$	TDC at risk neighborhood	E	CC: twice/week (4 months) TT: initial, booster, follow-up	PSBS relational aggression: $F=3.63$, $p=0.028$ ($g=-0.12$) ($I_2 > I_1$,C); PSBS overt aggression: $F=4.98$, $p=0.008$ ($g=-0.47$) ($I_2 > C$); HBRS aggression/impulsivity: *ns*; HBRS passivity: *ns* PSBS prosocial behavior: $F=7.98$, $p < 0.001$ ($g=.57$) ($I_2 > I_1$,C); HBRS prosocial behavior: $F=15.15$, $p < 0.001$ ($g=0.72$) (I_1, $I_2 > C$)	EBP/T SC/T	NA

Table 1 (continued)

First author	Sample		D	Intervention	Outcomes		Mediators/ moderators
	Size/location	Type			Intervention effects	Measure	
Anliak and Sahin (2010)	$N=83$ (Turkey) I: $n=40$ children C: $n=43$ children	TDC	E	CC: 83 lessons (4 months) TT: nr	DECB aggression: ns; DECB introvert: $F_{(1,70)}=9.17$, $p < 0.01$ ($g=-0.66$) DECB prosocial: $F_{(1,70)}=29.75$, $p < 0.01$ ($g=1.19$)	EBP/O SC/O	NA

D, design; *I*, intervention; *C*, control; *USA*, United States of America; *TDC*, typically developing children; *EBP*, emotional and behavioral problems; *E*, experimental; *QE*, quasi-experimental; *CC*, classroom curriculum; *TT*, teacher training; *T*, teacher/teacher report; *PIPS*, Preschool Interpersonal Problem Solving; *WHNG*, What Happens Next Game; *PBQ*, Preschool Behavior Questionnaire; *PSBS*, Preschool Social Behavior Scale; *HBRS*, Hahnemann Behavior Rating Scale; *DECB*, Drexel Early Childhood Behavior Rating Scale; *ns*, not significant; *SC*, social competence; *CA*, cognitive ability; *MS*, motor skills; *SR*, school readiness; *C*, child report; *NA*, non-applicable

($g = -0.12$ to -0.83), and no improvements in EF (Ciancio et al., 2001). Effect sizes for social competence depending on the type of measure were $g = 0.50$ to 1.52 for child direct assessment (Shure & Spivak, 1980; Ciancio et al., 2001; Feis & Simons, 1985; Vestal & Jones, 2004), $g = 0.57$ to 0.72 for teacher report (Boyle & Hassett-Walker, 2008), and $g = 1.17$ for independent observations of children's behavior (Anliak & Sahin 2010). In studies reporting outcomes for EBP, effect sizes for teacher rating varied from $g = -0.12$ to -0.83 (Boyle & Hassett-Walker, 2008; Feis & Simons, 1985; Shure & Spivak, 1980), whereas the effect size was $g = -0.66$ in the only study employing ratings from independent observers (Anliak & Sahin, 2010). In addition, one study (16.7%) tested for mediators of intervention effects, indicating that better developed social competence after ICPS implementation was associated with fewer EBP (Shure & Spivak, 1980).

Pathways to Alternative Thinking Strategies

Seven studies reporting findings for PATHS effectiveness are identified and synthesized in Table 2. The total sample size was $N = 5330$. Based on the geographic location, only three effectiveness studies (42.9%) were conducted in the USA (Domitrovich et al., 2017; Fishbein et al., 2016; Hughes & Cline, 2015). PATHS was delivered in four studies (57.1%) as a universal intervention (Arda & Ocak, 2012; Eninger et al., 2021; Hughes & Cline., 2015; Bilir Seyhan et al., 2019), and in three studies (42.9%) as a targeted intervention for children from disadvantaged backgrounds (Berry et al., 2016; Domitrovich et al., 2007; Fishbein et al., 2016). Four out of seven studies (57.1%) employed an experimental design (Berry et al., 2016; Domitrovich et al., 2007; Eninger et al., 2021; Fishbein et al., 2016). The PATHS classroom curriculum included 44 lessons, with only one study implementing a shorter 30 lesson version (Domitrovich et al., 2007). Provision of teacher training was described as an initial 2-day training (Berry et al., 2016; Hughes & Cline, 2015), a combination of the initial training and a booster session (Bilir Seyhan et al., 2019), or a combination between initial training, a booster session, and classroom consultations (Domitrovich et al., 2007; Eninger et al., 2021; Fishbein et al., 2016).

Children in the PATHS intervention group exhibited gains in social–emotional competencies ($g = 0.08$ to 3.43), lower EBP ($g = -0.05$ to -5.23), improved EF skills ($g = 0.15$ to 0.64), as well as skills needed for later school adjustment ($g = 0.10$ to 0.84). Effect sizes for social–emotional skills were $g = 0.08$ to 3.43 for parent and teacher ratings (Arda & Ocak, 2012; Berry et al., 2016; Domitrovich et al., 2007; Fishbein et al., 2016; Hughes & Cline, 2015; Bilir Seyhan et al., 2019), $g = 0.14$ to 1.22 in studies relying on child-reported emotion knowledge and problem solving (Domitrovich et al., 2007: Hughes and Cline, 2015; Eninger et al., 2021), and $g = 0.28$ for independent observations (Eninger et al., 2021). Studies including at least one measure of children's risk for EBP found effect sizes ranging from $g = -0.05$ to -5.23 for teacher ratings (Arda & Ocak., 2012; Berry et al., 2016; Domitrovich et al., 2007; Fishbein et al., 2016; Hughes & Cline, 2015; Eninger et al., 2021). However, such improvements were reported on few subscales and parents' ratings revealed no significant reduction in EBP following PATHS implementation (Domitrovich et al., 2007; Eninger et al., 2021; Hughes & Cline, 2015). When

Table 2 Study-level characteristics and findings for the Pathways to Alternative Thinking Strategies (PATHS) program

First author	Sample		D	Intervention	Outcomes		Mediators/ moderators
	Size/location	Type			Intervention effects	Measure	
Domitrovich et al. (2007)	$N=246$ (USA) I: $n=10$ classrooms (120 children) C: $n=10$ classrooms (126 children)	TDC Low income (about 50% minority)	E	CC: 30 lessons once/week TT:2-day training + 1 booster session + monthly consultation	KEI emotion vocabulary: $F_{(8,166)}=8.44$, $p < 0.001$, ($g=.14$); DPI emotion perspective taking: $F_{(8,157)}=3.54$, $p < 0.05$ ($g=0.18$); ACES accuracy: $F_{(8,163)}=5.59$, $p < 0.05$ ($g=0.29$); ACES anger bias: $F_{(8,163)}=6.71$, $p < 0.001$ ($g=-0.24$) Day/night: ns; peg tapping: ns; letter attention: *ns* CST problem solving: *ns* Head start competence: $F_{(7,186)}=16.16$, $p < 0.001$ ($g=0.53$); PKBS social skills: $F_{(7,187)}=17.62$, $p < 0.001$ ($g=0.37$ PKBS externalizing: *ns*; PKBS internalizing: *ns* Head start competence: $F_{(7,181)}=7.82$, $p < 0.01$ ($g=0.41$); PKBS social skills: *ns* PKBS externalizing: ns; PKBS internalizing: *ns*	EC/C EF/C SC/C EC + SC/T EBP/T EC + SC/P EBP/P	Moderator: intervention by verbal ability—social cooperation
Arda and Ocak (2012)	$N=95$ (Turkey) I: $n=51$ children C: $n=45$ children	TDC	QE	CC: 44 lessons in 9 months TT: nr	KEI emotion vocabulary: *ns* Head start competence: $F_{(1,93)}=29.23$, $p < 0.001$, ($g=1.10$); Paths kit social-emotional competence: $F_{(1,93)}=11.69$, $p < 0.05$ ($g=0.69$) Paths kit aggression: $F_{(1,93)}=7.06$, $p < 0.001$ ($g=-0.53$) Paths kit concentration/attention: $F_{(1,93)}=6.24$, $p < 0.05$, ($g=0.50$)	EC/C EC + SC/T EBP/T EF/T	NA

Table 2 (continued)

First author	Sample		D	Intervention	Outcomes		Mediators/ moderators
	Size/location	Type			Intervention effects	Measure	
Hughes and Cline (2015)	$N = 57$ (USA) I_{PATHS}: $n = 20$ I_2: $n = 20$ C: $n = 17$	TDC	QE	CC: 44 lessons in 9 months, 1–2 activities/week TT: 2-day training	KEI emotion vocabulary: $F_{(1,53)} = 11.58$, $p < 0.001$, ($g = 1.22$); DPI emotion perspective taking: *ns* SDQ emotional difficulties: $F_{(1,49)} = 5.71$, $p < 0.01$ ($g = -0.32$); SDQ conduct problems: $F_{(1,50)} = 4.46$, $p < 0.01$ ($g = -0.47$); SDQ hyperactivity: $F_{(1,48)} = 3.23$, $p < 0.05$ ($g = -0.77$); SDQ peer problems: *ns* SDQ emotional: *ns*; SDQ conduct: *ns*; SDQ hyperactivity: *ns*; SDQ peer problems: *ns* SDQ prosocial skills: $F_{(1,49)} = 4.55$, $p < 0.01$ ($g = 0.50$) SDQ prosocial skills: *ns* EYBC: $F_{(1,49)} = 5.30$, $p < 0.001$ ($g = -0.25$)	EC/C EBP/T EBP/P SC/T SC/P EBP/T	NA

Table 2 (continued)

First author	Sample		D	Intervention	Outcomes		Mediators/ moderators
	Size/location	Type			Intervention effects	Measure	
Berry et al. (2016)	*N* = 4004 (UK) I: *n* = 2203 (29 schools) C: *n* = 1801 (27 schools)	TDC (50% minority)	E	CC: 44 lessons 1 h/week TT: 1-day training	SDQ conduct problems: *ns* (T2/24-month FU); SDQ hyperactivity: *ns* (T2/24-month FU); PTRS Aggressive: −0.13 (−0.23; −0.04)[1] (*g* = −.13) (T2)/ns (24-month FU); PTRS inattention/hyperactivity: −0.06 (−0.13; −0.02) (*g* = −0.05) (T2)/*ns* (24-month FU); PTRS impulsivity/hyperactivity: −0.06 (−0.13; −0.01) (*g* = −0.06) (T2)/*ns* (24-month FU); PTRS relational aggression: *ns* (T2/24-month FU); PTRS internalizing: *ns* (T2/24-month FU); SDQ emotional: *ns* (T2/24-month FU) PTRS emotion regulation: *ns* (T2/24-month FU); SDQ peer relations: *ns* (T2/24-month FU); PTRS peer relations: 0.12 (0.22;0.02) (*g* = 0.10) (T2)/*ns* (24-month FU); SDQ pro-social *ns* (T2/24-month FU); PTRS pro-social behavior: *ns* (T2/24-month FU); PTRS social competence: 0.14 (0.01;0.29) (*g* = 0.08) (T2)/*ns* (24-month FU): *ns* PTRS academic performance. *ns* (T2/24-month FU); PTRS learning behavior: 0.05 (0.003; 0.100) (*g* = 0.10) (T2)/*ns* (24-month FU)	EBP/T EC/T SC/T SR/T	Moderator: intervention by qualification for free school meals/ baseline emotional difficulties on total difficulties

Table 2 (continued)

First author	Sample		D	Intervention	Outcomes		Mediators/ moderators
	Size/location	Type			Intervention effects	Measure	
Fishbein et al. (2016)	$N=327$ (USA) I: $n=2$ schools C: $n=2$ schools	TDC + disadvantaged neighborhood (minority)	E	CC: 44 lessons twice/week (20 min) TT: 2-day training + weekly consultation	SCS prosocial: $\beta=1.03$, $p<0.001$ ($g=3.43$); SCS emotion regulation: $\beta=0.72$, $p<0.001$ ($g=0.55$); PRQ peer relations: $\beta=0.50$, $p<0.001$ ($g=3.14$) TOCA-R aggression: $\beta=-0.46$, $p<0.001$ ($g=-5.23$); TOCA-R internalizing: $\beta=-0.55$, $p<0.001$ ($g=-2.66$); ADHD rating scale impulsivity: $\beta=-0.21$, $p<0.01$ ($g=-4.48$); ADHD rating scale inattention: $\beta=-0.19$, $p<0.01$ ($g=-3.49$); ACES academic skills: $\beta=0.32$, $p<0.05$ ($g=0.84$); DoG: *ns*; peg tapping: $\beta=1.02$, $p<0.05$ ($g=0.15$); WAM go accuracy: $\beta=0.03$, $p<0.05$ ($g=0.64$) WAM go average response time: *ns*; WAM no-go accuracy: *ns*; WAM no-go average response time: *ns*; KBIT-2 intelligence: *ns*	SC + EC/T EBP/T SR/T EF/C CA/C	NA
Bilir Seyhan et al. (2019)	$N=565$ (Turkey) I: $n=285$ (21 classrooms) C: $n=280$ (20 classrooms)	TDC	QE	CC: 33 lessons (15–20 min)/9 weeks TT: initial + booster	Head start competence: $F_{(1,550)}=24.81$, p ‹ 0.001 ($g=0.41$)	SC + EC/T	NA

Table 2 (continued)

First author	Sample		D	Intervention	Outcomes		Mediators/ moderators
	Size/location	Type			Intervention effects	Measure	
Eninger et al. (2021)	$N=285$ (Sweden) I: $n=145$ (14 schools) C: $n=140$ (12 schools)	TDC	E	CC: 33 lessons 15–20 min once/ week, TT: 2-day training + 1-day booster session + monthly consultation	ACES emotion knowledge: $\beta=0.226$ (−0.006; 0.458) ($g=0.21$); CST emotion awareness: *ns* SCS emotion regulation: *ns*; SCS prosocial: *ns* SCS emotion regulation: *ns*; SCS prosocial: $\beta=0.406$ (0.093; 0.719) ($g=0.28$) CST competent: *ns*; CST aggressive: *ns*; CST inept: *ns* PKBS cooperation: *ns*; PKBS interaction: *ns*; PKBS independence: *ns* knock and tap: *ns*; day–night: *ns*; word span: $\beta=0.387$ (0.153; 0.622) ($g=0.35$); TOS orientation: *ns*; SCS academic skills: *ns* PKBS social withdrawal: *ns*; PKBS anxiety: *ns*; PKBS aggression: *ns*; ADHD rating scale hyperactive/impulsive: $\beta=0.245$ (0.024; 0.467) ($g=-0.36$); ADHD rating scale inattention: *ns*	EC/C EC + SC/T EC + SC/O SC/C SC/T EF/C SR/T EBP/T	Moderator: intervention by gender on emotion knowledge and anxiety/somatic complaints

D, design; *I*, intervention; *C*, control; *USA*, United States of America; *UK*, United Kingdom; *TDC*, typically developing children; *EBP*, emotional and behavioral problems; *E*, experimental; *QE*, quasi-experimental; *CC*, classroom curriculum; *TT*, teacher training; *nr*, not reported; *T*, teacher/teacher report; *SCS*, Social Competence Scale; *TOCA-R*, Teacher Observation of Child Adaptation-Revised; *PRQ*, Peer Relations Questionnaire; *ACES*, Academic Competence Evaluation Scales; *DoG*, delay of gratification; *WAM*, whack-a-mole; *KBIT-2*, Kaufmann Assessment Battery for Children-II; *SDQ*, Strengths and Difficulties Questionnaire; *PTRS*, PATHS Teacher Rating Scale; *ns*, not significant; *SC*, social competence; *EC*, emotion competence; *CA*, cognitive ability, *EF*, executive function; *SR*, school readiness; *C*, child report; *T2*, postintervention; *FU*, follow-up; *NA*, non-applicable

[1] Reported statistical analyses include mean difference between post-intervention scores and corresponding confidence intervals (CIs)

tasks tapping into working memory, inhibitory control, and cognitive flexibility were employed, reported effect sizes varied from $g = 0.15$ to 0.64 (Eninger et al., 2021; Fishbein et al., 2016), whereas teachers' assessment of children's increased attention was associated with an effect size of $g = 0.50$ (Arda & Ocak, 2012). Also, studies reporting on children's pre-academic skills found effect sizes ranging from $g = 0.10$ to 0.84 for teacher ratings post-intervention (Berry et al., 2016; Fishbein et al., 2016), albeit these effects were no longer significant at follow-up in one of these studies (Berry et al., 2016). Moderator analyses revealed that children with better developed verbal abilities exhibited increased social cooperation (Domitrovich et al., 2007), children who were eligible for free meals and who exhibited higher baseline emotional difficulties exhibited fewer EBP post-intervention (Berry et al., 2016), and girls exhibited more emotion knowledge and fewer anxiety/somatic complaints compared to boys as a result of PATHS participation (Eninger et al., 2021).

Second Step

For the Second Step program, we identified five studies with a total number of 2556 preschool age participants, which were all conducted in the USA. These studies are synthesized in Table 3. In three studies the Second Step intervention was delivered as a universal intervention (Kemple et al., 2019; Upshur et al., 2013; Wenz-Gross et al., 2018), whereas in the other two studies, the program was offered as a selective intervention for children from disadvantaged backgrounds (Upshur et al., 2017, 2019). Only one study (20%) employed a quasi-experimental design (Kemple et al., 2019). In all studies, the Second Step curriculum was described similarly, encompassing 28 weekly themes. Teachers delivered the curriculum after participating in monthly training sessions and were provided with classroom supervision. In addition, parents were informed through weekly handouts about each theme of the classroom curriculum.

Findings revealed that Second Step participation was associated with improved social–emotional skills ($g = 0.07$ to 0.62), reduced EBP ($g = -0.38$), and increased EF skills ($g = 0.07$ to 0.39). For gains in social–emotional skills measured by child report, effect sizes ranged from $g = 0.07$ to 0.20 (Upshur et al., 2017), whereas for teacher ratings, the effect size was $g = 0.62$ (Kemple et al., 2019). Second Step participation was predictive of teacher-rated lower internalizing/externalizing problems $g = -0.38$ (Upshur et al., 2013). All studies which reported findings on EF relied on direct child assessment with effect sizes ranging from $g = 0.22$ to 0.39 (Upshur et al., 2017, 2019; Wenz-Gross et al., 2018). However, no significant effects were found for SR (Upshur et al., 2017). The only study describing intervention mechanisms found evidence that Second Step predicted children's improved school readiness in the 1st grade through preschool EF skills and pre-literacy/pre-math abilities in preschool (Wenz-Gross et al., 2018).

Tools of the Mind

Five studies with a total number of $N = 1494$ participants are identified for Tools of the Mind and synthesized in Table 4. Two studies were conducted in the USA

Table 3 Study-level characteristics and findings for the Second Step program

First author	Sample		D	Intervention	Outcomes		Mediators/ Moderators
	Size/location	Type			Intervention effects	Measure	
Upshur et al. (2013)	Year 1 (Y1): $N=285$ (US) I: $n=113$ (8 classrooms) C: $n=96$ (7 classrooms) Year 2 (Y2): $N=157$ I: $n=95$ (7 classrooms) C: $n=62$ (4 classrooms)	TDC	E	CC: 89 lessons TT: 7 monthly sessions (Y1); 5 monthly sessions (Y2); monthly supervision PI: weekly handout	ASBI behavior problems: $t_{(123)}=-2.27$, $p<0.05$ ($g=-0.38$) (Y1); ASBI behavior problems: *ns* (Y2) ASBI prosocial behavior: *ns* (Y1); ASBI prosocial behavior: *ns* (Y2)	EBP/T SC/T	NA
Upshur et al. (2017)	$N=492$ children (USA) I: $n=252$ C: $n=240$	TDC low income, homeless	E	CC: 28 weekly themes TT: 7 sessions (Y1); 5 sessions (Y2); monthly supervision PI: weekly handout	EMT + CST combined total score: $\beta=0.54$, $p=0.08$ (EMT: $g=0.07$; CST: $g=0.20$) HTKS + BDS combined total score: $\beta=1.57$, $p<0.05$ (HTKS: $g=0.39$; BDS: $g=0.31$)	EC + SC/C EF/C	NA
Wenz-Gross et al. (2018)	$N=972$ children (USA) I: $n=501$ children C: $n=471$ children	TDC	E	CC: 28 weekly themes TT: 7 sessions (14 h; Y1); 5 sessions (10 h; Y2) PI: weekly handout	HTKS + LM + BDS combined score: $\beta=0.21$, $p<0.01$ (HTKS: $g=0.30$; LM: $g=0.22$; BDS: $g=0.22$) EMT-SF + CST combined score: *ns*	EF/C EC + SC/C	Mediators: intervention on kindergarten SR through preschool EF and pre-literacy skills/ preschool EF and pre-math skills
Kemple et al. (2019)	$N=37$ children (USA) I: $n=17$ children C: $n=20$ children	TDC	QE	CC:28 weekly themes (4 times/week) TT: previously trained; monthly supervision PI: weekly handout	SSKAI social–emotional knowledge: *ns* SSRS social skills total: $t(35)=2.19$, $p<0.05$ ($g=0.62$) SSRS problem behavior: *ns*	EC + SC/C SC/T EBP/T	NA
Upshur et al. (2019)	N = 770 (USA) I: $n=393$ C: $n=377$	TDC low-income	E	CC: 28 weekly themes TT: 5/7 sessions; monthly supervision PI: weekly handout	HTKS + BDS combined score: $B=0.419$, $p=0.045$ (HTKS: $g=0.27$; BDS: $g=0.24$) EMT + CST combined score: *ns* WJ-III preacademic skills: *ns*	EF/C EC + SC/C SR/C	NA

D, design; *I*, intervention; *C*, control; *TDC*, typically developing children; *EBP*, emotional and behavioral problems; *E*, experimental; *QE*, quasi-experimental; *CC*, classroom curriculum; *TT*, teacher training; *PI*, parent information; *nr*, not reported; *T*, teacher/teacher report; *SCS*, Social Competence Scale; *ACES*, Assessment of Children's Emotional Skills; *CST*, challenging situation task; *PKBS*, Preschool Kindergarten Behavior Scales; *ASBI*, Adaptive Social Behavior Inventory; *EMT*, emotion matching test; *CST*, challenging situation task; *PPVT*, Peabody picture vocabulary test; *HTKS*, head–toes–knees–shoulders task; *BDS*, backward digit span; *SSKAI*, second step knowledge assessment interview; *SSRS*, Social Skills Rating Scale; *WJ-III*, Woodcock-Johnson Test of Achievement III; *ns*, not significant; *SC*, social competence; *EC*, emotion competence; *CA*, cognitive ability; *EF*, executive function; *SR*, school readiness; *C*, child report; *O*, observation; *NA*, non-applicable

and three in Canada (Diamond et al., 2007, 2019; Solomon et al., 2018). In one study (20%) the program was delivered as a universal intervention (Solomon et al., 2018), and in the other four studies as a targeted prevention program for children from low-income families or minority families (Barnett et al., 2008; Blair & Raver., 2014; Diamond et al., 2007, 2019). All five studies involved random assignment of schools/classrooms in the intervention and control group. Teachers participated in workshops during the first or second implementation year, and initial training was followed by the provision of classroom supervision (Barnett et al., 2008; Solomon et al., 2018).

Effectiveness studies for Tools of the Mind reported effect sizes of $g = 0.26$ for children's social competencies, $g = -0.21$ to -0.47 for EBP, $g = 0.05$ to 0.43 for EF, and $g = 0.07$ to 0.43 for SR. The only study to report proved social competencies as a result of Tools employed teacher ratings (Barnett et al., 2008), and reductions in social exclusion and interaction problems were also reported in the context of teacher ratings (Diamond et al., 2019). Laboratory tasks were employed to measure children's performance of EF-yielded effect sizes ranging from $g = 0.05$ to 0.43 (Blair & Raver, 2014; Diamond et al., 2007, 2019), whereas one study relying on ratings of attention and behavioral inhibition found effect sizes of $g = 0.21$ to 0.35 (Diamond et al., 2019). Similarly, effect sizes for children's performance of tasks measuring SR found effect sizes ranging from $g = 0.07$ to 0.43 in verbal abilities/vocabulary (Barnett et al., 2008; Blair et al., 2014; Diamond et al., 2019) and fluid intelligence (Blair & Raver, 2014), However, no significant improvements were reported for math skills (Blair & Raver, 2014; Diamond et al., 2019), In addition, one study of moderator effects found that intervention group children from schools indexed as high poverty exhibited reduced interference in response latency to emotional stimuli, better developed vocabulary, and increase in intelligence/reasoning abilities after the intervention (Diamond et al., 2019).

Risk of Bias

A description of each study's risk of bias rating is provided in Supplemental material Table 4. Also, a summary of risk assessment across the nine criteria is presented in Supplemental material Fig. 1. In relation to selection bias, 78% of studies were low risk due to the random allocation, thus reflecting the higher number of RCTs included in this review. However, allocation concealment indicated a high risk of bias for 96% of the studies, as participants (teachers) could not be blinded due to training procedures. In addition, in 92% of the studies, blinding participants was not possible, which is a common occurrence when assessing the implementation of classroom-wide interventions. Steps to ensure protection against contamination resulting from the presence of intervention and control groups in the same study location were taken in 48% of the reported studies, and strategies for assessing fidelity of implementation were adequately reported in 52% of the included studies. Only 22% of the studies relying exclusively on child direct observations were able to conduct assessments with researchers blinded to group allocation and study hypotheses. Low risk for lack of baseline equivalence was found for 74% of reported studies,

Table 4 Study-level characteristics and findings for the Tools of the Mind program

First author	Sample		D	Intervention	Outcomes		Mediators/ Moderators
	Size/location	Type			Intervention effects	Measure	
Diamond et al. (2007)	$N=147$ children (Canada) $I_{Tools:}$ $n=85$ children C_{dBL}: $n=62$ children	TDC low income	E	CC: daily activities TT: nr	Dots-congruent: $F_{(3, 152)}=2.90$, $p=0.04$ ($g=0.27$); Dots-incongruent: $F_{(3, 142)}=7.06$, $p<0.001$ ($g=0.43$); standard flanker task: $F_{(3, 132)}=4.48$, $p<0.01$ ($g=0.33$); Reverse flanker task: $F_{(3, 132)}=4.48$, $p<0.01$ ($g=0.33$)	EF/C	NA
Barnett et al. (2008)	$N=205$ children (USA) I_{Tools}: $n=7$ classrooms (85 children) C_{dBL}: $n=11$ classrooms (120 children)	TDC Low income	E	CC: daily activities TT: 4 days (32 h); additional training (9 h); weekly classroom visits	SSRS social skills: $B=-7.31$, $p<0.05$ ($g=0.26$) PPVT-III verbal ability: $B=3.72$, $p<0.05$ ($g=0.11$); EOWPVT-R vocabulary: *ns*; WJ-III preacademic skills: *ns*	SC/T SR/C	NA
Blair and Raver (2014)	$N=579$ (USA) I: $n=42$ classrooms C: $n=37$ classrooms	TDC Low income	E	CC: daily activities TT: 4 workshops (5 days)/Y1; 3 workshops (3 days)/Y2 + classroom visits (Y1 + Y2)	BDS: $b=0.02$, $p<0.05$ (T2) ($g=0.14$); DCCS + Hearts & Flowers + Flanker with Reverse Flanker Composite Score: $b=20.62$, $p<0.05$ (T2) ($g=0.05$); dot-probe: $b=102.2$, $p<0.05$ (T2) ($g=0.10$); speed of processing information: $b=1.44$, $p<0.05$ (T2) ($g=0.05$); WJ-III mathematics: $b=2.10$, $p<0.05$ ($g=0.14$) (T2)/ *ns* (1st grade FU); EOWPVT vocabulary: $b=8.34$, $p<0.05$ ($g=0.15$) (T2)/$b=2.16$, $p<0.05$ ($g=0.13$) (1st grade FU) Raven colored matrices: $b=0.75$, $p<0.05$ ($g=0.07$)	EF/C SR/C CA/C	Moderator: intervention by school-level poverty indicator on attentional control, vocabulary, intelligence
Solomon et al. (2018)	$N=194$ children (Canada) I_{Tools}: $n=10$ classrooms (109 children) I_{YMCA}: $n=10$ classrooms (86 children)	TDC	E	CC: daily activities (15 months) TT_{Tools}: 5 sessions + classroom visits	Day-night: *ns*; HTT: *ns* SDQ total difficulties: *ns* SDQ total difficulties: *ns*; SCBE-20 anxiety/withdrawal: *ns*; SCBE-30 anger/aggression: *ns* SCBE-30 social competence: *ns*	EF/C EBP/P EBP/T SC/T	NA

Table 4 (continued)

First author	Sample		D	Intervention	Outcomes		Mediators/ Moderators
	Size/location	Type			Intervention effects	Measure	
Diamond et al. (2019)	$N=351$ (Canada) I: $n=172$ children C: $n=180$ children	TDC (minority status; English as a second language)	E	CC: daily activities (8 months) TT: 4- and 3-day workshops (Y1); 21/2-day workshops (Y2) + classroom visits	DRA reading: $F(1,15)=6.67$, $p=0.02$ ($g=0.27$); DRA writing: $F(1,15)=18.10$, $p=0.005$ ($g=0.43$); DRA math: *ns* Interaction problems: $F(1, 15)=20.59$, $p<0.001$ ($g=-0.47$); presence of cliques; $\chi^2(1, N=18)=11.99$, $p<0.001$ ($g=-0.35$); social exclusion: $\chi^2(1, N=18)=4.87$, $p=0.02$ ($g=-0.21$) Self-control: $F(1, 15)=11.43$, $p<0.005$ ($g=0.35$); Attention regulation: $\chi^2(1, N=18)=4.92$, $p<0.05$ ($g=0.21$)	SR/C EBP/T EF/T	NA

D, design; *I*, intervention; *C*, control; *USA*, United States of America; *TDC*, typically developing children; *EBP*, emotional and behavioral problems; *E*, experimental; *QE*, quasi-experimental; *CC*, classroom curriculum; *TT*, teacher training; *PI*, parent information; *Y1*, year 1; *Y2*, year 2; nr, not reported; *T*, teacher/teacher report; *BDS*, backward digit span; *SSRS*, Social Skills Rating Scale; *PPVT*, Peabody picture vocabulary test; *EOWPVT*, expressive one-word picture vocabulary test; *WJ-III*, Woodcock-Johnson Test of Achievement III; *BDS*, backward digit span; *DCSS*, Dimensional Change Card Sort task; *HTT*, head to toes; *SDQ*, Strengths and Difficulties Questionnaire; *SCBE-10*, Social Competence and Behavior Evaluation Scale; *ns*, not significant; *DRA*, developmental reading assessment; *T2*, postintervention; *FU*, follow-up; *ns*, not significant; *SC*, social competence; *EC*, emotion competence; *CA*, cognitive ability, *EF*, executive function; *SR*, school readiness; *C*, child report; *P*, parent report; *NA*, non-applicable

whereas 56% were low on risk for incomplete outcomes due to attrition and deficient handling of missing data.

Discussion

The current systematic review aimed at (1) classifying SEL classroom-wide interventions for preschoolers based on the JCAPP criteria for evidence-based interventions; (2) synthesizing study characteristics of programs identified as well established; and (3) assessing risk of bias corresponding to studies classified as well-established interventions. Among the identified SEL programs, the smallest percentage (10.5%) could be assigned to the well-established category of interventions, suggesting that although a relatively large number of programs undergo testing of their effectiveness, few could be regarded as providing sufficiently compelling empirical evidence (Southam-Gerrow & Prinstein, 2014). A second category of probably efficacious interventions included almost twice as many programs as the well-established category (21.1%), and future replications of outcomes by independent research teams could lead to gathering the empirical evidence required for inclusion in the level 1 category. However, more than half of the reviewed studies require additional research employing rigorous experimental designs and replications across contexts to be considered effective for preschool age children.

According to the findings of this study, the well-established (level 1) classroom-based SEL interventions included four programs: ICPS, PATHS, Second Step, and Tools of the Mind. The available data suggest that that most of these programs were implemented in the USA, with a few studies conducted in Turkey ($n=3$), Canada ($n=3$), the UK ($n=1$), and Sweden ($n=1$). Distributions by country in which these programs were delivered to preschoolers are similar to those reported by previous reviews indicating that most studies regarding SEL efficacy were conducted in English-speaking countries and to a lesser extent in other geographical areas (Luo et al., 2020; Murano et al., 2020). This suggests that an important question which needs to be addressed involves classroom-wide SEL programs' cultural acceptability. More recently, researchers have noted that attempting to transfer SEL interventions from one cultural context to another requires careful consideration of how to adjust programs in order to be responsive to the children's needs (Baker-Henningham et al., 2009; Gaete et al., 2019). The relative scarcity of data from cultural adaptations of well-established programs indicates that more research is needed to ascertain how SEL classroom-based curriculum can be transferred to other cultures with different educational systems and expectations for young children's development.

Regarding the targeted population in these well-established programs, it appears that these were more likely to target children from low socio-economic backgrounds, from minority families, or exposed to high levels of neighborhood violence (i.e., targeted intervention) than children who were not exposed to contextual risk factors (i.e., universal interventions). Considering that early exposure to aggressive/violent behavior, poverty, reduced parental involvement in children's education, and minority status function as cumulative risk factors for reduced social–emotional competence and increased risk for EBP (Li et al., 2017; Yoshikawa et al., 2012), it would

be reasonable to assume that disadvantaged children might benefit more than those who are not. However, most studies assessing poverty status or similar risk indexes suggest that moderator effects are the exception rather than the rule (Berry et al., 2016; Diamond et al., 2019). This raises the possibility that classroom-wide interventions do not elicit significant SEL learning in children from socio-economically disadvantaged backgrounds, but could prove effective particularly as indicated interventions for children at risk for EBP. Some programs targeting reductions in either anxiety symptoms (e.g., Fun Friends) or behavior problems (e.g., Coping Power, Social-Emotional Prevention Program) provide support for the notion that classroom-based interventions promoting social–emotional skills can lower the risk of EBP.

Not surprisingly, 75% of the studies corresponding to well-established interventions were based on randomized controlled trials, which are known to reduce threats to internal validity and increase confidence regarding the outcomes. Randomized or experimental designs have become a "gold standard" for assessing interventions that work (Shadish et al., 2002; Singleton & Straits, 2005), and the fact that evidence reported here is extracted mostly from such studies suggests that programs categorized as well-established are supported by more rigorous research designs.

It is also noteworthy that programs from the well-established category included two different approaches to SEL in the classroom: (1) a separate curriculum implemented in addition to regular classroom teaching activities (i.e., ICPS, PATHS, Second Step); and (2) an integrated approach, in which all teaching is conducted within a particular framework and skills are stimulated consistently throughout the day by teachers (i.e., Tools of the Mind). Teachers represent a valuable resource in implementing classroom-wide SEL interventions, and hence, a common feature of these programs is related to preparing them to deliver these programs effectively. However, teacher training components vary from providing support for implementing the activities from the classroom curriculum (i.e., ICPS, Tools of the Mind) to added components about ways in which teachers can improve classroom climate through behavioral management strategies (i.e., PATHS. Second Step). Some extant evidence suggests that overall, the most effective teacher trainings for SEL development are those including added knowledge about behavioral strategies aimed at increasing positive teacher–child interactions, and implicitly reducing the risk of negative, coercive processes (Ritchie & Howes, 2003; Sabey et al., 2017). Also, in some cases PATHS, Second Step and Tools of the Mind encompass individualized consultations, a strategy meant to improve content delivery through personalized feedback to teachers (Diamond et al., 2019; Domitrovich et al., 2007; Kemple et al., 2019). Still, it remains unclear which components of teacher interventions foster enhanced SEL, and the extent to which individualized coaching contributes to changes in children's behaviors. Regardless of the amount of training and support teachers are provided with during implementation, it is apparent that preparing them to act as the main intervention agents is a mandatory requirement for adequately implementing SEL programs. Increased self-efficacy in delivering curriculum content and including SEL in routine interactions could be particularly relevant for motivating teachers to adopt them in contexts which are no research related. Perhaps policymakers might consider establishing specific certification requirements for implementing

classroom-wide interventions which would stimulate the implementation of such practices in schools.

In the well-established SEL programs reviewed in the current study, only one program involved informing parents about the classroom activities (Second Step), although it is unclear if and how this component had a significant effect on the intervention's effectiveness. Findings from meta-analyses suggest that interventions in which parents are explicitly trained in coaching their children in developing social–emotional skills are associated with larger effects sizes than programs exclusively delivered in schools (Murano et al., 2020; Smith et al., 2020). Several programs included in this review, but not classified as well-established, encompass a parent-training component coupled with the classroom intervention (e.g., Making Choices and Strong Families, Social-Emotional Prevention Program, Insights). Hence, it is apparent that parental involvement could be an essential ingredient for increased effectiveness of classroom-wide interventions and more consistent outcomes across settings. Still, more research is needed to firmly establish the contribution of parent trainings compared to the delivery of the SEL programs alone.

The first type of outcomes synthesized was related to improved social–emotional skills due to participating in well-established classroom-wide SEL interventions. For ICPS, PATHS and Second Step effect sizes varied from small to large ($g = 0.07$ to 3.43), whereas Tools of the Mind was associated with small effect sizes ($g = 0.26$) in the only study to report such outcomes (Upshur et al., 2017). One potential explanation for the limited evidence supporting positive outcomes for SEL in the case of Tools of the Mind could be attributed to the fact that this program is primarily aimed at improving self-regulation rather than explicit teaching of social–emotional skills. In addition, when considering the source of the evidence supporting well-established SEL classroom-wide interventions' effectiveness on social-emotional competencies, effect size ranges were similar irrespective of the employed measure (i.e., questionnaire, child direct assessment, observation). However, it should be noted that there is limited evidence supporting skill transfer from the classroom to the home setting, as only one study included parent ratings of social–emotional skills (Domitrovich et al., 2007) and only one study employed observational measures (Eninger et al., 2021). Therefore, potential future directions could be directed toward including more diversified means of assessing program effectiveness and avoiding exclusive reliance on teacher ratings of children's behaviors.

Outcomes related to preschoolers' risk of EBP suggested that effect sizes showed significant reductions with effect sizes varying from small to large ($g = -0.05$ to -5.23). Evidence supporting reductions of internalizing/externalizing problems relied similarly to the findings for social–emotional skills on teachers' reports and, to a lesser extent, on independent observations of disruptive or withdrawn behaviors (Anliak & Sahin, 2010; Kemple et al., 2019), thus raising questions about the confidence with which it can be concluded that these interventions reduce EBP. In addition, significant effects were found in the case of specific subscales and inconsistently across scales employed in the same study. Findings from previous meta-analyses suggest that combining classroom interventions with parent trainings leads to more consistent reductions in challenging behaviors, probably because children's skills and behaviors are systematically reinforced both at school and at home (Luo

et al., 2020; Murano et al., 2020). Consequently, future research could investigate if parental involvement in the context of universal classroom-wide interventions strengthens reported outcomes for EBP.

Findings regarding improved EF skills were reported in three of the four reviewed programs: PATHS, Second Step, and Tools of the Mind. Variations in effect sizes ranged from small to moderate ($g = 0.05$ to 0.64), with similar variations for both laboratory tasks and teacher rated attention, suggesting small variability across types of measures. One potential explanation for the inclusion of EF-related outcomes in effectiveness studies of the abovementioned programs could be a reflection of a common feature, namely the adoption of findings on neuro-cognitive development suggesting that working memory, behavioral inhibition, and attention contribute to children's SEL development and vice versa, and that such skills are required for improved capacity to learn (Nesbitt et al., 2015; Ursache et al., 2012). Additionally, all programs reported outcomes of children's academic competencies in at least one study. However, the ICPS and Second Step found no significant effects for preschoolers' SR. Conversely, for PATHS assessments of SR which relied exclusively on teacher reports, effect sizes varied from small to large ($g = 0.05$ to 0.84), whereas for the measures of children's performance on tasks measuring verbal abilities, vocabulary and math skills employed in Tools of the Mind effect sizes were small ($g = 0.11$ to 0.27).

Findings for well-established interventions indicate that effect sizes for EF and SR are smaller than those reported for social–emotional competencies and EBP, thus suggesting that gains in these domains are less consistent. It is however important to note that interest in measuring more distal outcomes related to SEL interventions is grounded in research, suggesting that gains in social–emotional skills enable children to use more effectively their cognitive abilities, which in turn leads to enhanced SR (Blair & Raver, 2015; Cooper et al., 2014). The only effectiveness study to find support for this hypothesized mechanism was conducted by Wenz-Gross et al. (2018), but replications of these results are required. Also, more research is needed to establish the extent to which SEL programs alone or in combination with specific intervention components aimed at stimulating pre-academic skills are more effective for enhancing preschoolers' later school performance.

When considering the quality of evidence supporting the programs included in the well-established category, it is important to note that the risk of bias is lower for certain criteria. For instance, the higher percentage of studies including random assignment of participants seems to be associated with ensuring baseline equivalence of groups, and with lower attrition rates compared to previously reported risk of bias related to SEL programs which were not selected based on quality criteria (Luo et al., 2020). In a similar vein, 52% of studies pertaining to programs from the well-established category were rated as low risk on procedural fidelity compared to the 20% in the meta-analysis of Luo et al. (2020). Also, previously conducted meta-analyses suggest that effect sizes tend to be higher for studies not reporting implementation fidelity than those providing the data (Luo et al., 2020; Murano et al., 2020). Taken together, these findings suggest that reduced bias could be a consequence of including studies based on quality criteria, and that effectiveness outcomes might be more accurately estimated in the context of well-established interventions.

However, future studies might also compare well-established interventions with the other three classification categories to determine the extent to which the risk of bias varies across types of programs. In addition, considering the strength of the empirical evidence and predominant reliance on randomized trials, policymakers should consider promoting well-established classroom-wide interventions as examples of best practices recommended for large-scale implementation in schools.

Limitations

Limitations of Included Studies

Analyses of risk of bias indicated that in 96% of the included studies participants' allocation in the intervention and control groups could not be concealed. Also, there was a high risk of bias due to the lack of blinding participants and personnel involved in delivering the intervention for 92% of studies included in the well-established category. These findings are in line with previously reported outcomes of meta-analyses (Luo et al., 2020) and suggest that these issues represent common limitations in effectiveness studies of SEL programs. Similarly, about 50% of studies were assessed as high risk for blinding outcome assessment, reflecting the reliance on questionnaire-type measures and more specifically on teachers' ratings of children's behaviors. As previously noted, teachers are responsible for both delivering the intervention and assessing the outcomes, which suggests that multi-informant and multi-method approaches might provide more reliable estimates of effectiveness.

Another limitation is related to the insufficient data regarding the long-term effects of the reviewed program. Moreover, in the few studies presenting longitudinal findings, program participation is not associated with improved outcomes at follow-up (Berry et al., 2016; Blair & Raver, 2014). These results could imply that in some cases, the measures employed to assess children's behaviors might not be relevant as some skills such as emotion recognition, problem solving, or abilities related to school readiness skills (i.e., reading, writing, math) develop in time. Consequently, there is a strong possibility that children who serve as comparisons can achieve similar levels of performance as children who are exposed to more intensive support. Finally, there is little evidence regarding mediators/moderators of intervention effectiveness, which signals that more efforts should be directed at unveiling the mechanisms explaining SEL interventions' effects on children's behaviors (i.e., mediators) or the conditions under which the programs' effectiveness is facilitated (i.e., moderators). In addition, establishing the interventions' core components responsible for eliciting positive outcomes is particularly important to test hypothesized mechanisms of change posited by the theoretical underpinnings of each program. Gathering such data could prove crucial for understanding how programs exert their effects and are essential for adapting SEL programs for large-scale implementation in schools (Domitrovich et al., 2008).

Limitations of the Current Review

First, the programs included in the current study were identified from previously published reviews or meta-analyses focused on preschool SEL implementation and did not rely on a separate systematic search of the literature in order to identify relevant interventions. Hence, it is possible that some programs were not included in our analyses. Second, given the exclusion of the "gray" literature which is more likely to report null or inconsistent findings, it is possible that the reviewed outcomes might be affected by publication bias, and thus the reported effect sizes may be overestimated. In addition, potentially relevant information for classifying SEL programs may have been overlooked and could explain why no interventions were found to be of questionable efficacy. Third, only publications written in English were considered, which might reduce the generalizability of the current findings. Fourth, the current systematic review focused on programs included in the well-established category of SEL programs, and hence, similar analyses could be carried out on the other categories of identified evidence-based interventions. And fifth, the synthesized empirical evidence was limited to child-related outcomes, thus excluding information about measures of teachers' classroom management skills or teacher–child interactions. Future systematic reviews or meta-analyses could be aimed at determining whether teacher trainings offered within the context of multicomponent classroom-based SEL interventions effectively change teachers' behaviors and attitudes in the classroom.

Conclusions

The current review provides a classification of classroom-wide SEL interventions based on criteria related to the methods employed and the replicability of their evidence across contexts/cultures. The in-depth assessment of programs from the well-established category adds to the evidence suggesting that classroom-delivered programs foster increased social–emotional competencies, prevent EBP, and potentially stimulate EF and pre-academic skills (Blewitt et al., 2018; Luo et al., 2020; Murano et al., 2020). However, as opposed to study-level approaches concluding that SEL programs are effective, our findings also suggest that the support for reducing EBP in well-established programs is mainly associated with teachers' reports, whereas measures of EF and SR tend to be less frequently employed across studies and with smaller effects sizes. In addition, parental participation could prove an effective strategy in enhancing replicability of classroom-based interventions across settings and improve child-related outcomes. The reduced risk of bias in some categories (i.e., fidelity, baseline equivalence, attrition) for well-established interventions compared with studies including all types of SEL programs (Luo et al., 2020) suggests that research endorsing well-established interventions is more rigorously conducted and possibly provides more accurate estimations of effectiveness. However, large-scale implementation of such practices requires careful consideration of school contexts and their ability to adopt SEL practices into their teaching routines, as well as human resource training and motivation for implementing these programs

(Domitrovich et al., 2008; Herlitz et al., 2020). Consequently, more efforts should be directed at understanding what specific components and training requirements are needed to ensure the widespread adoption and sustainability of these educational practices within schools.

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Declarations

Conflict of Interest The authors declare no competing interests.

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* Denotes studies included in the systematic review.

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