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Systematic Review

Digital School-Based Social and Emotional Learning Interventions for Children and Adolescents: A Systematic Review of Randomized Controlled Trials with a Descriptive Comparison of Fully Digital and Blended Delivery

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Highlights

What are the main findings?

- Across 35 randomized and cluster-randomized trials, 25 reported a between-group advantage of a digital school-based SEL intervention on at least one outcome; certainty of evidence was moderate for composite social–emotional competence, low for the five CASEL competencies and well-being, and very low for emotional and behavioural difficulties, including anxiety and depressive symptoms. Only nine of the 35 trials were prospectively registered, a significant limitation of the available evidence.
- Thirteen interventions were fully digital and twenty-two blended, but no trial compared these formats directly, and delivery format overlapped with participants' age, the outcomes measured, and the type of informant.

What are the implications of the main findings?

- Current trials do not show whether adding human support to digital SEL improves its effects; differences between fully digital and blended programs cannot be attributed to delivery format.
- Larger, longer-term trials that compare delivery formats directly, within specific age groups, and that report between-group effects with confidence intervals are needed.

Abstract

Background/Objectives: Social and emotional learning (SEL) promotes children's social–emotional competencies and well-being, and educational technology offers new ways of delivering it. This systematic review evaluated digital school-based SEL interventions for children and adolescents, focusing on competencies of the Collaborative for Academic, Social, and Emotional Learning (CASEL) framework and mental health outcomes, and described how fully digital and blended programs differ in delivery and reported outcomes. Methods: Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement, Scopus, Web of Science, PubMed, the Education Resources Information Center (ERIC), and Google Scholar were searched for randomized and cluster-randomized trials published between January 2015 and August 2026. Risk of bias was assessed with the revised Cochrane risk-of-bias tool (RoB 2), including its

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cluster-randomized extension; results were synthesized without meta-analysis following the Synthesis Without Meta-analysis (SWiM) guideline, using vote counting by effect direction, and certainty was rated with the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach. Results: Thirty-five trials (N = 15,026) were included; thirteen interventions were fully digital and twenty-two blended. Twenty-five trials reported a between-group advantage on at least one outcome. Only nine trials (26%) were prospectively registered. Coded by direction irrespective of statistical significance, all trials measuring composite social–emotional competence, relationship skills, or social awareness, and fourteen of fifteen measuring self-management, favoured the intervention. Certainty was moderate that the interventions probably improve composite social–emotional competence, low that they may improve the five CASEL competencies and well-being, and very low for emotional and behavioural difficulties, including anxiety and depressive symptoms, for which inconsistent results and risk-of-bias concerns limited confidence. No trial compared fully digital with blended delivery of the same program, and format overlapped with age, outcomes measured, and informant. Conclusions: Digital school-based SEL interventions are a promising but still emerging approach. Whether human support enhances their effects remains untested, and the low rate of prospective trial registration limits confidence in the evidence.

Keywords: social and emotional learning; digital interventions; school-based mental health; randomized controlled trials; serious games; blended learning; children; adolescents

1. Introduction

Social and emotional learning (SEL) has become a core component of modern education, as there is growing recognition that academic success alone is not sufficient to prepare children and adolescents for the complex social, emotional, and professional challenges of the twenty-first century. SEL is the process through which individuals develop and use the knowledge, attitudes, and skills needed to understand and manage their emotions, develop and sustain positive relationships, exhibit empathy, make responsible decisions, and achieve personal and collective goals [1,2]. The Collaborative for Academic, Social, and Emotional Learning (CASEL) has proposed the most widely used framework for SEL, organizing the construct into five interrelated competency domains: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making [1]. These competencies help children and adolescents identify and manage their emotions, understand other people's perspectives, develop healthy relationships, resolve interpersonal conflicts, and make constructive choices across different life contexts.

Social and emotional competencies are increasingly recognized as complementary to academic achievement and as important predictors of long-term educational, occupational, and psychosocial outcomes. Extensive evidence indicates that developing these competencies is linked to better academic outcomes, improved social functioning, fewer behavioral problems, and greater psychological well-being [3,4]. International organizations such as the Organisation for Economic Co-operation and Development (OECD), the World Health Organization (WHO), and UNICEF regard social and emotional skills as key predictors of employability, resilience, health, civic engagement, and life satisfaction [5–7]. The OECD framework highlights these skills as essential for adapting successfully to rapidly changing social and economic contexts, while WHO and UNICEF identify emotional regulation, communication, empathy, problem-solving, and decision-making as core life skills for healthy development and psychosocial adjustment [7,8].

The connection between SEL and mental health has become increasingly prominent over the past decade. Social and emotional competencies act as protective factors that reduce the likelihood of emotional and behavioral difficulties and strengthen resilience, self-efficacy, adaptive coping, and psychological well-being [9,10]. Meta-analytic evidence indicates that school-based SEL programs can reduce emotional distress, conduct problems, anxiety, and depressive symptoms, while also improving prosocial behavior and academic outcomes [3,4,11]. Longitudinal findings further suggest that these benefits may persist for years after program participation, supporting the view of SEL as both an educational intervention and a preventive mental health strategy [11].

At the same time, educational systems worldwide are undergoing a profound digital transformation. The emergence of educational technology has created new opportunities for delivering instruction through digital platforms, serious games, mobile applications, virtual reality (VR), artificial intelligence (AI), online learning environments, and gamified educational systems. These technologies offer the potential to improve accessibility, scalability, personalization, and student engagement, making them particularly attractive for delivering SEL interventions [12–14]. The rapid development of digital technologies during and after the COVID-19 pandemic has further increased interest in technology-based approaches to supporting students' social, emotional, and mental health needs. As children and adolescents increasingly interact through digital platforms, schools face new challenges related to emotional regulation, online communication, digital citizenship, and psychological well-being, further reinforcing the need for evidence-based digital SEL interventions [6,15,16].

Digital SEL interventions encompass a range of strategies, including serious games that foster empathy and social skills, gamified platforms that promote emotional self-regulation, virtual reality environments that simulate real-life social situations, mobile applications targeting emotion regulation, and online programs that involve family or teacher participation. Emerging evidence suggests that such interventions can positively influence several SEL competencies and mental health outcomes, including emotion regulation, social competence, communication skills, and anxiety and depressive symptoms. For example, game-based interventions such as Adventures Aboard the S.S. GRIN have shown improvements in students' social–emotional skills [17], whereas virtual reality-based programs have shown promise in enhancing emotion regulation, emotional self-efficacy, and psychological well-being in adolescents [18,19].

Despite this expanding body of research, important gaps remain. Recent evidence syntheses have begun to quantify the effects of digitally delivered SEL, yet each has been framed in ways that leave the question of school implementation open. Nordlund [20] restricted inclusion to interventions delivered via computers, tablets, or mobile phones and explicitly excluded those requiring dedicated hardware such as VR, whereas Zhang et al. [21] examined VR-based programs alone; these two strands have developed in parallel and remain difficult to compare directly. Most recently, Cai et al. [22] synthesized 37 studies across devices and reported a medium pooled effect on social–emotional skills, but combined randomized with quasi-experimental designs, included general alongside clinically identified populations (approximately 40% of samples presented social impairments such as autism spectrum disorder or attention-deficit/hyperactivity disorder), and drew on interventions delivered at home, in controlled research settings, and in real-world contexts as well as in schools, with fewer than half of the included studies implemented in school settings. Notably, that review found the school setting to yield the smallest effect on affect and attitudes, a result that raises rather than answers the question of how technology should be embedded in classroom practice.

Two further syntheses have engaged with delivery format more directly, though neither addresses the distinction at issue here. Lynn et al. [23] reviewed 31 studies of universal, classroom-based SEL programs for adolescents and compared standard delivery—manual-based psychoeducation delivered by a teacher with paper-based and physical consolidation activities—against game-based delivery encompassing digital game-based learning, serious games, e-learning tools, and gamified programs. Both modes were associated with positive effects on social–emotional competence, and the authors concluded that the method of delivery may matter as much as the content itself, calling for research into which delivery-specific factors most benefit students in school settings. Their contrast, however, is drawn between digital and non-digital delivery rather than between digital programs that stand alone and digital programs embedded in teacher-mediated instruction; methodological quality was appraised but not used to restrict inclusion, and designs ranged from randomized trials to descriptive and mixed-methods studies. Kang-Yi et al. [24] synthesized 27 studies of digital interventions implemented in schools to improve youth emotion regulation, organizing them by delivery method (mobile app, tablet app, hybrid, and internet-based), and concluded that rigorous evidence of effectiveness remains scarce. That review shares the present focus on school implementation and recognizes a hybrid category, but it is bounded by a single outcome domain, admits non-randomized and feasibility designs alongside trials, and its database searches were conducted through August 2023.

What remains unresolved is the distinction that matters most for school practice: whether digital technologies function best as stand-alone tools delivered directly to students, or as components of blended designs in which technology is combined with teacher facilitation, classroom discussion, cooperative learning, structured reflection, or parental involvement. Only one previous synthesis has coded the degree of human mediation directly, finding no significant moderating effect, but on a small number of studies spanning school, home, and research settings [20]. Accordingly, the present review synthesizes evidence exclusively from randomized and cluster-randomized controlled trials of SEL interventions delivered within school facilities to general and at-risk student populations identified through schools rather than through clinical pathways. Specifically, the review seeks to (a) describe how fully digital and blended interventions are delivered and what outcomes they report, and identify any trials that compared delivery formats directly, (b) identify the types of digital technologies used to support SEL, (c) examine their effects on CASEL-related social and emotional competencies, and (d) assess their effects on mental health outcomes. By narrowing the evidence base to randomized school-based trials and foregrounding delivery format, this review addresses a question of direct relevance to educators, researchers, and policymakers that broader syntheses have not been positioned to answer.

2. Materials and Methods

2.1. Protocol and Registration

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines [25]. The review was registered retrospectively on Open Science Framework (OSF) Registries on 13 June 2026 (DOI: 10.17605/OSF.IO/MUN2P), after the initial literature search, study selection, data extraction, and narrative synthesis had been completed. The registration specified the four review questions, including the descriptive comparison of fully digital and blended interventions, the PICOS eligibility criteria, the use of RoB 2, and a narrative synthesis without meta-analysis; differences between the registration and the final review are reported in Section 2.7. The PICOS framework applied in the present review is presented in Table 1.

Table 1. Inclusion and Exclusion Criteria Based on the PICOS Framework.

PICOS Component	Inclusion Criteria	Exclusion Criteria
Population	Children and adolescents enrolled in preschool, primary, elementary, middle, or secondary school settings (K–12), including general and at-risk student populations	University students, adults, and populations outside school settings; participants recruited through clinical or hospital-based diagnostic pathways rather than school-based identification
Intervention	Digital school-based interventions designed to promote SEL competencies and/or mental health outcomes	Non-digital interventions; interventions not delivered within school facilities (e.g., conducted exclusively at home, in clinical/hospital settings, or through unsupervised individual use outside school)
Comparison	Waitlist controls, active controls, business-as-usual instruction, standard educational practices, or alternative interventions	Studies without a comparison condition
Outcomes	SEL competencies and/or mental health outcomes	Studies not reporting SEL or mental health outcomes
Study Design	RCTs, cluster-RCTs, and pilot RCTs	Observational studies, qualitative studies, case studies, reviews, conference abstracts, protocols, dissertations, and non-randomized studies
Publication Characteristics	Peer-reviewed studies published in English between January 2015 and August 2026	Non-peer-reviewed publications and studies published in languages other than English

2.2. Eligibility Criteria

Eligibility criteria were established using the Population, Intervention, Comparison, Outcomes, and Study Design (PICOS) framework.

2.2.1. Population

Studies were eligible if participants were children or adolescents enrolled in preschool, primary, elementary, middle, or secondary school settings (K–12). Participants older than 18 years were included only when they were enrolled in secondary school settings at the time of the study. Both general student populations and students identified as being at risk for social, emotional, or behavioral difficulties were considered eligible. Studies involving participants recruited on the basis of a formal clinical or psychiatric diagnosis (e.g., autism spectrum disorder, non-suicidal self-injury disorder) through clinical or hospital-based services, rather than through school-based identification, were excluded.

2.2.2. Intervention

Studies were included if they evaluated digital school-based interventions designed to promote social–emotional learning competencies and/or mental health outcomes. Eligible technologies included serious games, educational games, gamified interventions, virtual reality environments, mobile applications, tablet-based interventions, online platforms, web-based programs, and technology-supported learning systems.

Both fully digital and blended interventions were eligible. An intervention was classified as fully digital when students worked directly with the digital program and adults provided no more than technical, logistical, or brief introductory support (e.g., logging students in, an initial tutorial, supervising a computer room, or a short debriefing). An

intervention was classified as blended when a substantive part of the program was delivered through adult-led sessions in which the digital component was embedded (e.g., facilitator-led group sessions, teacher- or counsellor-led lessons and discussions, or teacher–student meetings structured by a digital tool), or when the program was delivered by teachers with the support of a digital platform.

To be considered primarily digital, and therefore eligible, technology had to be a specified and integral component of the intervention as delivered to students or to the adults implementing it, rather than an incidental medium (e.g., slides used to present otherwise conventional lessons). Programs in which technology mainly supported adult-led delivery, such as teacher-facing cooperative-learning platforms or web-based teacher and parent training, were retained when the original authors described the digital component as a core part of the intervention and its use was required for implementation; these trials are identified in Section 3.6. Interventions in which digital materials were optional or supplementary to a conventional program were classified as not primarily digital and excluded at the full-text stage (Table S3a,c).

Delivery format was coded with three questions applied to each trial, in order: (1) Did students use the digital component directly? (2) If so, did adults do more than provide technical or logistical support, an introductory tutorial, supervision, or a brief debriefing? (3) If students did not use the technology directly, was it a required part of the program used by the adults who delivered it? Trials answering yes to (1) and no to (2) were coded as fully digital; trials answering yes to (1) and (2), or yes to (3), were coded as blended. The answers for each trial are given in Section 3.6. The eligibility criteria did not set a minimum intervention duration, so four single-session interventions met them [26–29]; they were retained because they were school-based randomized trials of a digital SEL activity, but because a single session cannot show sustained skill development, their influence on the conclusions was examined in Section 3.8.

For the purposes of this review, interventions were considered school-based if they were delivered within school facilities, regardless of whether sessions occurred during or outside timetabled instructional hours. Interventions delivered exclusively outside school premises (e.g., at home, in libraries, or through unsupervised individual use of mobile devices) were excluded.

2.2.3. Comparison

Eligible comparison conditions included waitlist controls, business-as-usual instruction, active control groups, standard educational practices, or alternative intervention programs.

2.2.4. Outcomes

Studies were required to report at least one outcome related to social–emotional learning competencies or mental health indicators. SEL-related outcomes included the five CASEL competency domains and related constructs, such as self-awareness, self-management, social awareness, relationship skills, responsible decision-making, empathy, communication skills, social competence, and emotional awareness. Mental health outcomes included emotion regulation, resilience, stress management, coping skills, anxiety, depression, emotional self-efficacy, psychological well-being, emotional functioning, and other indicators of mental health.

2.2.5. Study Design

Only randomized controlled trials (RCTs), cluster-randomized controlled trials (cRCTs), and pilot randomized controlled trials were eligible for inclusion. Observational studies, qualitative studies, case studies, review articles, conference abstracts, protocols,

dissertations, and non-randomized intervention studies were excluded. The inclusion and exclusion criteria are summarized in Table 1.

2.3. Information Sources and Search Strategy

A systematic literature search was conducted across five electronic sources: Scopus, Web of Science, PubMed, the Education Resources Information Center (ERIC), and Google Scholar (used as a supplementary source). The search was first conducted in April 2026 and updated on 11 August 2026, covering studies published between January 2015 and 11 August 2026. Only peer-reviewed studies published in English were considered eligible, due to the language proficiency of the review team. In the earlier searches, Scopus was limited to journal articles in English published from 2015 onward in the subject areas Health Professions, Neuroscience, and Social Sciences; ERIC was searched with Scopus-style field tags and limited to journal articles with the platform's date filter, which covers records from 2017 onward; Web of Science was searched in April 2026 only; and PubMed was limited to records from 2015–2026 indexed as randomized controlled trials, in English, with participants aged 0–18 years. To remove these limitations, three searches were repeated during the second round of peer review: ERIC with its own syntax for peer-reviewed records published in 2015–2026 (2 November 2026), Scopus without the subject-area restriction (2 November 2026), and Web of Science with the original string for 2015–2026 (2 November 2026). Records from these searches that had not been retrieved by the earlier searches were de-duplicated and screened against the same eligibility criteria, and studies first published online after 11 August 2026 were not included. Because the articles excluded at the full-text stage of the original review could not be identified individually, the records of the earlier ERIC, Scopus, PubMed, and Web of Science searches were also re-screened during the second round of peer review against the eligibility criteria and the revised definitions of delivery format (Section 2.2.2). Because Google Scholar returns results ranked by relevance and does not support fully reproducible systematic searches, it was searched on 11 August 2026 with three shorter queries combining SEL, technology, school, and trial terms; results were sorted by relevance, and a total of 200 top-ranked records were screened. The exact search strings as executed in each source, together with the search dates, filters, and number of records retrieved, are reported in Table S2. No grey literature sources were searched.

The search strategy combined keywords related to social–emotional learning, digital technologies, school-based interventions, and children and adolescents. An indicative version of the string is shown below; the exact strings as run in each database, which differed in some terms and in database-specific syntax and filters, are reported in Table S2:

("social emotional learning" OR "social and emotional learning" OR SEL OR "social emotional competence" OR "social-emotional skills" OR "socio-emotional" OR "socioemotional" OR "social competence" OR "emotional intelligence" OR "emotion regulation" OR "emotional skills" OR "social skills" OR "emotional literacy" OR "emotional wellbeing" OR "mental wellbeing" OR "psychological wellbeing" OR resilience OR "prosocial behavio*" OR prosociality OR "emotional difficulties" OR "behavio* difficulties" OR "emotional symptoms" OR empathy)

AND

("digital" OR "technology" OR "online" OR "computer" OR "computer-based" OR "web-based" OR "internet" OR "mobile application" OR "app" OR "tablet*" OR "smartphone*" OR "mobile phone" OR "mHealth" OR "eHealth" OR "e-learning" OR "platform" OR "gamification" OR "serious game" OR "video game" OR "game-based" OR "virtual reality" OR "VR" OR "artificial intelligence" OR "robot*")

AND

("child*" OR "student*" OR adolescent* OR youth OR preschool OR kindergarten OR pupil* OR school*)

AND

(program* OR intervention* OR training OR curriculum)

Additionally, the reference lists of relevant reviews and included studies were manually examined to identify potentially eligible publications; no additional eligible studies were identified through this process.

2.4. Study Selection

All retrieved records were exported to Zotero (Corporation for Digital Scholarship, Vienna, VA, USA; https://www.zotero.org) reference management software and duplicates were removed prior to screening. Study selection was conducted in two stages by two reviewers independently. First, titles and abstracts were screened according to the predefined eligibility criteria; disagreements were resolved through discussion. Studies were excluded if they did not involve school-aged populations, did not employ digital technologies, were not school-based interventions, did not target SEL or mental health outcomes, or were not randomized studies. Second, full-text articles of potentially eligible studies were independently assessed against the inclusion criteria, with disagreements resolved in the same manner. Studies meeting all eligibility criteria were included in the qualitative synthesis. Records retrieved by the August 2026 update were screened using the same two-stage procedure; records from the searches repeated during the second round of peer review were screened against the same eligibility criteria (Section 2.3). The number of full-text articles excluded for each reason, together with the operational definition of each reason, is reported in Table S3.

2.5. Data Extraction

A standardized data extraction form was designed and employed to gather information from each included study. Two reviewers independently extracted the data and cross-checked the extracted information for accuracy. Discrepancies were resolved through discussion and consensus within the review team. The following information was extracted from each study: author(s), year of publication, country, sample size, participant age and educational level, study design, number of randomized clusters, type of digital intervention, delivery format (fully digital or blended) and the human support involved, duration of intervention, comparison condition, targeted SEL competencies, mental health outcomes assessed, and, for each outcome, the measure, informant, time point, between-group result with its effect size and confidence interval where reported, and any within-group change. Trial registration was added as a data item during peer review and was checked for all included trials in the trial reports, any published protocols, and ClinicalTrials.gov, the International Standard Randomised Controlled Trial Number (ISRCTN) registry, and the Australian New Zealand Clinical Trials Registry (ANZCTR); a trial was classified as prospectively registered when registration preceded the start of enrolment. The extracted data were tabulated and summarized according to study characteristics, intervention components, targeted competencies, mental health outcomes, and intervention effectiveness.

2.6. Quality Assessment

The methodological quality and risk of bias were assessed with the revised Cochrane Risk of Bias tool for randomized trials (RoB 2) [30]. For the 24 cluster-randomized trials, and for one trial in which the unit of randomization was unclear [31], the RoB 2 extension for cluster-randomized trials was applied, which adds domain D1b, bias arising from the timing of identification and recruitment of participants in relation to the allocation of

clusters; this domain was not applicable to the ten individually randomized trials. The other domains were bias arising from the randomization process (D1), deviations from intended interventions (D2), missing outcome data (D3), measurement of the outcome (D4), and selection of the reported result (D5). Judgments refer to the primary outcome(s) at the primary post-intervention time point listed in Table S4; where a trial used different types of informant (e.g., performance-based tasks and teacher ratings), D4 and the overall judgment were made separately for each informant type. Risk of bias was assessed independently by two reviewers, and disagreements were resolved through discussion. Each domain was rated as low risk of bias, some concerns, or high risk of bias. Imprecision arising from small samples or few randomized clusters was not treated as a source of bias but was examined separately (Section 3.8). Per-study judgments and their rationale are reported in Section 3.7 and visualized following the format of the robvis tool [32].

2.7. Data Synthesis

A meta-analysis was considered but not conducted. The heterogeneity that precluded pooling was primarily clinical and methodological. First, comparators ranged from waitlist and business-as-usual conditions to active alternatives, including face-to-face versions of the same content, role-play, Lego-based play, picture-book lessons, a non-gamified version of the same curriculum, and an established SEL curriculum, so that a pooled estimate would combine conceptually different contrasts. Second, outcomes were measured with different instruments and informants (self-report, teacher and parent ratings, observer-rated video, and performance-based or behavioural tasks). Third, effect sizes were reported in non-convertible metrics (d, g, η, η^2, ηp^2, standardized path coefficients, regression coefficients, and percentage change), often without the means, standard deviations, or confidence intervals required to compute a common metric. Fourth, intracluster correlations were rarely reported, and several cluster-randomized trials had very few clusters. We also examined whether subsets of trials with similar outcomes could be pooled separately. Emotion regulation, the most frequently assessed outcome (twelve trials [18,19,26,27,31,33–39]), was measured as difficulties in emotion regulation, knowledge of regulation strategies, adaptive and maladaptive strategy use, cognitive reappraisal, emotional control, or observer- or assessor-rated regulation, by different informants and against different comparators, and one trial reported effect sizes against an active comparator without significance tests [18]. Outcomes related to relationship skills and to anxiety and depression showed similar diversity. Separate pooling was therefore not considered meaningful, and findings were synthesized narratively.

Findings were organized by intervention features, effects on CASEL competencies, mental health outcomes, and delivery format. For each outcome, we recorded the comparator, informant, and time point, and whether the reported result was a difference between groups (an advantage over the comparison condition) or a change within the intervention group; immediate post-intervention results were distinguished from follow-up results (Table S4). Only between-group differences were treated as evidence of intervention effects; within-group improvements are reported descriptively. Effect sizes are given in the metric used by the original authors; because percentage change, standardized mean differences, variance-explained statistics, and regression coefficients are not interchangeable, their magnitudes were not compared across studies. When mapping outcomes onto the CASEL domains, we distinguished the competencies each intervention targeted from those for which a between-group benefit was reported (Section 3.3).

Delivery format was classified using the definitions in Section 2.2.2, on the basis of the intervention as delivered in each trial; all 35 classifications were checked against the full texts, and the human support involved in each trial is described in Section 3.6. The comparison

between formats is descriptive: it contrasts groups of trials that differ in many respects besides delivery format, and only trials that randomized participants to different delivery formats can inform the effect of format itself. These trials are identified in Section 3.6.

To examine the robustness of the main conclusions, the synthesis was repeated after excluding trials that randomized one or two clusters per arm, were described by their authors as exploratory, or did not report the unit of randomization clearly [31,40–43], and, separately, after excluding all trials with fewer than 100 participants [18,29,34,40–42,44–47] and the four single-session trials [26–29]. Findings were also examined by developmental stage (preschool and kindergarten, primary school, and secondary school).

Following the Synthesis Without Meta-analysis (SWiM) reporting guideline [48], results were summarized by vote counting based on the direction of effect and displayed in an effect-direction plot, following the method of Boon and Thomson [49] (Section 3.4). Outcomes were grouped into eight domains: the five CASEL competencies, with emotion-regulation outcomes grouped under self-management; composite social–emotional competence (measures combining several CASEL domains); emotional and behavioural difficulties, including anxiety and depressive symptoms; and well-being (quality of life, resilience, positive emotions, and self-compassion). The direction of each result was coded separately from its statistical significance, using the between-group estimate reported by the authors when available and otherwise the pre–post change in each group at the primary post-intervention time point. Results whose direction could not be determined were coded as unclear, rather than as showing no effect, and were excluded from the denominator. For each trial and domain, a direction was assigned when at least 70% of the results in that domain had the same direction, and the domain was otherwise coded as mixed. Whether at least one result in the domain was statistically significant is shown separately in the effect-direction plot, and the coding of every result is reported in Table S5. Vote counts are reported as the number of trials favouring the intervention out of those measuring each domain, overall and separately for fully digital and blended trials, and were compared across all trials with a two-sided sign test (mixed results excluded); they describe the consistency of effect direction and do not estimate the size of effects. Executive-function outcomes (working memory, inhibitory control, and planning) were not coded as SEL outcomes.

The certainty of evidence for each outcome domain was rated with the GRADE approach [50], adapted for syntheses without a single effect estimate [51]. Evidence from randomized trials started at high certainty and was downgraded by one or two levels for risk of bias, inconsistency (differences in the direction and size of effects across trials, rather than in the number of statistically significant findings), indirectness, imprecision (few or small trials, confidence intervals that were wide or not reported, and effective sample sizes reduced by clustering), and publication bias. Ratings were made independently by two reviewers, and disagreements were resolved through discussion.

Because the registration was retrospective, all registered methods were specified after the included studies were known. The final review differs from the registration in the following respects. The registration listed Scopus, Web of Science, PubMed, and Google Scholar and a search period up to May 2026; ERIC was also searched, and the search was updated in August 2026, so that the registration, which reported 14 included trials, preceded the inclusion of the final set of 35 trials; seventeen of these were identified during the second round of peer review, nine by the repeated searches [28,31,36–38,45,52–54] and eight by re-screening the records of the earlier searches [29,39,46,47,55–58]. The registration planned a descriptive comparison of fully digital and blended interventions but did not define coding rules; these were specified during peer review (Section 2.2.2) and applied to every trial, which led to two reclassifications. The following were also added during peer review: the RoB 2 extension for cluster-randomized trials applied at outcome level, vote counting

by direction of effect with an effect-direction plot following SWiM, the GRADE certainty assessment, and the robustness analyses. Apart from the sign test used to summarize vote counts, none of these involved new inferential statistical tests. In the second round of peer review, effect direction was recoded separately from statistical significance and the GRADE ratings were reassessed accordingly. The comparison between delivery formats should be regarded as exploratory.

3. Results

3.1. Results of the Search and Selection Process

The earlier searches resulted in a total of 2361 records. In particular, 545 records were retrieved from Scopus, 131 from Web of Science, 511 from PubMed, 974 from ERIC, and 200 from Google Scholar. After removal of duplicates, 2146 articles were available for screening of titles and abstracts. 2053 records were excluded during the screening process, as they did not meet the pre-defined inclusion criteria. The most common reasons for exclusion were non-school-based populations, absence of digital intervention components, missing social–emotional learning or mental health outcomes, and non-randomized study designs.

Eligibility assessment was performed on 93 full-text articles. After the full-text review, 75 studies were excluded due to non-randomized methodologies, lack of relevant SEL or mental health outcomes, the intervention not being primarily digital (as defined in Section 2.2.2), or delivery outside school facilities (n = 31, 11, 10, and 23, respectively); the operational definition of each reason is given in Table S3a. Eighteen studies satisfied all the eligibility criteria. The searches repeated during the second round of peer review retrieved 2722 records (ERIC, 976; Scopus without the subject-area restriction, 1168; Web of Science, 578). After removal of 1429 records retrieved by the earlier searches and 199 duplicates across the three sources, 1094 records were screened on title and abstract and 22 full texts were assessed. Thirteen were excluded because the design was not randomized ($n = 3$), the intervention was delivered outside school ($n = 5$), the report was first published after 11 August 2026 ($n = 3$), participants were recruited on the basis of a clinical diagnosis ($n = 1$), or no SEL or mental health outcome was reported ($n = 1$), and nine trials were included [28,31,36–38,45,52–54]. Re-screening of the 1790 unique records of the earlier ERIC, Scopus, PubMed, and Web of Science searches against the revised definitions led to 32 full-text assessments: 21 articles were excluded (not school-based, $n = 9$; not primarily digital, $n = 4$; non-randomized design, $n = 4$; participants not school-aged, $n = 2$; no relevant SEL or mental health outcome, $n = 1$; additional report of an included trial, $n = 1$), the full texts of three could not be retrieved, and eight trials were included [29,39,46,47,55–58]; each decision is listed in Table S3c. In total, 35 trials were included in the synthesis. No additional eligible studies were identified through manual examination of the reference lists of relevant reviews and included studies. The study selection process is shown in the PRISMA 2020 flow diagram (Figure 1).

3.2. Characteristics of Included Studies

The final sample included 35 randomized and cluster-randomized controlled trials published between 2016 and 2026. Altogether, these studies involved 15,026 participants from preschool, primary, and secondary education settings in North America, South America, Europe, and Asia. Sample sizes varied widely, from 34 participants in small pilot trials to 2801 participants in large-scale cluster-randomized studies. The included interventions targeted participants from early childhood (preschool, approximately 3 years) to late adolescence (up to 19 years, enrolled in secondary school). The studies were conducted in the United States, the United Kingdom, Australia, Portugal, Romania, Italy, China, Taiwan, Malaysia, Iran, Colombia, Chile, Argentina, and Uruguay, reflecting growing international

interest in the application of digital technologies to support social–emotional learning and mental health outcomes.

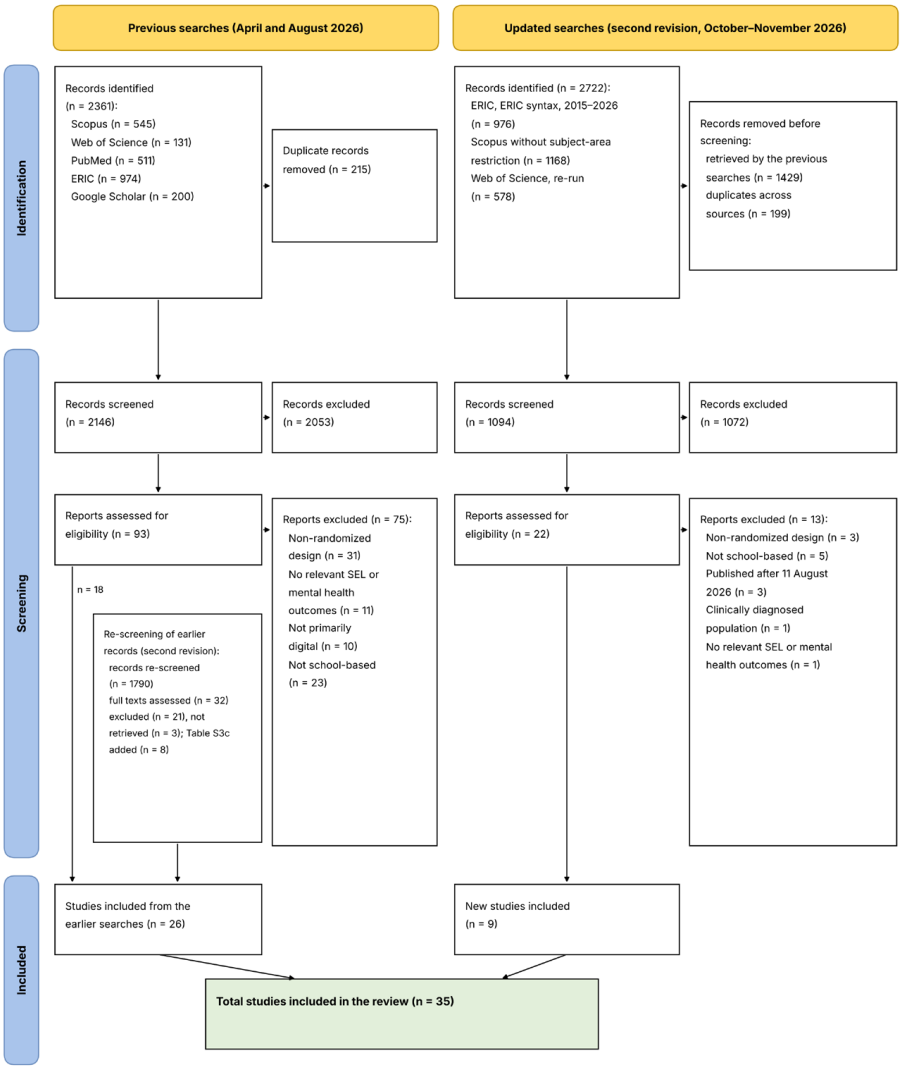


Figure 1. PRISMA 2020 flow diagram of the study identification, screening, and inclusion process, including the searches repeated during peer review and the re-screening of the earlier search records.

A range of educational technologies was used, such as serious games, gamified learning environments, mobile applications, tablet-based programs, virtual reality interventions, web-based platforms, multimedia learning environments, and technology-supported cooperative learning systems. Intervention duration ranged from short multi-session programs to year-long implementations embedded in school curricula. Across studies, the main outcomes concerned the development of CASEL-related competencies, such as self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. Other studies examined broader mental health outcomes, including emotion regulation, anxiety, depression, emotional self-efficacy, communication skills, and social competence. Table 2 summarizes the characteristics, delivery formats, main findings, and reported effect sizes of the included studies.

Table 2. Characteristics, Interventions, and Main Findings of the Included Studies.

Study	Country	Sample (N)	Age/Grade	Study Design; Comparator	Digital Intervention	Delivery Format	Duration	Primary Outcomes	Main Findings	Effect Size
David et al. (2019) [33]	Romania	142	10–16 years	RCT (3-arm); vs. waitlist and face-to-face REBE	REThink	Fully digital (videogame)	7 sessions	Emotional symptoms, depressive mood, emotion regulation	vs. waitlist at post-test: ↓ depressive mood (d = 0.66); ↑ emotional awareness (d = 0.49) and emotional control (d = 0.53); emotional symptoms decreased within the REThink group only; only REThink, not face-to-face REBE, differed from waitlist	d = 0.49–0.66 (between-group)
Calear et al. (2016) [58]	Australia	1767	Secondary school students	Cluster RCT (30 schools; 3 arms); externally supported or teacher-supported program vs. waitlist	e-couch Anxiety and Worry	Fully digital (self-directed online program completed in class)	6 weekly modules	Generalized anxiety; social anxiety; anxiety sensitivity; depressive symptoms; mental well-being (self-report)	No significant differences from waitlist at post-test or at 6- and 12-month follow-up on any outcome	d = −0.30 to 0.23 (range across outcomes and time points)
Hadley et al. (2019) [18]	USA	85	12–15 years	Pilot RCT; vs. ER program with role-play (active)	ER + IVRE	Blended (VR practice within facilitator-led group sessions)	4 sessions (4 weeks)	Emotion regulation, emotional self-efficacy	vs ER + role-play (active comparator) at 3 months: less difficulty accessing ER strategies (d = 0.46) and higher emotional self-efficacy (d = 0.20); higher attendance; pilot not powered for significance testing	d = 0.20–0.46 (between-condition)
Houck et al. (2022) [34]	USA	85	12–14 years	Pilot RCT; vs. waitlist	iTRAC	Fully digital (tablet)	4 weeks	Emotional awareness, emotion regulation	vs waitlist at 3 months: ↑ belief that emotions are controllable (d = 0.72, 95% CI 0.27–1.16); differences in ER difficulties, ER strategy use, and emotional self-efficacy had 95% CIs including zero; shorter persistence on a distress task (d = −0.71)	d = 0.08–0.72 (absolute values; 95% CIs reported)

Table 2. *Cont.*

Study	Country	Sample (N)	Age/Grade	Study Design; Comparator	Digital Intervention	Delivery Format	Duration	Primary Outcomes	Main Findings	Effect Size
Sexton et al. (2022) [57]	Australia	188	Preschool (early learning centres)	Pilot cluster RCT (10 rooms in 6 centres); vs. usual care	Early Minds (Smiling Mind)	Blended (educator-delivered, app-based)	8 weeks	Internalizing, externalizing, prosocial behaviour (educator and parent SDQ)	vs usual care at 3 months: fewer educator-rated externalizing problems at cluster level only; other differences favoured the program but were not significant	MD = −2.2 (95% CI −4.29, 0.14) for externalizing (cluster level)
Conroy et al. (2022) [47]	USA	34 (randomized arms)	Preschool (3–5 years), children at risk of emotional/behavioural disorders	RCT (19 teachers randomized); web-based vs. on-site delivery of the same teacher program	BEST in CLASS—Web	Blended (web-based teacher training and coaching) [a]	One school year	Social skills, problem behaviours (teacher-rated SSIS, C-TRF); teacher–child relationship; observed engagement	Web-based and on-site delivery produced similar gains; social skills higher with web-based delivery (not tested statistically)	d = 1.16 (social skills, web vs. on-site, post-test)
Bardhoshi et al. (2020) [40]	USA	38	Kindergarten (5–6 years)	Cluster RCT (1 classroom per arm); vs. TAU (Second Step)	SOBE Stories	Blended (app within counsellor-led classroom lessons)	10 sessions	Social skills, problem behaviors	vs TAU (Second Step) 1 month post: ↑ social skills (η^2 = 0.20; d = 0.78) and ↓ problem behaviors (η^2 = 0.16), teacher-rated (unblinded); no effect on academic achievement; one classroom per arm	d = 0.78; η^2 = 0.16–0.20
Edridge et al. (2020) [59]	UK	409	10–15 years	Cluster RCT; vs. management as usual	ReZone	Fully digital (app)	3 months	Emotional and behavioral difficulties, wellbeing, empowerment	No significant between-group differences on any outcome (self-report)	None reported
Mesurado et al. (2020) [60]	Argentina, Uruguay	880	12–15 years	Cluster RCT; vs. waitlist	Hero	Fully digital (web-based)	5 sessions	Prosociality, empathy, positive emotions, forgiveness	vs waitlist: ↑ prosocial behavior and some empathy and forgiveness subscales, with results differing by country; no effect on gratitude; effects largely sustained at 10-week follow-up (self-report)	Reported as "eta" = 0.01–0.08 (variance-explained statistic not further specified)

Table 2. *Cont.*

Study	Country	Sample (N)	Age/Grade	Study Design; Comparator	Digital Intervention	Delivery Format	Duration	Primary Outcomes	Main Findings	Effect Size
Perkins et al. (2021) [29]	UK	80	16–18 years	Pilot RCT (individual); vs. usual school activities (waitlist)	Enhanced psychological mindset session	Fully digital (single self-administered online session)	1 session (30 min)	Self-compassion; self-esteem; anxiety and depressive symptoms (self-report)	vs waitlist at 4 weeks: small to moderate differences favouring the intervention, confidence intervals including zero	ES = 0.33–0.45 (between-group)
Krach et al. (2021) [46]	USA	72 (analysed)	Grades 3–5	Cluster RCT (classes randomized to fall or spring delivery; 1 school); vs. waitlist	The Social Express	Fully digital (computer-based vignettes)	One semester	Prosocial behaviour (teacher-rated)	vs waitlist at post-test: difference favouring the program, $p = 0.058$	None reported
Oades-Sese et al. (2021) [39]	USA	766	Preschool (3–5 years)	Cluster RCT (62 preschools, 159 classrooms); vs. Sesame Workshop healthy-habits digital toolkit	Little Children, Big Challenges	Blended (teacher-led activities with digital media)	12 weeks	Emotion vocabulary; social problem solving (child tasks); self-regulation, social skills, problem behaviours, teacher–child relationship (teacher)	vs active comparator: ↑ emotion vocabulary, initiative, self-control, emotion regulation, adaptability, attachment; ↓ attention and emotion-control problems, lability, teacher conflict; no effect on social problem solving, social skills, closeness	d = 0.03–0.88 (between-group change)
Xavier et al. (2023) [61]	Portugal	295 (164 analysed)	Grade 3–4 (8–10 years)	Cluster RCT; vs. no program	The Me and the Us of Emotions	Blended (psychologist-led sessions + serious games)	10 sessions	Empathy, cooperation, emotional climate	No significant group × time interaction on any outcome; empathy, soothing, and drive improved within the intervention group only	$\eta p^2 = 0.02–0.07$ (time effects only)

Table 2. *Cont.*

Study	Country	Sample (N)	Age/Grade	Study Design; Comparator	Digital Intervention	Delivery Format	Duration	Primary Outcomes	Main Findings	Effect Size
Raccanello et al. (2023) [38]	Italy	548	Grades 2 and 4 (6–10 years)	Cluster RCT (34 classes randomly assigned within 9 schools; described by the authors as quasi-experimental); vs. no program	PrEmT program with the HEMOT web application	Blended (tablet app levels + researcher-led activities)	10 weekly 1-h units (about 3 months)	Emotion recognition; emotion lexicon; knowledge of emotion-regulation strategies; beliefs about the malleability of emotions; general well-being (child-completed)	vs no program at post-test: ↑ emotion recognition, emotion lexicon, emotion-regulation strategies, and beliefs that emotions can be changed (significant group × phase interactions); well-being did not differ between groups	Post-hoc contrasts only; no between-group effect size with CI
Ștefan et al. (2023) [35]	Romania	330	Preschool (54–72 months)	Cluster RCT; vs. waitlist	SEP	Blended (teacher-delivered curriculum; web-based teacher and parent training)	18 weeks	Social competence, emotion regulation, externalizing/internalizing problems	Teacher-rated, vs. waitlist: ↑ social competence ($\beta = 0.39$), ↑ adaptive and ↓ maladaptive ER ($\beta = 0.21$ and -0.20); no significant effect on externalizing or internalizing problems; parent-rated effects estimated for participating vs. non-participating parents (CACE)	$\beta = 0.20$–0.39 (95% CIs reported)
Fernandes et al. (2023) [26]	USA	100	14–19 years (Gr. 9–12)	Pilot RCT; vs. control without game	empowerED	Fully digital (videogame)	Single session (~1.5 h; gameplay ≈13 min)	Cognitive reappraisal	↑ cognitive reappraisal vs. control immediately after the session (LSM difference = 1.33, 95% CI 0.38–2.27); no effect on self-efficacy, emotional self-efficacy, or beliefs	LSM difference; no standardized ES

Table 2. *Cont.*

Study	Country	Sample (N)	Age/Grade	Study Design; Comparator	Digital Intervention	Delivery Format	Duration	Primary Outcomes	Main Findings	Effect Size
Gómez-Restrepo et al. (2023) [41]	Colombia	70	12–18 years	Exploratory cluster RCT (pilot); vs. counselling as usual (active)	DIALOG + S	Blended (teacher–student meetings structured by a tablet app)	6 months	Resilience, depression, anxiety, quality of life	No statistically significant between-group differences vs. counselling as usual (exploratory, underpowered)	ES = 0.21–1.50 (within-group only)
Wang et al. (2023) [44]	China	88	9–15 years	RCT (2 studies); vs. Lego-based play (Study 1); vs. Lego and traditional classroom (Study 2)	Floreo VR/Arts & Culture	Blended (VR + instructor)	8 sessions	Social competence, perceived social support	Study 1 (VR vs. Lego): no time × group interaction; Study 2 (VR vs. Lego vs. traditional classroom): significant interaction for general social competence and subjective social support (VR $n = 10$)	$\eta^2 = 0.00–0.48$
Williams et al. (2023) [56]	USA	699	Middle school	Cluster RCT (14 schools); LST with digital tools vs. LST alone	Botvin LifeSkills Training with Galaxia video game and digital materials	Blended (classroom sessions + educational video game)	Classroom program plus 4 game modules	Bullying and cyberbullying perpetration and victimization; skills knowledge (self-report)	vs LST alone: lower social bullying and cyberbullying perpetration in single-level models; not significant when clustering was modelled; no effect on victimization	None reported
Zarifsanaiey et al. (2022) [45]	Iran	60	Grade 3 (girls)	RCT (described by the authors as quasi-experimental); vs. routine class (no intervention)	Digital storytelling with group discussion	Blended (digital stories with researcher-led group discussion)	4 sessions × 2 h (4 weeks)	Social intelligence (Tromsø); emotional intelligence (Bar-On)	↑ social and emotional intelligence vs. control 3 months after the intervention (MANCOVA; self-report)	$\eta^2 = 0.53–0.55$
Hong et al. (2023) [28]	China	129 (119 analysed)	15–18 years	RCT (3-arm); vs. face-to-face mindfulness with identical content and active control (poetry video)	Brief digital mindfulness (pre-recorded audio)	Fully digital (audio on iPad)	Single session (~10 min)	Online charitable donation (behavioural task); empathy; social connectedness; self-compassion	↑ donations vs. active control; no difference between digital and face-to-face mindfulness; group × time interaction for empathic concern only (three groups); no interaction for perspective taking, social connectedness, or self-compassion	d = 1.05–1.12 (donation, vs. control; 95% CIs reported)

Table 2. *Cont.*

Study	Country	Sample (N)	Age/Grade	Study Design; Comparator	Digital Intervention	Delivery Format	Duration	Primary Outcomes	Main Findings	Effect Size
Low and Van Ryzin (2024) [62]	USA	813	Grades 6–9	Cluster RCT; vs. business as usual	PeerLearning.net [a]	Blended (teacher-facing platform)	1 academic year	Five CASEL competencies, prosocial behavior, supportive peer relations	↑ all five SEL competencies, prosocial behavior, and supportive peer relations vs. business as usual at end of school year (self-report)	ES = 0.34–0.82 (author-reported; statistic not specified)
Nuñez et al. (2024) [36]	Chile	100 (95 analysed)	Years 9–11 (mean 15 years); students at risk identified by school screening	Cluster RCT (21 schools); vs. treatment as usual (referral to primary care)	Reframe-IT+	Blended (online CBT modules completed at school with a psychologist present, plus face-to-face CBT sessions)	13 sessions (8 online, 5 face-to-face)	Suicidal ideation; depressive and anxiety symptoms; hopelessness; social problem solving; emotion-regulation strategies (self-report)	vs TAU at post-intervention: ↓ suicidal ideation, depressive and anxiety symptoms, and hopelessness; ↑ social problem solving, behavioural activation, and cognitive reappraisal	d = 0.47–0.81 (between-group)
Flynn et al. (2024) [17]	USA	1645	Grade 3	Cluster RCT; vs. business as usual	Adventures Aboard the S.S. GRIN	Blended (serious game) [c]	9 weeks	Social competence, SEL competencies	↑ performance-based social–emotional skills (Zoo U g = 0.60; SELweb g = 0.41) and teacher-rated strengths (BERS-2 g = 0.19); no significant difference in teacher-rated social behavior (SSBI)	g = 0.11–0.60 (95% CIs reported)
Bowrin et al. (2025) [42]	Taiwan	45	Grades 4, 5, 7, 8	Cluster crossover RCT; vs. non-gamified delivery of the same curriculum	RENEW	Blended (gamified) [b]	8 weeks	Social–emotional competence	Within-condition SEC gain larger under gamified (RNG, 15%) than non-gamified (RN, 4%) delivery; no formal between-condition test reported (teacher-rated)	Relative change 15% vs. 4%

Table 2. *Cont.*

Study	Country	Sample (N)	Age/Grade	Study Design; Comparator	Digital Intervention	Delivery Format	Duration	Primary Outcomes	Main Findings	Effect Size
Mayer et al. (2025) [55]	UK	2801	Years 3 and 5 (7–11 years)	Cluster RCT (classes randomized; 3 arms); vs. teaching as usual and an active control	SEE+	Blended (teacher-led whole-class animated activities)	30 activities over 10 weeks	Emotion recognition; theory of mind (child tasks)	vs teaching as usual: higher socio-emotional task scores ($p = 0.004$), equivalent to about 6 months of development	Score difference = 0.12 (vs 0.47 between Years 3 and 5)
Mesurado and Resett (2025) [52]	Uruguay	229	9–11 years	Cluster RCT (8 classrooms); vs. waitlist	Little Hero	Fully digital (web-based)	4 weekly sessions (45–60 min) plus assessment sessions	Prosocial behaviour; cognitive empathy; positive emotions (self-report)	vs waitlist: ↑ prosocial behaviour, emotional recognition, perspective taking, and serenity; gratitude maintained while it declined in controls; no effect on personal satisfaction; analyses not adjusted for clustering	ηp^2 = 0.02–0.23 (time × condition)
Baharuddin et al. (2025) [19]	Malaysia	226	13–14 years	RCT; vs. usual curriculum	REAL™	Blended (VR within psychologist-led group sessions)	12 sessions (4 weeks)	Emotion regulation, depression, anxiety	Main effect of group favoring intervention for ER, depression, and anxiety across post-test, 3- and 6-month follow-up; no group × time interaction for ER; attrition 24% (control) vs. 5% (intervention)	ηp^2 = 0.08–0.19
Robinson and Van Ryzin (2026) [43]	USA	155	Grade 9	Cluster RCT (2 schools); vs. curriculum-based SEL (Wayfinder)	PeerLearning.net [a]	Blended (teacher-facing platform)	1 semester (January–May)	Peer support, loneliness, social stress, bullying, victimization, anxiety, depression	↑ Peer support; ↓ loneliness, victimization, bullying, social stress, anxiety and depression vs. curriculum-based SEL (Wayfinder); self-report; one school per arm	η^2 = 0.03–0.26

Table 2. *Cont.*

Study	Country	Sample (N)	Age/Grade	Study Design; Comparator	Digital Intervention	Delivery Format	Duration	Primary Outcomes	Main Findings	Effect Size
Low et al. (2026) [54]	USA	691	Grade 9	Cluster RCT (13 high schools); vs. business as usual	PeerLearning.net	Blended (teacher-facing platform) [a]	One school year (≥2 lessons per month; mean 73 lessons per school)	Peer stress; anxiety; depression; loneliness; peer academic support; bullying; victimization; suicide risk (self-report)	vs business as usual at end of year: ↓ peer stress, anxiety, depression, loneliness, discrimination, bullying, and victimization; ↑ peer academic support; no effect on suicide risk	d = 0.31–1.21 (between-group change)
Feng et al. (2026) [27]	China	297	Grade 7 (≈12 years)	RCT (3-arm); vs. face-to-face game and no intervention	Collaborative multi-user VR game	Fully digital (VR)	Single session (10–15 min)	Social–emotional competencies (observer-rated)	↑ observer-rated overall SEC, task performance, collaboration, and engagement with others; VR > face-to-face game (MD = 0.60, $p = 0.039$) and no-intervention control; no between-group effect on emotional regulation	η^2p = 0.03–0.06
Yao and Abdullah (2026) [31]	China	100	4–5 years	RCT (unit of randomization unclear; described by the authors as quasi-experimental); vs. picture-book emotion lessons (active)	EmoPlay Pals	Blended (app used in teacher-delivered lessons)	16 lessons × 15 min (8 weeks)	Emotional self-regulation: attention, impulse control, adaptability (assessor-rated tasks)	Time × group interactions favouring the app for attention, impulse control, adaptability, and overall emotion regulation across post-test and 3-week delayed post-test	ηp^2 = 0.10–0.27 (time × group)
Gaete et al. (2026) [53]	Chile	153 (149 analysed)	Pre-kindergarten (~4 years)	Pilot cluster RCT (7 schools); vs. treatment as usual	Japi 2.0	Fully digital (tablet game) [e]	24 sessions × 15 min (12 weeks)	Emotion recognition; social problem solving; empathy; executive functions; difficulties (SDQ, ECBI); social competence	vs TAU: ↑ empathy (adjusted MD 0.84, 95% CI 0.06–1.62) and ↓ parent-rated SDQ difficulties (−0.84, −1.41 to −0.26); no differences in emotion recognition, social problem solving, executive functions, teacher-rated SDQ, ECBI, or parent-rated social competence	Adjusted MD (95% CIs reported)

Table 2. *Cont.*

Study	Country	Sample (N)	Age/Grade	Study Design; Comparator	Digital Intervention	Delivery Format	Duration	Primary Outcomes	Main Findings	Effect Size
Meurer et al. (2026) [37]	USA	329	Grades 5–10	Cluster RCT with crossover factorial design (classrooms in 4 schools); game vs. coach-mentorship vs. both vs. control	STRYV365: Brain Agents video game	Fully digital (video game) [f]	≈10 sessions × 23 min per semester	Coping options; emotion regulation; relationships; self-awareness (self-report survey)	Brain Agents arm vs. control: ↑ coping options ($p = 0.03$); no significant effect on emotion regulation, relationships, or self-awareness (direction not reported)	None reported (p values only)
Zagni et al. (2026) [63]	Italy	577	8–12 years (Grades 4–6)	Cluster RCT (36 classes); vs. waitlist	PeerLearning.net [a]	Blended (teacher-facing platform; psychologist-led sessions) [d]	1 school year (4 sessions + 16 lessons)	Cooperative behaviour (behavioural task); social–emotional skills (self-report) [64]	↑ Cooperative behaviour vs. waitlist control (time × group interaction, $p = 0.006$); companion report: greater gain in self-reported social–emotional skills index (time × group, $p < 0.01$) [64]	$\beta = 0.07$; $R^2m = 0.15$

Note. Total participants: N = 15,026 (range 34–2801). Main findings describe differences between groups unless labelled as within-group change. Effect sizes are reported as provided by study authors using the metric(s) given in the original publication (d, Cohen's d; g, Hedges' g; η or η^2, eta or eta squared; ηp^2, partial eta squared; β, standardized regression or path coefficient; LSM, least-squares mean; MD, mean difference; ES, author-labelled effect size where the specific statistic was not named); values are not directly comparable across studies given these differences in metrics and in outcome measures, and "None reported" indicates that the original publication did not provide a quantitative effect size; ↑, higher scores (an increase) in the intervention group than in the comparison condition, or a within-group increase where so labelled; ↓, lower scores (a decrease); ≈, approximately; ×, interaction between factors (e.g., group × time) or number of sessions multiplied by session length. Delivery format follows the definitions in Section 2.2.2; the human support involved in each trial is described in Section 3.6, and outcome-level results are given in Table S4. [a] In Low and Van Ryzin [62], Robinson and Van Ryzin [43], and Zagni et al. [63], the technology (PeerLearning.net) functions as a teacher-facing tool supporting fidelity of cooperative-learning delivery, rather than as student-facing digital content. [b] In Bowrin et al. [42], the comparison contrasted a gamified (Kahoot!-based) with a non-gamified delivery of the same SEL curriculum, rather than a digital intervention versus a no-intervention control. [c] Flynn et al. [17] report combined results from two cohorts of a single efficacy trial; findings from the first cohort were published separately [65] and are not counted as an independent study here. Implementation fidelity in this trial required teacher-facilitated post-episode discussions, and the intervention was therefore classified as blended. [d] Zagni et al. [63] report the behavioural outcome of a cluster-randomized trial whose self-reported social–emotional outcomes were published separately [64]; both reports are summarized here, and the trial and its participants are counted once. [e] Gaete et al. [53] describe their delivery as integrating the digital platform with adult support; adults gave general instructions, technical support, and brief end-of-session questions without task-specific guidance, which meets the definition of fully digital in Section 2.2.2. [f] Meurer et al. [37] used a factorial crossover design that also included a non-digital coach-mentorship program; only the comparison of the Brain Agents game with the control condition is summarized here.

3.3. Characteristics of Digital SEL Interventions

The included interventions varied greatly in terms of technological design and pedagogical implementation. Nonetheless, they can be classified into several major categories: serious games, gamified interventions, virtual reality programs, mobile and tablet-based interventions, and technology-supported cooperative learning systems. Serious games were among the most frequently used approaches. Interactive narratives and game mechanics were integrated into programs such as Adventures Aboard the S.S. GRIN and The Me and the Us of Emotions to foster empathy, emotional understanding, social awareness, and relationship skills. Gamification was applied in interventions such as RENEW, using game elements, rewards, and structured challenges to increase engagement and promote emotion regulation and self-management.

Virtual reality (VR) interventions represented a relatively novel but promising category in the reviewed literature. Programs such as REAL™ and the VR-enhanced emotion regulation program evaluated by Hadley et al. [18] aimed to provide realistic social experiences that foster emotional awareness, emotional self-efficacy, and emotion regulation; in both, VR practice was embedded in facilitator-led group sessions. A further trial compared a single-session, multi-user collaborative VR game with an equivalent face-to-face game and a no-intervention control [27]. Mobile and tablet-based tools included iTRAC, which students completed independently, and DIALOG + S, in which a tablet application structured monthly teacher–student meetings; the videogame empowerED targeted cognitive reappraisal. In preschool settings, Japi 2.0 offered individual tablet games on emotion recognition, empathy, and social problem solving [53], and EmoPlay Pals was used by teachers in short emotion lessons [31]. Web-based and multimedia programs included Little Hero, which promoted prosocial behaviour, empathy, and positive emotions [52], digital storytelling combined with group discussion [45], a brief pre-recorded mindfulness session [28], online cognitive–behavioural modules completed at school with a psychologist present [36], the Brain Agents video game [37], and the HEMOT web application, used on tablets at the start of each researcher-led unit of a program on emotions and coping with earthquakes [38]. Classroom programs also used digital media in teacher-led activities [39,55] or alongside classroom sessions [56], and two preschool programs relied on technology used by educators, an app-based mindfulness program [57] and web-based teacher training [47]. Fully digital programs completed in class included an online anxiety program [58], a single online mindset session [29], and computer-based social skills vignettes [46]. Together, these programs addressed emotional awareness, emotion regulation, cognitive reappraisal, empathy, prosocial behaviour, and mental health monitoring.

The scope of digital SEL was further extended through technology-assisted learning systems incorporating collaborative learning, peer interaction, communication, social problem-solving, and family involvement. Examples included PeerLearning.net, evaluated in four trials [43,54,62,63], and the Social–Emotional Prevention Program (SEP), which used web-based resources, multimedia content, and technology-supported teacher and parent training. In these programs, technology mainly supported the adults delivering the intervention rather than being used directly by students. Table 3 maps each intervention onto the five CASEL competency domains, distinguishing targeted domains from those for which a between-group benefit was reported.

Table 3. Mapping of Included Interventions onto the Five CASEL Competency Domains.

Study	Self-Awareness	Self-Management	Social Awareness	Relationship Skills	Responsible Decision-Making
David et al. (2019) [33]	●	●			○
Calear et al. (2016) [58]		○			
Hadley et al. (2019) [18]		○			
Houck et al. (2022) [34]	○	○			
Sexton et al. (2022) [57]	○	○		○	
Conroy et al. (2022) [47]		○		○	
Bardhoshi et al. (2020) [40]	○	◐	◐	◐	◐
Edridge et al. (2020) [59]	○	○			
Mesurado et al. (2020) [60]		○	●	●	
Perkins et al. (2021) [29]		○			
Krach et al. (2021) [46]			○	○	
Oades-Sese et al. (2021) [39]	●	●		◐	
Xavier et al. (2023) [61]	○	○	○	○	
Raccanello et al. (2023) [38]	●	●			
Ștefan et al. (2023) [35]	○	●	○	◐	○
Fernandes et al. (2023) [26]	○	●			
Gómez-Restrepo et al. (2023) [41]	○	○			
Wang et al. (2023) [44]	○	○	○	◐	
Williams et al. (2023) [56]		○		○	○
Zarifsanaiey et al. (2022) [45]	◐	◐	◐	◐	
Hong et al. (2023) [28]	○		●	●	

Table 3. *Cont.*

Study	Self-Awareness	Self-Management	Social Awareness	Relationship Skills	Responsible Decision-Making
Low and Van Ryzin (2024) [62]	●	●	●	●	●
Nuñez et al. (2024) [36]	○	●			●
Flynn et al. (2024) [17]	○	◐	◐	◐	◐
Bowrin et al. (2025) [42]	○	○	○	○	○
Mayer et al. (2025) [55]			●		
Mesurado and Resett (2025) [52]			●	●	
Baharuddin et al. (2025) [19]	○	●	○		
Robinson and Van Ryzin (2026) [43]		○	○	●	
Low et al. (2026) [54]		○	○	●	
Feng et al. (2026) [27]		○	○	●	
Yao and Abdullah (2026) [31]	○	●			
Gaete et al. (2026) [53]	○	○	●	○	
Meurer et al. (2026) [37]	○	●	○	○	○
Zagni et al. (2026) [63]	◐		◐	●	

Note. ● = domain targeted, and a between-group advantage was reported on an outcome specific to this domain; ◐ = domain targeted, and a between-group advantage was reported on a composite measure that includes this domain; ○ = domain targeted, but no between-group advantage was demonstrated (outcome not measured separately, difference not significant, or between-group comparison not tested); blank = domain not targeted. Targeted domains are based on each intervention's described content and stated objectives. For Zagni et al., results from both reports of the trial [63,64] are combined. Outcome-level results are given in Table S4. CASEL = Collaborative for Academic, Social, and Emotional Learning.

3.4. Effects on CASEL Competencies

Table 3 distinguishes the CASEL domains that each intervention targeted from those for which a between-group advantage was reported. Benefits were most consistent for relationship skills (14 of the 22 trials that targeted this domain) and least consistent for self-awareness (6 of 23). Within-group improvements that were not accompanied by a between-group difference are noted below but are not treated as evidence of effectiveness.

3.4.1. Self-Awareness

Twenty-three interventions targeted self-awareness, but a between-group advantage on a self-awareness outcome was reported in only six trials: REThink improved emotional awareness relative to a waitlist [33], technology-supported cooperative learning improved self-reported self-awareness [62], and composite measures that included emotional knowledge or intrapersonal skills favoured the Italian PeerLearning.net trial [64] and digital storytelling with group discussion [45], and the PrEmT program improved emotion recognition and emotion vocabulary relative to no program [38], and Little Children, Big Challenges improved preschool children's emotion vocabulary relative to an active digital-media comparator [39]. In iTRAC, the difference in difficulties with emotional awareness had a 95% confidence interval that included zero [34], in Japi 2.0 emotion recognition did not differ from usual practice [53], self-awareness did not differ significantly in the STRYV365 game arm [37], and REAL™ did not report awareness separately from overall emotion regulation [19]. Coded by direction, all six trials that measured self-awareness favoured the intervention (Figure 2), but the certainty of this evidence was low (Section 3.10).

3.4.2. Self-Management

Self-management was the most frequently targeted domain (30 trials), but a between-group advantage was reported in fewer than half of these. Advantages were found for emotional control after REThink [33], for cognitive reappraisal after a single empowerED session [26], for teacher-rated adaptive and maladaptive emotion-regulation strategies in SEP [35], for emotion regulation in REAL™ [19], for assessor-rated attention, impulse control, and adaptability with EmoPlay Pals [31], for cognitive reappraisal and behavioural activation with Reframe-IT+ [36], for coping options in the Brain Agents game arm of STRYV365 [37], for knowledge of emotion-regulation strategies and beliefs that emotions can be changed with the PrEmT program [38], for teacher-rated initiative, self-control, emotion regulation, and adaptability with Little Children, Big Challenges [39], and for self-reported self-management with PeerLearning.net [62]; composite measures that included self-control or coping with stress also favoured SOBE Stories [40], Adventures Aboard the S.S. GRIN [17], and digital storytelling with group discussion [45]. Other effects were smaller or less certain: in iTRAC, only the belief that emotions are controllable differed clearly from the waitlist [34]; the VR-enhanced program of Hadley et al. showed small differences relative to role-play that were not tested for significance [18]; the collaborative VR game did not affect observer-rated emotional regulation [27]; and Hero showed no group differences in emotional regulation in either country [60]. Coded by direction irrespective of significance, however, fourteen of the fifteen trials that measured self-management favoured the intervention, and only Hero favoured the comparator (Figure 2; Table S5).

3.4.3. Social Awareness

Between-group advantages in social awareness were reported for empathy-related outcomes in Hero, with results that differed between the two participating countries [60], in Little Hero, which improved emotional recognition and perspective taking [52], and in Japi 2.0, which improved preschool children's empathy [53]; brief digital mindfulness was associated with a group × time interaction for empathic concern but not for perspective taking [28], and PeerLearning.net improved self-reported social awareness [62]. In the largest trial, whole-class SEE+ activities improved primary-school children's performance on emotion-recognition and theory-of-mind tasks relative to teaching as usual [55]. Composite measures that included social awareness favoured SOBE Stories [40], Adventures Aboard the S.S. GRIN [17], the Italian PeerLearning.net trial [64], and digital storytelling with group discussion [45]. In The Me and the Us of Emotions, empathy increased over time in

the intervention group, but the group × time interaction was not significant, so no advantage over the control group was shown [61]. By direction, all seven trials that measured social awareness separately favoured the intervention (Figure 2).

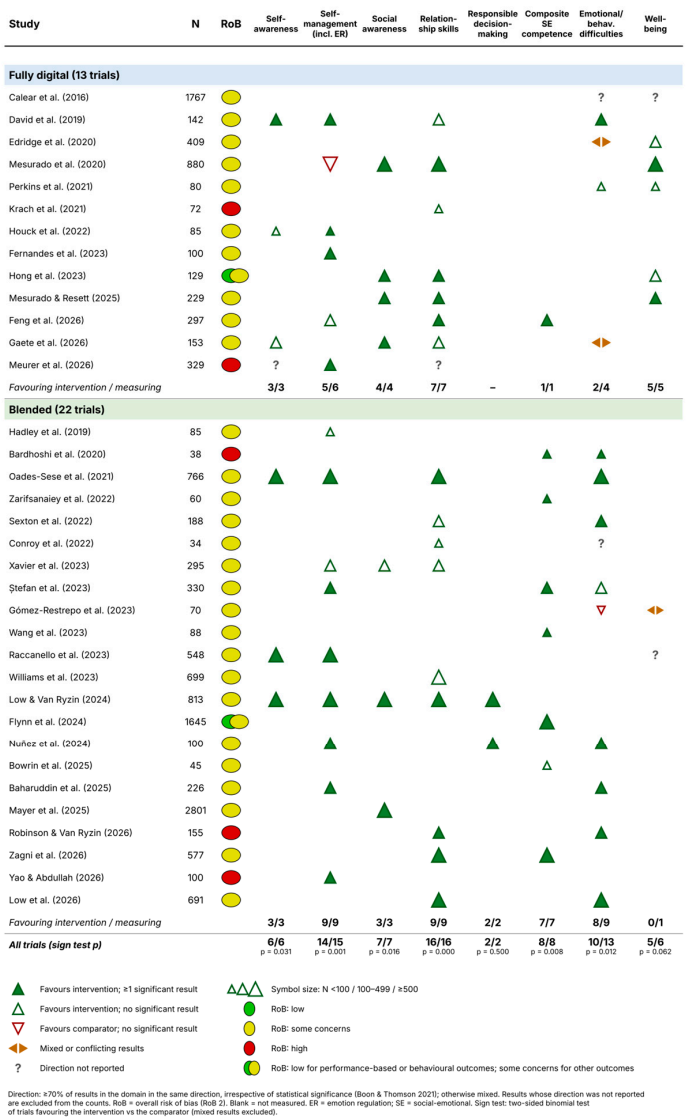


Figure 2. Effect-direction plot by outcome domain in the 35 included trials, grouped by delivery format (Synthesis Without Meta-analysis; method of Boon and Thomson [49]). Triangles show the direction of effect, coded irrespective of statistical significance; filled symbols indicate that at least one result in the domain was statistically significant, symbol size reflects sample size. Vote counts give the number of trials favouring the intervention out of those measuring each domain, with a two-sided sign test across all trials. Differences between the two groups are confounded by age, outcomes measured, informant, and comparator and should not be interpreted as effects of delivery format; the coding of each result is given in Table S5. Trials shown: fully digital—Calear et al. [58], David et al. [33], Edridge et al. [59], Mesurado et al. [60], Perkins et al. [29], Krach et al. [46], Houck et al. [34], Fernandes et al. [26], Hong et al. [28], Mesurado and Resett [52], Feng et al. [27], Gaete et al. [53], and Meurer et al. [37]; blended—Hadley et al. [18], Bardhoshi et al. [40], Oades-Sese et al. [39], Zarifsanaiey et al. [45], Sexton et al. [57], Conroy et al. [47], Xavier et al. [61], Ștefan et al. [35], Gómez-Restrepo et al. [41], Wang et al. [44], Raccanello et al. [38], Williams et al. [56], Low and Van Ryzin [62], Flynn et al. [17], Nuñez et al. [36], Bowrin et al. [42], Baharuddin et al. [19], Mayer et al. [55], Robinson and Van Ryzin [43], Zagni et al. [63,64], Yao and Abdullah [31], and Low et al. [54].

3.4.4. Relationship Skills

Relationship skills showed the most consistent between-group benefits. Advantages were reported for prosocial behaviour in Hero [60] and Little Hero [52]; for relationship skills, prosocial behaviour, and supportive peer relations with PeerLearning.net [62]; for peer academic support and reduced loneliness, bullying, and victimization in a 13-school high-school trial of PeerLearning.net [54]; and for peer support and reduced victimization and bullying relative to a curriculum-based SEL program, although in a trial with one school per arm [43]. Three trials used measures other than self-report: students in PeerLearning.net classrooms showed greater gains than waitlist controls in cooperation observed during a dyadic behavioural task [63], a single collaborative VR session improved observer-rated collaboration and engagement with others relative to both an equivalent face-to-face game and no intervention [27], and adolescents donated more in an online charity task after a brief digital mindfulness session than after an active control activity [28]. Composite social competence or social skills measures also favoured SOBE Stories [40], SEP [35], Adventures Aboard the S.S. GRIN [17], digital storytelling with group discussion [45], and, in the second study of Wang et al., VR-assisted instruction over traditional classroom teaching [44]. Little Children, Big Challenges improved teacher-rated attachment and reduced teacher–child conflict, but not social skills or social problem solving [39]. In Japi 2.0, social problem solving and parent-rated social competence did not differ from usual practice [53], and differences favouring the intervention were not statistically significant for prosocial behaviour in Early Minds [57] and The Social Express [46] or for bullying perpetration once clustering was modelled when a video game and digital materials were added to LifeSkills Training [56]. All sixteen trials that measured relationship skills favoured the intervention in direction (Figure 2).

3.4.5. Responsible Decision-Making

Eight interventions targeted responsible decision-making. Domain-specific between-group advantages were reported for PeerLearning.net [62] and for social problem solving with Reframe-IT+ [36], and composite measures that included social problem-solving favoured SOBE Stories [40] and Adventures Aboard the S.S. GRIN [17]. Overall, the evidence supports benefits of digital SEL interventions for relationship skills and, less consistently, for self-management and social awareness, whereas evidence for self-awareness and responsible decision-making is limited.

3.5. Influence on Mental Health Outcomes

Mental health and psychological well-being outcomes were measured in fewer trials than social–emotional competencies, and between-group evidence for these outcomes came from a small number of studies.

3.5.1. Emotion Regulation

Between-group improvements in emotion regulation were reported for REAL™ relative to the usual curriculum, with a main effect of group across post-test and follow-up but no group × time interaction [19], for teacher-rated adaptive and maladaptive strategy use in SEP [35], and for assessor-rated emotional self-regulation in preschool children using EmoPlay Pals, relative to picture-book emotion lessons [31], and for teacher-rated emotion regulation and self-control in preschool children with Little Children, Big Challenges [39]; in the last trial, the unit of randomization was unclear and the risk of bias was high (Section 3.7). Among students at risk identified by school screening, Reframe-IT+ improved cognitive reappraisal and behavioural activation relative to treatment as usual [36]. In iTRAC, most regulation outcomes had confidence intervals that included zero [34], and the VR-enhanced

program of Hadley et al. was compared with role-play rather than with a no-intervention control [18]. In SEP, the original authors reported that children's emotion regulation mediated the effect on social competence; because the mediator and the outcome were rated by the same teachers at the same time point, this finding should be regarded as exploratory. Parent-reported outcomes in SEP compared participating with non-participating parents, a comparison that is not protected by randomization.

3.5.2. Resilience

A small number of studies examined resilience and related psychological resources. In the exploratory DIALOG + S pilot, resilience was assessed alongside depression and anxiety; no statistically significant differences were detected relative to counselling as usual, consistent with the study's limited statistical power, and the larger effect sizes reported in that study (up to 1.50) referred to change within groups. Little Hero improved self-reported serenity and maintained gratitude, which declined in the waitlist group, but did not affect personal satisfaction [52], and a brief digital mindfulness session did not change self-compassion relative to an active control [28], general well-being did not differ between groups in the PrEmT trial [38], a single online mindset session produced small, non-significant gains in self-compassion and self-esteem [29], and mental well-being did not differ after the e-couch program [58]. Resilience and well-being therefore remain relevant but under-evaluated outcomes in digital school-based SEL research.

3.5.3. Anxiety and Depression

Evidence on anxiety and depressive symptoms came from eight trials. REAL™ showed lower anxiety and depression than the usual curriculum across post-test and follow-up assessments [19], although attrition was markedly higher in the control group and outcome assessment procedures differed between arms (Section 3.7). REThink reduced self-reported depressive mood relative to a waitlist at post-test [33]. Two trials of technology-supported co-operative learning reported reductions in anxiety and depressive symptoms: one compared it with a curriculum-based SEL program in only two schools, so that intervention effects cannot be separated from differences between the schools [43], and the other compared it with business as usual in 13 high schools ($d = 0.49$ for both anxiety and depression) [54]. Among students at risk identified by school screening, Reframe-IT+ reduced suicidal ideation, depressive and anxiety symptoms, and hopelessness relative to treatment as usual [36]. In the largest trial of a fully digital program, e-couch did not reduce anxiety or depressive symptoms relative to a waitlist in 30 schools [58], and a single online mindset session produced small, non-significant reductions [29]. DIALOG + S found no between-group differences, and the median reductions in depression and anxiety scores were larger in the control group [41]. In the preschool Japi 2.0 pilot, parent-rated total difficulties decreased more than with usual practice, whereas teacher-rated difficulties and parent-rated behaviour problems did not differ [53]. Evidence for effects on these symptoms therefore remains limited, relies on self-report, and comes from trials with risk-of-bias concerns, although the two most recent trials randomized more schools [36,54].

3.5.4. Emotional Self-Efficacy

Emotional self-efficacy was assessed in three trials. The differences favouring the VR-enhanced program over role-play ($d = 0.20$) [18] and iTRAC over a waitlist ($d = 0.63$, 95% CI −0.01 to 1.28) [34] were small or imprecise, and empowerED had no effect on emotional self-efficacy [26]. There is therefore no clear between-group evidence that digital SEL interventions improve emotional self-efficacy.

3.6. Fully Digital Versus Blended Interventions

Re-examination of the trials against the definitions in Section 2.2.2 led to two reclassifications. In the trial by Hadley et al. [18], each two-hour session comprised about 1.5 h of facilitator-led group work and 0.5 h of VR practice, and VR scenes were operated in real time by a trained facilitator; in DIALOG + S [41], teachers held monthly meetings with students that were structured by a tablet application. Both are now classified as blended. Thirteen interventions (37%) were therefore fully digital [26–29,33,34,37,46,52,53,58–60]: students used the program directly, and adults provided only technical or logistical support, an introductory tutorial, supervision, or a brief debriefing. The authors of Japi 2.0 describe their delivery as combining the platform with adult support, but adults gave only general instructions, technical help, and brief end-of-session questions without task-specific guidance, so the trial meets the definition of fully digital [53]. Twenty-two (63%) were blended. In fourteen of these, the digital component was embedded in sessions led by facilitators, researchers, psychologists, counsellors, or teachers [18,19,31,36,38–42,44,45,55,56,61]. In Adventures Aboard the S.S. GRIN, students completed online episodes, and teacher-facilitated post-episode discussions were part of the trial's implementation-fidelity criteria, although the developers describe the program as self-guided [17]. In the remaining seven, adults delivered the program and technology primarily supported them, through cooperative-learning platforms used by teachers [43,54,62,63], an app used by preschool educators [57], or web-based teacher and parent training [35,47]. Table 4 describes the human support involved in each trial.

Table 4. Delivery Format, Human Support, and Within-Trial Comparisons of Formats in the 35 Included Trials.

Study	Format	Human Support as Delivered	Technology Used by Students	Within-Trial Comparison of Formats
David et al. (2019) [33]	Fully digital	Psychologist present during after-class sessions; brief debriefing after each module	Yes: therapeutic videogame, 7 modules	Yes: game vs. face-to-face REBE group (and waitlist)
Calear et al. (2016) [58]	Fully digital	Students completed the online program in class, supervised by a teacher or an external facilitator	Yes: web-based program, 6 modules	No (waitlist; external vs. teacher support compared)
Houck et al. (2022) [34]	Fully digital	Research assistant logged students in and resolved technical problems only	Yes: tablet program, 4 modules	No (waitlist)
Edridge et al. (2020) [59]	Fully digital	Initial guided tutorial with an adult; subsequent use at teachers' discretion	Yes: web-based app	No (management as usual)
Perkins et al. (2021) [29]	Fully digital	Students worked individually at a computer in class; no adult-led component	Yes: single online session	No (waitlist)

Table 4. *Cont.*

Study	Format	Human Support as Delivered	Technology Used by Students	Within-Trial Comparison of Formats
Krach et al. (2021) [46]	Fully digital	Students used the program at their own pace during class time	Yes: computer-based animated vignettes	No (waitlist)
Mesurado et al. (2020) [60]	Fully digital	Psychologist present in the computer room to check the application and direct tasks	Yes: web-based program, 5 sessions	No (waitlist)
Fernandes et al. (2023) [26]	Fully digital	Research staff supervised a single after-school session	Yes: videogame	No (control without game)
Feng et al. (2026) [27]	Fully digital	Facilitators managed VR equipment; no teacher-led discussion	Yes: multi-user VR game, one 10–15-min session	Yes: VR vs. equivalent face-to-face game (and no intervention)
Hong et al. (2023) [28]	Fully digital	Brief introduction to mindfulness; the session itself was pre-recorded audio without an instructor	Yes: pre-recorded mindfulness audio on iPad, one ~10-min session	Yes: digital vs. face-to-face (tutor-led) delivery of identical content (and active control)
Mesurado and Resett (2025) [52]	Fully digital	Teacher and psychologist introduced the program and supervised computer-room sessions	Yes: web-based program, 4 sessions	No (waitlist)
Gaete et al. (2026) [53]	Fully digital [c]	Research assistants gave general instructions, technical support, and brief end-of-session questions; educators present for classroom management only	Yes: tablet game with headphones, 24 × 15 min	No (treatment as usual)
Meurer et al. (2026) [37]	Fully digital [d]	Students played the game in school; no adult-led component in the game arm	Yes: Brain Agents video game, ≈10 sessions per semester	No (factorial comparison with a non-digital coach-mentorship program and control)
Hadley et al. (2019) [18] †	Blended	Two facilitators led 2-h after-school groups (≈1.5 h group work, 0.5 h practice); facilitator operated VR scenes in real time	Yes: VR practice scenes	Yes: VR vs. role-play practice within the same group program

Table 4. *Cont.*

Study	Format	Human Support as Delivered	Technology Used by Students	Within-Trial Comparison of Formats
Bardhoshi et al. (2020) [40]	Blended	Counsellor educator delivered 10 classroom lessons with instruction, discussion, and role-play	Yes: iPad app (social stories, game), shared in groups of three	No (TAU curriculum)
Oades-Sese et al. (2021) [39]	Blended	Teachers led daily activities that included Sesame Street videos and interactive media	Shared: digital media toolkit	No (active digital comparator)
Sexton et al. (2022) [57]	Blended [b]	Educators delivered mindfulness activities from an app	Shared: app used by educators	No (usual care)
Conroy et al. (2022) [47]	Blended [b]	Teachers implemented classroom practices after web-based training and remote coaching	No: web-based teacher training and coaching	Yes: web-based vs. on-site training and coaching
Xavier et al. (2023) [61]	Blended	Two psychologists per class led 10 weekly 60-min sessions (partly by videoconference); teacher present	Yes: serious games on a web platform, also used at home	No (no-program control)
Gómez-Restrepo et al. (2023) [41] †	Blended	Teachers held six monthly ~30-min meetings with students, structured by the app	Shared: tablet app used during teacher–student meetings	No (counselling as usual)
Wang et al. (2023) [44]	Blended	Instructor guided each VR session and explained social norms; cooperative tasks with a peer	Yes: Floreo VR; Google Arts & Culture	Yes: VR vs. Lego-based play (Study 1); vs. Lego and traditional classroom (Study 2)
Williams et al. (2023) [56]	Blended	Teachers delivered LST classroom sessions; students played four game modules	Yes: Galaxia video game	Partly: LST with vs. without digital tools
Raccanello et al. (2023) [38]	Blended	Educational psychologists (with a geology expert in two units) led ten weekly 1-h units; each began with a tablet activity	Yes: HEMOT web application, one level per unit	No (no program)
Zarifsanaiey et al. (2022) [45]	Blended	Researcher presented the stories and led group discussion in four 2-h sessions	Shared: digital stories viewed together by the group	No (routine class)

Table 4. *Cont.*

Study	Format	Human Support as Delivered	Technology Used by Students	Within-Trial Comparison of Formats
Bowrin et al. (2025) [42]	Blended	Eight 40-min face-to-face classroom sessions	Yes: Kahoot! gamified activities	Yes: gamified vs. non-gamified (slides) delivery, crossover
Mayer et al. (2025) [55]	Blended	Teachers led whole-class activities with projected animations	Shared: projected animations	No (teaching as usual and active control)
Baharuddin et al. (2025) [19]	Blended	Two developmental psychologists per group of ~11 students; 12 sessions with games, scenarios, and role-play	Yes: VR scenarios (≈120 min of each 180-min session)	No (usual curriculum)
Flynn et al. (2024) [17]	Blended [a]	Teachers assigned episodes; post-episode discussions were part of the fidelity criteria; teacher dashboard	Yes: online game episodes, 9 × 30–45 min	No (business as usual)
Ștefan et al. (2023) [35]	Blended [b]	Teachers delivered 43 classroom activities; teacher and parent training online with web-platform materials	No: technology used by teachers and parents	No (waitlist)
Low and Van Ryzin (2024) [62]	Blended [b]	Teachers delivered cooperative-learning lessons after two 2-h training sessions	Partly: platform structures groups, roles, and reflection; mainly teacher-facing	No (business as usual)
Nuñez et al. (2024) [36]	Blended	Psychologist present during online modules and delivered five face-to-face CBT sessions	Yes: eight online CBT modules	No (treatment as usual)
Robinson and Van Ryzin (2026) [43]	Blended [b]	Teachers delivered cooperative-learning lessons after training	Partly: as above	Partly: technology-supported cooperative learning vs. curriculum-based SEL (Wayfinder)
Zagni et al. (2026) [63,64]	Blended [b]	Four psychologist-led classroom sessions, then 16 teacher-delivered cooperative-learning lessons with job shadowing	Partly: as above	No (waitlist)

Table 4. *Cont.*

Study	Format	Human Support as Delivered	Technology Used by Students	Within-Trial Comparison of Formats
Low et al. (2026) [54]	Blended [b]	Teachers delivered cooperative-learning lessons after two 2-h training sessions	Partly: as above	No (business as usual)
Yao and Abdullah (2026) [31]	Blended	Regular teachers delivered two 15-min emotion lessons per week using the app	Yes: EmoPlay Pals app during lessons	No (picture-book emotion lessons)

Note. Fully digital: 13 trials (37%); blended: 22 trials (63%). † Reclassified from fully digital to blended during revision. [a] The developers describe Adventures Aboard the S.S. GRIN as self-guided; it is classified as blended because teacher-facilitated post-episode discussions were part of the trial's implementation-fidelity criteria. [b] Technology used mainly by the adults delivering the program (Section 2.2.2). [c] Described by the authors as integrating the platform with adult support; because adults gave only general instructions, technical support, and brief end-of-session questions, it is classified as fully digital. [d] Only the comparison of the video game arm with the control condition is considered; the trial also evaluated a non-digital coach-mentorship program. No trial compared fully digital with blended delivery of the same program; one trial compared digital with face-to-face delivery of identical content [28].

No included trial randomized participants to fully digital versus blended delivery of the same program. Six trials compared digital and non-digital versions of similar content: a therapeutic game versus face-to-face group REBE [33], VR versus role-play practice within the same facilitator-led program [18], a collaborative VR game versus an equivalent face-to-face game [27], VR-assisted versus Lego-based and traditional classroom instruction [44], gamified versus non-gamified delivery of the same curriculum [42], pre-recorded versus tutor-led mindfulness with identical content [28], and web-based versus on-site teacher training and coaching in the same program [47]. An eighth compared LifeSkills Training with and without a video game and digital materials [56], and a ninth compared technology-supported cooperative learning with a curriculum-based SEL program [43]. These comparisons tested the added value of a technology rather than of human support, and their results were uncertain. The collaborative VR game scored higher than the equivalent face-to-face game on observer-rated overall competence (mean difference 0.60, $p = 0.039$) [27]. In the second study of Wang et al., the time × group interaction across VR-assisted, Lego-based, and traditional instruction was significant for general social competence, but the VR and Lego groups contained only 10 children each [44]. VR practice and role-play differed by d = 0.20–0.46 without significance testing [18], and gamified and non-gamified delivery were not compared statistically [42]. Web-based and on-site delivery of BEST in CLASS produced similar gains, with higher post-test social skills after web-based delivery that were not tested statistically [47]; adding digital tools to LifeSkills Training reduced bullying perpetration in single-level but not in multilevel models [56]. Pre-recorded and tutor-led mindfulness did not differ in charitable donations, with a numerically higher mean in the tutor-led group [28]. REThink differed from the waitlist whereas face-to-face REBE did not, but the two active conditions were not shown to differ from each other [33], so this pattern does not show that the digital version was more effective. Because none of these trials was designed or powered to test non-inferiority, non-significant differences between digital and non-digital versions cannot be taken as evidence that the two are equivalent.

Comparisons between the two groups of trials are therefore descriptive and confounded. At least one between-group benefit was reported in nine of the thirteen fully

digital trials and in sixteen of the twenty-two blended trials (three of which did not test between-group differences). Blended trials more often reported benefits across several interpersonal outcomes, whereas the earlier fully digital trials more often targeted and measured individual-level outcomes such as emotional awareness, emotion regulation, and cognitive reappraisal. This difference partly reflects what was measured, and fully digital trials that did measure interpersonal outcomes reported benefits—prosocial behaviour in Hero [60] and Little Hero [52], observer-rated collaboration in the VR game [27], charitable donation after brief mindfulness [28], and empathy in Japi 2.0 [53]—which argues against attributing the pattern to delivery format: blended trials assessed a broader set of outcomes, so a wider range of reported benefits would be expected regardless of delivery format. The two groups also differed in developmental stage—twelve of the thirteen fully digital trials enrolled students aged 8–19 years, and six of the seven trials in preschool and kindergarten were blended [31,35,39,40,47,57]—and in program duration, comparators, and informants, with blended trials in young children relying mainly on teacher or assessor ratings and fully digital trials mainly on self-report. Results were heterogeneous within both groups: among fully digital trials, REThink [33], Hero [60], Little Hero [52], and the collaborative VR game [27] reported between-group benefits, whereas ReZone [59] and e-couch [58] did not; among blended trials, Adventures Aboard the S.S. GRIN [17] and PeerLearning.net [62,63] reported benefits, whereas The Me and the Us of Emotions [61] and DIALOG + S [41] did not. The current evidence therefore does not show that either delivery format is more effective.

Figure 2 shows the direction of effect for each trial and outcome domain, coded irrespective of statistical significance and grouped by delivery format; the coding of each result is given in Table S5. Across all trials, every trial that measured composite social–emotional competence (8 of 8), relationship skills (16 of 16), social awareness (7 of 7), self-awareness (6 of 6), or responsible decision-making (2 of 2) favoured the intervention, as did fourteen of fifteen trials measuring self-management, while one (Hero) favoured the comparator [60]. The sign test gave $p < 0.001$ for relationship skills, $p = 0.001$ for self-management, $p = 0.008$ for composite competence, $p = 0.016$ for social awareness, and $p = 0.031$ for self-awareness; with only two trials, as for responsible decision-making, the sign test cannot reach $p < 0.05$. Direction was less consistent for emotional and behavioural difficulties (ten of thirteen trials favouring the intervention, one favouring the comparator [41], and two mixed [53,59]; $p = 0.012$) and favoured the intervention in five of six trials measuring well-being (one mixed [41]). In one trial, the direction of non-significant results on self-awareness and relationships was not reported; these results were coded as unclear and excluded from the counts [37], as were non-significant results whose direction was not reported in three other trials [38,47,58]. In several domains, effect direction was more consistent than statistical significance: in self-management, for example, fourteen trials favoured the intervention but in only seven were most results in the domain statistically significant, which suggests that many non-significant results reflected small or imprecisely estimated effects rather than an absence of effect. Among fully digital trials, the intervention was favoured in five of six trials measuring self-management, seven of seven measuring relationship skills, and two of four measuring emotional and behavioural difficulties; among blended trials, in nine of nine, nine of nine, and eight of nine, respectively. Because the two groups of trials differed in the domains they measured, the age of participants, informants, and comparators, these counts describe the evidence and do not compare the effectiveness of the two formats.

Overall, the findings are compatible with the view that digital technologies can be combined productively with human relationships, social interaction, and educational guidance, but the included trials do not test whether such a combination improves effectiveness.

3.7. Risk of Bias Assessment

Risk of bias was assessed with RoB 2 [30], with the cluster-randomized extension (domain D1b) applied to the 24 cluster-randomized trials and to one trial whose unit of randomization was unclear [31]. Judgments were revisited at outcome level against the full texts, which led to revised ratings for several trials. For SEP [35], schools were informed of their allocation before parental consent and baseline data collection, and the primary outcomes were rated by teachers who delivered the program and by parents who took part in it (D1b and D4: some concerns). For REAL™ [19], outcomes in the intervention group were assessed by the facilitators who delivered the program, whereas different assessors evaluated the control group; attrition was markedly higher in the control group (24% vs. 5%); and the groups differed in age at baseline (D1, D3, and D4: some concerns). For the Italian PeerLearning.net trial [63,64], schools enrolled voluntarily and intervention and control classes were drawn from different schools, so allocation was not clearly separable from school membership (D1b: some concerns). For The Me and the Us of Emotions [61], only the 164 of 295 randomized children with complete data were analysed (D3: some concerns). In the PrEmT trial [38], which its authors describe as quasi-experimental, classes were randomly assigned within schools without a reported method, children with disabilities or language difficulties were excluded from the analysis after allocation, and outcomes were unblinded questionnaires closely aligned with the program content (D1, D2, D4, and D5: some concerns). Among the trials identified by re-screening the earlier search records, The Social Express [46] excluded many control children after allocation, including those who did not use the program in the following semester, and was rated at high risk in D3 and overall; in Little Children, Big Challenges [39], child-task outcomes were judged at low risk and teacher-rated outcomes at some concerns. For SOBE Stories [40] and RENEW [42], the timing of consent relative to cluster allocation was not reported (D1b: some concerns). For Adventures Aboard the S.S. GRIN [17], performance-based outcomes were judged at low risk and teacher-rated outcomes at some concerns, and the same distinction was made for the behavioural donation task and self-reported empathy in the brief mindfulness trial [28] and for blinded child assessments and parent and teacher ratings in Japi 2.0 [53]. In Japi 2.0, parental consent was sought after schools had been allocated and was lower in control schools, and in Reframe-IT+ and the 13-school PeerLearning.net trial students were identified or consented after schools had been allocated (D1b: some concerns) [36,53,54]. SOBE Stories [40] and the PeerLearning.net trial that compared two schools [43] each randomized only one cluster per arm, so that any intervention effect is inseparable from pre-existing differences between the participating classroom or school; both were rated at high risk of bias in D1 and overall. EmoPlay Pals [31] was described by its authors as quasi-experimental; although a computer-generated sequence was used, it was unclear whether children or classes were allocated, and the reported class sizes were inconsistent with the group sizes, so it was rated at high risk in D1 and overall. STRYV365 [37] reported only p values, gave the direction of effects only for significant results, and surveyed varying numbers of students across semesters; with some concerns in several domains, it was judged at high risk overall. For every trial, Table 5 states the outcome to which the judgments refer.

Because most interventions were educational and behavioral in nature, blinding of participants was rarely feasible [3,4], and many studies relied on self-report instruments to assess social–emotional competencies, emotion regulation, and mental health outcomes. Although these instruments are widely used and validated in SEL research, self-report data are subject to response bias and social desirability effects [66]. Teacher and parent ratings raised similar concerns when the raters delivered or took part in the intervention. Unblinded subjective outcome assessment was therefore the principal source of concern in the domain of outcome measurement.

Table 5. Risk-of-Bias Judgments (RoB 2, Including the Extension for Cluster-Randomized Trials) for the Primary Outcome(s) of Each Included Study.

Study (Design)	D1	D1b	D2	D3	D4	D5	Overall	Outcome Assessed and Main Reasons for Concerns
David et al. (2019) [33] (Ind.)	Low	NA	Low	Low	SC	Low	SC	Outcome: Depressive mood; emotional awareness and control (self-report). Stratified permuted-block randomization; balanced attrition; unblinded self-report (D4).
Calear et al. (2016) [58] (30 cl.)	SC	SC	Low	SC	SC	Low	SC	Outcome: Anxiety, depressive symptoms, well-being (self-report). Schools randomized, method and concealment not reported in the main report (D1); timing of student consent relative to allocation unclear (D1b); attrition across follow-ups (D3); unblinded self-report (D4).
Hadley et al. (2019) [18] (Ind.)	SC	NA	Low	Low	SC	Low	SC	Outcome: ER difficulties; emotional self-efficacy (self-report). Pilot; allocation concealment poorly reported (D1); unblinded self-report (D4).
Houck et al. (2022) [34] (Ind.)	SC	NA	Low	Low	SC	Low	SC	Outcome: Beliefs about emotions; ER difficulties (self-report). Pilot; limited concealment detail (D1); unblinded self- and parent-report (D4).
Sexton et al. (2022) [57] (10 cl.)	SC	Low	Low	SC	SC	Low	SC	Outcome: Internalizing, externalizing, prosocial behaviour (educator and parent SDQ). Ten rooms randomized after baseline data collection (D1, D1b); incomplete parent data (D3); unblinded educator ratings (D4).
Conroy et al. (2022) [47] (19 cl.)	SC	SC	Low	SC	SC	SC	SC	Outcome: Social skills, problem behaviours (teacher-rated). Nineteen teachers randomized to two active formats; comparison with a non-randomized business-as-usual group not used (D1); children identified after allocation (D1b); unblinded teacher ratings (D4); no prespecified format comparison (D5).
Bardhoshi et al. (2020) [40] (2 cl.)	High †	SC †	Low	Low	SC	Low	High †	Outcome: Social skills; problem behaviours (teacher). One classroom per arm, so the intervention effect cannot be separated from classroom differences, and baseline imbalance in social skills (D1); timing of consent relative to allocation not reported (D1b); unblinded teacher ratings (D4).

Table 5. *Cont.*

Study (Design)	D1	D1b	D2	D3	D4	D5	Overall	Outcome Assessed and Main Reasons for Concerns
Edridge et al. (2020) [59] (cl.)	Low	Low	Low	Low	SC	Low	SC	Outcome: Emotional and behavioural difficulties (self-report). Independent randomization after recruitment and baseline (D1, D1b); unblinded self-report (D4).
Mesurado et al. (2020) [60] (50 cl.)	Low	Low	Low	SC	SC	Low	SC	Outcome: Prosociality (self-report). Consent before allocation (D1b); substantial attrition and inconsistent sample counts (D3); unblinded self-report (D4).
Perkins et al. (2021) [29] (Ind.)	Low	NA	Low	SC	SC	SC	SC	Outcome: Self-compassion, self-esteem, anxiety, depression (self-report). Block randomization after consent (D1); attrition at follow-up (D3); unblinded self-report (D4); feasibility trial without a prespecified efficacy analysis (D5).
Krach et al. (2021) [46] (cl.)	SC	SC	Low	High	SC	SC	High	Outcome: Prosocial behaviour (teacher-rated). Classes randomized by drawing teachers' names in one school (D1); consent timing unclear (D1b); many control children excluded after allocation, including those who did not later use the program (D3); unblinded teacher ratings (D4).
Oades-Sese et al. (2021) [39] (62 cl.)	SC	SC	Low	SC	Low (child tasks); SC (teacher)	SC	SC	Outcome: Emotion vocabulary, social problem solving (child tasks); self-regulation and problem behaviours (teacher). Method of randomization not reported (D1); consent timing unclear (D1b); complete teacher-rated data for 76–77% (D3); unblinded teacher ratings (D4); no registration reported (D5).
Xavier et al. (2023) [61] (14 cl.)	Low	Low	Low	SC †	SC	Low	SC	Outcome: Empathy, cooperation, emotional control (self-report). Consent and baseline before randomization (D1b); complete-case analysis of 164 of 295 randomized children (D3); unblinded self-report (D4).
Ștefan et al. (2023) [35] (10 cl.)	Low	SC †	Low	Low	SC †	Low	SC †	Outcome: Social competence; ER strategies (teacher). Schools informed of allocation before parental consent and baseline (D1b); teacher raters delivered the program; parent outcomes compare participants with non-participants (D4).

Table 5. *Cont.*

Study (Design)	D1	D1b	D2	D3	D4	D5	Overall	Outcome Assessed and Main Reasons for Concerns
Fernandes et al. (2023) [26] (Ind.)	SC	NA	Low	Low	SC	Low	SC	Outcome: Cognitive reappraisal (self-report). Unmasked allocation, limited concealment detail (D1); unblinded self-report (D4).
Gómez-Restrepo et al. (2023) [41] (14 cl.)	SC	Low	Low	SC	SC	SC	SC	Outcome: Quality of life, resilience, symptoms (self-report). Teacher-selected students within clusters (D1); students enrolled before randomization (D1b); attrition (D3); self-report (D4); exploratory, possible selective reporting (D5).
Wang et al. (2023) [44] (Ind.)	SC	NA	Low	Low	SC	SC	SC	Outcome: Social competence (self-report). Very small groups and limited allocation detail (D1); post hoc deletion of scale items (D4, D5).
Williams et al. (2023) [56] (14 cl.)	SC	SC	Low	SC	SC	SC	SC	Outcome: Bullying and cyberbullying perpetration (self-report). Schools matched before randomization but differed in ethnicity at baseline (D1); consent timing unclear (D1b); amount of missing data not reported (D3); unblinded self-report (D4); one-tailed tests and single-level primary models (D5).
Raccanello et al. (2023) [38] (34 cl.)	SC	Low	SC	Low	SC	SC	SC	Outcome: Emotion knowledge, emotion-regulation knowledge, well-being (child-completed questionnaire). Classes randomly assigned within schools, method and concealment not reported, unequal arms (20 vs. 14 classes) (D1); consent obtained before allocation (D1b); 37 children excluded after allocation for disabilities, language difficulties, or absence (D2); outcome data for 93% of allocated children (D3); unblinded questionnaires closely aligned with program content, open answers coded without reported blinding (D4); not pre-registered (D5).
Zarifsanaiey et al. (2022) [45] (Ind.)	SC	NA	Low	Low	SC	Low	SC	Outcome: Social and emotional intelligence (self-report). Allocation by random allocation software, but the design is described by the authors as quasi-experimental and allocation concealment is not reported (D1); unblinded self-report (D4).

Table 5. *Cont.*

Study (Design)	D1	D1b	D2	D3	D4	D5	Overall	Outcome Assessed and Main Reasons for Concerns
Hong et al. (2023) [28] (Ind.)	Low	NA	Low	Low	Low (task); SC (self-report)	Low	Low (task); SC (self-report)	Outcome: Charitable donation (behavioural task); empathy (self-report). Automated randomization; participants and experimenters unaware of allocation; 10 of 129 dropped out and were excluded (D3); self-reported empathy (D4 some concerns).
Low and Van Ryzin (2024) [62] (12 cl.)	Low	Low	Low	Low	SC	Low	SC	Outcome: Five CASEL competencies (self-report). Matched-pair school randomization; near-complete opt-out enrolment (D1b); unblinded self-report (D4).
Nuñez et al. (2024) [36] (21 cl.)	Low	SC	Low	Low	SC	Low	SC	Outcome: Suicidal ideation, depressive and anxiety symptoms (self-report). Independent computer-generated allocation of schools (D1); students identified by screening after allocation, with more refusals after the confirmatory interview (D1b); unblinded self-report (D4).
Flynn et al. (2024) [17] (88 cl.)	Low	Low	Low	Low	Low (tasks); SC (teacher) †	Low	Low (tasks); SC (teacher) †	Outcome: Social–emotional skills (performance tasks); social behaviour and strengths (teacher). Intact classrooms randomized; performance-based tasks (D4 low); unblinded teacher ratings (D4 some concerns).
Bowrin et al. (2025) [42] (4 cl.)	Low	SC †	Low	Low	SC	Low	SC	Outcome: Social–emotional competence (teacher). Concealed allocation but only four classes; timing of consent not reported (D1b); single unblinded teacher rater (D4).
Mayer et al. (2025) [55] (cl.)	Low	SC	Low	Low	Low	SC	SC	Outcome: Emotion recognition and theory of mind (child tasks). Classes randomized independently (D1); consent procedures relative to allocation not described (D1b); outcome data for about 95% (D3); task-based outcomes (D4); trial embedded in a larger trial with a different primary intervention (D5).

Table 5. *Cont.*

Study (Design)	D1	D1b	D2	D3	D4	D5	Overall	Outcome Assessed and Main Reasons for Concerns
Mesurado and Resett (2025) [52] (8 cl.)	Low	SC	Low	SC	SC	Low	SC	Outcome: Prosocial behaviour; empathy; positive emotions (self-report). Classrooms drawn by lot by a person not involved in the study (D1); timing of consent relative to allocation not reported (D1b); fewer participants in the empathy and positive-emotion analyses than randomized (D3); unblinded self-report (D4).
Baharuddin et al. (2025) [19] (Ind.)	SC †	NA	Low	SC †	SC †	Low	SC †	Outcome: ER, anxiety, depression (self-report). Baseline age imbalance (D1); attrition 24% control vs. 5% intervention (D3); facilitators assessed the intervention group and other assessors the control group (D4).
Robinson and Van Ryzin (2026) [43] (2 cl.)	High †	Low	Low	Low	SC	Low	High †	Outcome: Peer support, victimization, anxiety, depression (self-report). One school per arm, so effects are confounded with school (D1); opt-out enrolment (D1b); unblinded self-report (D4).
Low et al. (2026) [54] (13 cl.)	Low	SC	Low	SC	SC	Low	SC	Outcome: Anxiety, depression, peer stress, peer relations (self-report). Schools randomized with a random-number generator, blocked by state, with baseline differences in sex and perceived discrimination (D1); students recruited with active consent (15–30%) after schools were allocated (D1b); amount of missing data not reported, handled by full-information maximum likelihood (D3); unblinded self-report (D4).
Feng et al. (2026) [27] (Ind.)	SC	NA	Low	Low	SC	Low	SC	Outcome: Social–emotional competence (observer-rated video). Allocation concealment not reported (D1); blinding of video raters not reported (D4).
Yao and Abdullah (2026) [31] (unclear)	High	SC	Low	Low	SC	Low	High	Outcome: Emotional self-regulation (assessor-rated tasks). Design described by the authors as quasi-experimental; computer-generated sequence, but the unit of allocation (children or classes) is unclear and the reported class sizes are inconsistent with the group sizes; two kindergartens (D1); blinding of assessors not reported (D4).

Table 5. *Cont.*

Study (Design)	D1	D1b	D2	D3	D4	D5	Overall	Outcome Assessed and Main Reasons for Concerns
Gaete et al. (2026) [53] (7 cl.)	SC	SC	Low	SC	Low (child tasks); SC (parent/ teacher)	Low	SC	Outcome: Empathy and emotion recognition (blinded assessor); difficulties (parent, teacher). Stratified computer-generated allocation of seven schools, with baseline differences in teacher-rated difficulties (D1); parental consent sought after allocation, with lower consent in control schools (D1b); 40% of intervention parents missing at follow-up (D3); blinded child assessments, unblinded parent and teacher ratings (D4).
Meurer et al. (2026) [37] (cl.)	Low	SC	Low	SC	SC	SC	High	Outcome: Coping, emotion regulation, relationships, self-awareness (self-report). Classrooms randomized with a random-number generator (D1); timing of consent relative to allocation not reported (D1b); numbers surveyed varied across semesters (D3); unblinded self-report (D4); only *p* values reported, with effect direction given only for significant results (D5); some concerns in several domains, judged high overall.
Zagni et al. (2026) [63,64] (36 cl.)	SC	SC †	Low	Low	Low (task); SC (self-report)	Low	SC	Outcome: Cooperative behaviour (task); social–emotional skills (self-report). Randomization method not reported (D1); voluntary schools, intervention and control classes from different schools (D1b); behavioural task (D4 low), self-report [64] (D4 some concerns).

Domain key: D1 = bias arising from the randomization process; D1b = bias arising from the timing of identification and recruitment of participants (cluster-randomized trials only; NA = not applicable); D2 = bias due to deviations from intended interventions; D3 = bias due to missing outcome data; D4 = bias in measurement of the outcome; D5 = bias in selection of the reported result. Low = low risk of bias; SC = some concerns; High = high risk of bias. Ind. = individually randomized; cl. = clusters; unclear = unit of randomization not clearly reported. † Judgment revised during peer review.

Two trials (6%) were judged to be at low overall risk of bias for their performance-based or behavioural outcomes [17,28], with their teacher-rated or self-reported outcomes raising some concerns; twenty-eight trials (80%) raised some concerns; and five trials (14%) were at high risk, two because they randomized one cluster per arm [40,43], one because the unit and process of randomization were unclear [31], one because of concerns in several domains [37], and one because of exclusions after allocation [46]. At the domain level, 43% of trials were judged to be at low risk for the randomization process (D1), 36% of the 25 trials assessed with the cluster extension for the identification and recruitment of participants (D1b), 97% for deviations from intended interventions (D2), 57% for missing outcome data (D3), 17% for measurement of the outcome (D4), and 71% for selection of the reported result (D5). Prospective registration was recorded separately from domain D5: nine trials (26%) were registered before enrolment began [35,36,41,42,53,54,57,58,62], two (6%) were registered after enrolment had begun [19,33], and for 24 (69%) no registration was reported in the trial report or found in the registries searched (Table S6). Unblinded teacher ratings were judged consistently as raising some concerns in D4 [17,35,40,42]. Measurement of the outcome remained the domain with the most concerns. Per-study judgments and their rationale are presented in Table 5 and summarized graphically in Figures 3 and 4.

3.8. Robustness to Trials with Few Clusters or Small Samples

Because imprecision was assessed separately from bias, we examined whether the main conclusions depended on trials with very few randomized clusters, an unclear unit of randomization, or small samples. Five trials randomized one or two clusters per arm, were described by their authors as exploratory, or did not report the unit of randomization clearly: SOBE Stories (one classroom per arm) [40], DIALOG + S [41], RENEW (two classes per arm, crossover) [42], the PeerLearning.net trial that randomized one school per arm [43], and EmoPlay Pals [31]. In such designs, intervention effects cannot be separated from differences between the participating clusters, and a larger number of students does not resolve this problem. Excluding these trials did not change the conclusion that digital SEL interventions can improve relationship skills, self-management, and social awareness: these findings remained supported by trials with more clusters, including Adventures Aboard the S.S. GRIN (88 classrooms) [17], PeerLearning.net with 12 schools [62] and with 36 classes [63,64], Hero (50 classrooms) [60], Little Hero (8 classrooms) [52], SEP (10 schools) [35], PeerLearning.net with 13 high schools [54], PrEmT (34 classes) [38], SEE+ [55], and Little Children, Big Challenges (62 preschools) [39], and by individually randomized trials [26–28,33]. Without the two-school trial [43], evidence on anxiety and depressive symptoms rested on REAL™ [19], a single depressive-mood outcome in REThink [33], and two trials that randomized 13 and 21 schools [36,54]. Excluding, in addition, all trials with fewer than 100 participants [18,29,34,40–42,44–47] removed most of the evidence on emotional self-efficacy and on VR practice within facilitator-led programs, but did not alter the overall pattern for social–emotional competencies. Excluding the four single-session trials [26–29] removed the only between-group evidence for cognitive reappraisal, for observer-rated collaboration, and for charitable donation, but benefits for relationship skills and composite social–emotional competence remained supported by multi-session trials [17,35,52,54,60,62,63]. The descriptive comparison between delivery formats was not materially affected, because the excluded trials came from both groups.

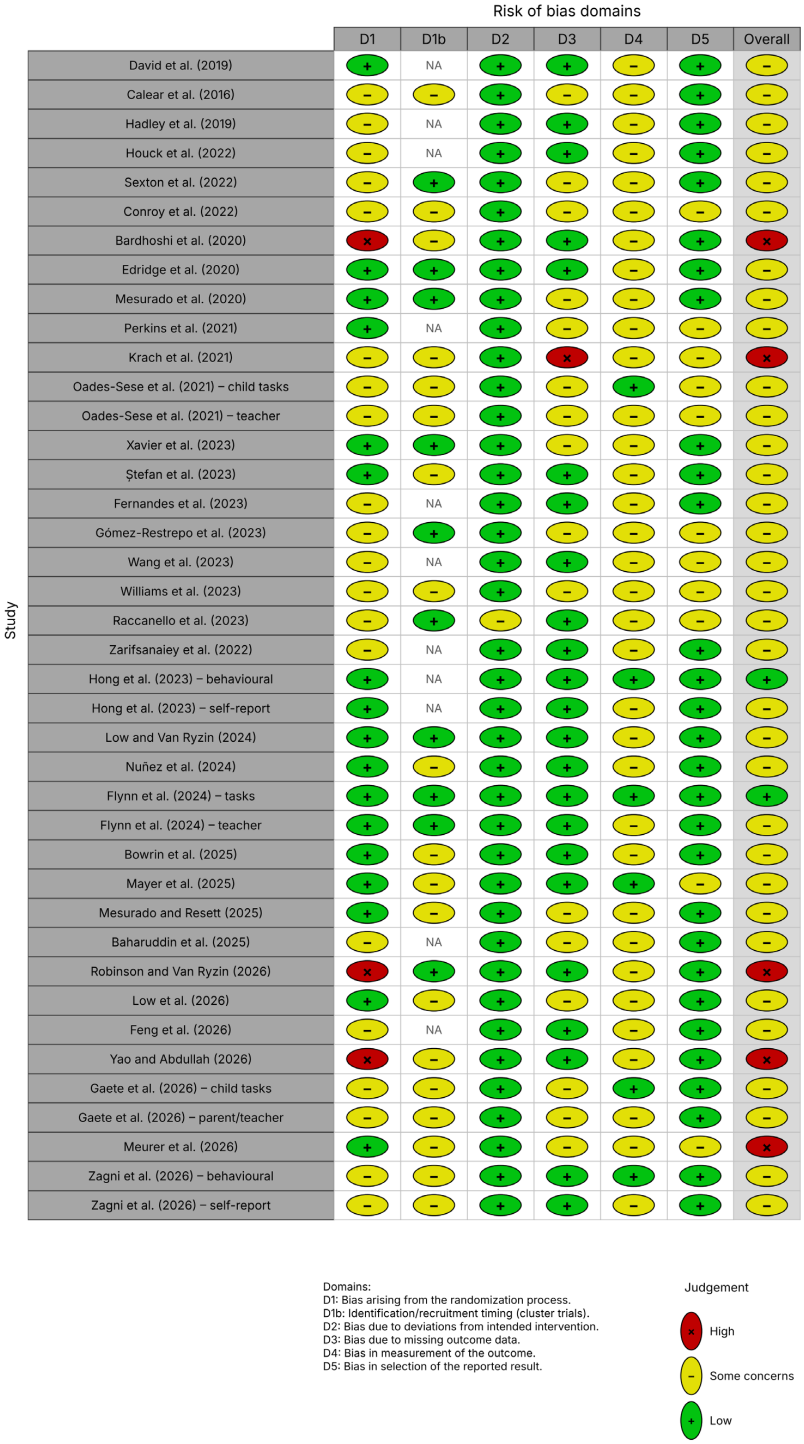


Figure 3. Traffic-light plot of risk-of-bias assessments across included studies using RoB 2 and its extension for cluster-randomized trials (D1b; NA for individually randomized trials). Trials with outcome-specific judgments are shown on separate rows. Studies, from top to bottom: David et al. [33], Calear et al. [58], Hadley et al. [18], Houck et al. [34], Sexton et al. [57], Conroy et al. [47], Bardhoshi et al. [40], Edridge et al. [59], Mesurado et al. [60], Perkins et al. [29], Krach et al. [46], Oades-Sese et al. [39], Xavier et al. [61], Ștefan et al. [35], Fernandes et al. [26], Gómez-Restrepo et al. [41], Wang et al. [44], Williams et al. [56], Raccanello et al. [38], Zarifsanaiey et al. [45], Hong et al. [28], Low and Van Ryzin [62], Nuñez et al. [36], Flynn et al. [17], Bowrin et al. [42], Mayer et al. [55], Mesurado and Resett [52], Baharuddin et al. [19], Robinson and Van Ryzin [43], Low et al. [54], Feng et al. [27], Yao and Abdullah [31], Gaete et al. [53], Meurer et al. [37], and Zagni et al. [63,64].

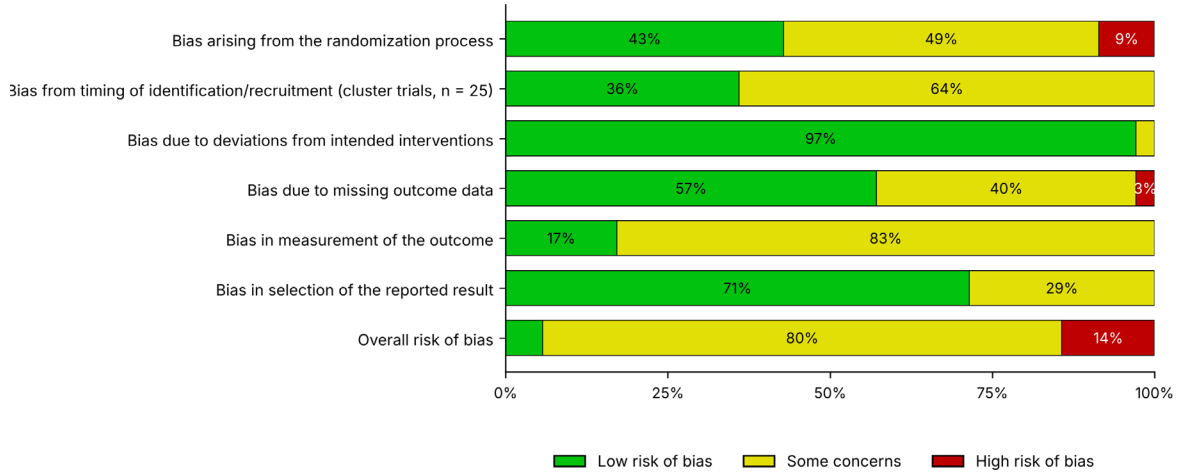


Figure 4. Summary risk-of-bias plot showing the proportion of studies rated as low risk, some concerns, and high risk across RoB 2 domains (D1b: cluster-randomized trials only, $n = 11$).

3.9. Effect Size Reporting

Regarding effect size reporting and interpretation, appraisal across the included studies indicated considerable variability. Of the eighteen trials included in the original review, eleven (61%) reported effect sizes and explicitly interpreted their magnitude in terms of practical or clinical significance [17,18,34,35,40–43,61–63], five (28%) reported effect sizes without an accompanying interpretation of their magnitude [19,27,33,44,60], and two (11%) reported no standardized effect size [26,59]. Of the nine trials added in the updated searches, six reported standardized effect sizes (d, η^2, or ηp^2) [28,31,36,45,52,54], one reported unstandardized adjusted mean differences [53], one reported only *p* values [37], and one reported post-hoc contrasts without a between-group effect size [38]. Of the eight trials added after re-screening of the earlier search records, four reported standardized effect sizes [29,39,47,58], one unstandardized mean differences [57], one a score difference expressed as months of development [55], and two only *p* values [46,56]. Confidence intervals for between-group effects were reported in only eight trials [17,26,28,29,34,35,53,57], and in three trials the effect sizes most prominently reported referred to change within groups or to time effects rather than to differences between groups [41,42,61]. This pattern, summarized in the Effect Size column of Table 2, suggests that inconsistencies in effect size reporting remain and should be addressed in future primary research.

3.10. Certainty of Evidence

Table 6 summarizes the certainty of evidence for each outcome domain, reassessed after effect direction was coded separately from statistical significance. Certainty was moderate that digital SEL interventions probably improve composite social–emotional competence: all eight trials favoured the intervention, and the largest of these trials used performance-based measures with low risk of bias and reported precise estimates [17]. Certainty was low that they may improve relationship skills, self-awareness, self-management including emotion regulation, social awareness, responsible decision-making, and well-being. In these domains effect directions were consistent, so the ratings were not downgraded for inconsistency, but the results relied largely on unblinded self-report, and confidence intervals were rarely reported or included zero. For responsible decision-making, the evidence came from two trials, one of 813 students in 12 schools without a reported confidence interval and one of 100 students in 21 schools; because effective sample sizes under clustering are much smaller than the number of students, certainty was downgraded by one level for imprecision. For well-being, statistically significant results came from a single trial [52]. For emotional

and behavioural difficulties, including anxiety and depressive symptoms, the evidence was very uncertain: the clearest reductions in anxiety and depressive symptoms came from REAL™ [19] and the two-school PeerLearning.net trial [43], both with serious risk-of-bias concerns, DIALOG + S favoured the comparator [41], and results were mixed in two trials [53,59]; two recent trials that randomized more schools reported reductions in anxiety and depressive symptoms [36,54], whereas the largest fully digital trial found no differences [58]; these trials relied on self-report and had some concerns about recruitment after allocation.

Table 6. Certainty of Evidence (GRADE) by Outcome Domain.

Outcome Domain	Trials (Participants)	Trials Favouring Intervention	Reasons for Downgrading	Certainty	Interpretation
Composite social–emotional competence	8 (3080)	8 of 8	Serious risk of bias (−1): most results unblinded or adult-rated; one trial at high risk [40]. Not downgraded for inconsistency (all eight trials favoured the intervention, although effect sizes varied) or imprecision (the largest of these trials reported precise performance-based effects [17]).	Moderate	Probably improves
Relationship skills	16 (6120)	16 of 16	Serious risk of bias (−1): mostly unblinded self-report, two trials at high risk [43,46]. Serious imprecision (−1): confidence intervals rarely reported and effective sample sizes reduced by clustering, with two trials not adjusted for clustering [52,60]. Not downgraded for inconsistency: all sixteen trials favoured the intervention.	Low	May improve
Self-awareness	6 (2507)	6 of 6	Serious risk of bias (−1): mostly unblinded self-report. Serious imprecision (−1): six trials, statistically significant in four, confidence intervals not reported or including zero.	Low	May improve
Self-management, including emotion regulation	15 (5096)	14 of 15	Serious risk of bias (−1): mostly unblinded self-report; two trials at high risk [31,37]. Serious imprecision (−1): mostly small trials with wide or unreported confidence intervals; most results statistically significant in only seven of fifteen trials. Not downgraded for inconsistency: fourteen of fifteen trials favoured the intervention.	Low	May improve

Table 6. *Cont.*

Outcome Domain	Trials (Participants)	Trials Favouring Intervention	Reasons for Downgrading	Certainty	Interpretation
Social awareness	7 (5300)	7 of 7	Serious risk of bias (−1): mostly unblinded self-report. Serious imprecision (−1): seven trials, statistically significant in four, confidence intervals rarely reported.	Low	May improve
Responsible decision-making	2 (913)	2 of 2	Serious risk of bias (−1): unblinded self-report. Serious imprecision (−1): two trials, the larger (813 students in 12 schools) without a reported confidence interval and the smaller with 100 students in 21 schools; effective sample sizes under clustering are much smaller than the number of students.	Low	May improve
Emotional and behavioural difficulties, including anxiety and depressive symptoms	13 (3348)	10 of 13	Serious risk of bias (−1): two of the trials favouring the intervention were at high risk [40,43] and others had assessor, attrition, or recruitment concerns [19,36,39,54,57]. Serious inconsistency (−1): one trial favoured the comparator [41], two were mixed [53,59], and the largest fully digital trial found no differences [58]. Serious imprecision (−1): confidence intervals rarely reported and most trials small.	Very low	Uncertain
Well-being (quality of life, resilience, positive emotions, self-compassion)	6 (1797)	5 of 6	Serious risk of bias (−1): unblinded self-report. Serious imprecision (−1): statistically significant results in one trial only [52]; direction not reported in two trials [38,58]. Not downgraded for inconsistency: five of six trials favoured the intervention and one exploratory trial was mixed [41].	Low	May improve

Note. Certainty was rated with the GRADE approach for syntheses without a single effect estimate, starting at high for randomized trials and downgrading for risk of bias, inconsistency (differences in the direction and size of effects across trials), indirectness, imprecision, and publication bias; no domain was downgraded for indirectness, and publication bias could not be assessed formally (Section 4.8). Trials favouring intervention: trials in which at least 70% of the results in the domain favoured the intervention, irrespective of statistical significance; results whose direction was not reported were excluded (Figure 2). Interpretation follows GRADE wording: moderate, "probably improves"; low, "may improve"; very low, "the evidence is very uncertain". ER = emotion regulation.

4. Discussion

4.1. Principal Findings

This systematic review synthesized evidence from thirty-five randomized controlled trials of digital school-based social and emotional learning (SEL) interventions for children and adolescents. Twenty-five trials reported a between-group advantage on at least one social–emotional or mental health outcome, seven found no between-group differences [29,41,46,56,58,59,61], and three did not test between-group differences [18,42,47]. In the effect-direction synthesis, all trials that measured composite social–emotional competence (moderate certainty) and relationship skills, including cooperation, prosocial behaviour, and peer relations (low certainty), favoured the intervention, as did all trials measuring self-awareness and social awareness and fourteen of fifteen measuring self-management (low certainty), although many of these differences were small or not statistically significant. Evidence for emotional and behavioural difficulties, including anxiety and depressive symptoms, was less consistent and of very low certainty, and evidence for well-being was of low certainty. Emotion regulation was the most frequently examined mental health-related outcome; most trials favoured the intervention in direction, but statistically significant between-group improvements were confined to a few trials [19,26,31,33,35,36,38,39].

The reviewed interventions used a wide variety of technological approaches, including serious games, gamified platforms, virtual reality environments, mobile and tablet-based applications, and technology-supported cooperative learning systems. The findings tentatively indicate that the effectiveness of an intervention may depend less on the technology itself and more on the quality of the pedagogical design, the opportunities for active participation and reflection, and the integration of evidence-based SEL principles. These findings are broadly consistent with prior meta-analyses showing that SEL interventions can enhance social–emotional competencies, behavioral adjustment, academic outcomes, and psychological well-being [3,4,11]. However, unlike earlier reviews that focused mainly on conventional face-to-face interventions, the present review highlights the growing role of digital technologies as potentially scalable and flexible tools to support both SEL development and school-based mental health promotion.

The methodological quality of the included studies ranged from low to high risk of bias. After outcome-level reassessment, two trials were judged at low overall risk for their performance-based or behavioural outcomes, three trials were at high risk because they randomized one cluster per arm or did not report the unit of randomization clearly, and the remaining trials raised some concerns, most commonly because of unblinded self-report or adult-rated outcomes. Using GRADE, the certainty of evidence was moderate for composite social–emotional competence, low for the five CASEL competencies and well-being, and very low for emotional and behavioural difficulties (Table 6). The findings should therefore be read as preliminary evidence that some digital SEL interventions can improve social–emotional competencies, with much less certain effects on mental health outcomes.

4.2. Relation to Recent Evidence Syntheses

The present findings can be situated against three recent syntheses of digitally delivered SEL. Nordlund [20], in a doctoral dissertation restricting inclusion to screen-based programs and typically developing participants, reported a small and non-significant pooled effect, whereas Zhang et al. [21], examining head-mounted VR alone, reported a moderate and significant effect. Cai et al. [22] integrated both strands across 37 studies and found a medium effect on social–emotional skills that was attenuated but remained significant after correction for publication bias, together with a small effect on prosocial and antisocial behaviors; the effect on affect and attitudes did not survive that correction. The direction of the present narrative synthesis is broadly consistent with this quantitative picture: benefits

are most evident for social–emotional competencies, and least stable for affective and attitudinal outcomes.

Two divergences are informative. First, Cai et al. [22] found the effect on affect and attitudes to be smallest in school settings and largest in home settings, interpreting this in terms of privacy, autonomy, and self-pacing. The present review, restricted to school-based trials, suggests a complementary question: whether what distinguishes school implementations is less the setting itself than the extent to which technology is embedded in teacher-facilitated and peer-mediated activity. In the present sample, blended programs more often reported interpersonal outcomes, whereas fully digital programs more often targeted individual-level outcomes such as emotional awareness and cognitive reappraisal; this difference, however, is confounded by age, outcomes measured, and informant (Section 3.6). Second, only one previous synthesis has examined the degree of human mediation directly. Nordlund [20] coded whether interventions were fully self-administered or incorporated human support, such as teacher-led instruction or peer discussion, and found no statistically significant moderating effect on either intrapersonal or interpersonal competence. That analysis, however, rested on a small number of studies per subgroup, excluded interventions requiring dedicated hardware, and combined trials delivered in school, home, and research settings. The present review, restricted to randomized trials conducted within school facilities and including VR-based programs, found no trial that compared delivery formats directly, and its descriptive comparison is therefore consistent with that null finding. Whether human mediation moderates intervention effects remains an open question warranting direct comparisons within trials and adequately powered meta-analytic testing.

Two further comparisons concern delivery format itself. Lynn et al. [23] found that both standard teacher-delivered and game-based SEL produced positive effects on social–emotional competence among adolescents, and identified mode of delivery as a research priority in its own right. The possibility that digital content might work best alongside school-based support was raised in that review only incidentally, as an inference drawn from a single included study whose program was completed outside classroom supervision and showed high attrition. The present review takes that possibility as its organizing question and examines it within randomized designs conducted inside school facilities. Kang-Yi et al. [24] provide the closest parallel in scope, synthesizing school-implemented digital interventions for emotion regulation and distinguishing hybrid delivery from app-based and internet-based delivery. Their conclusion—that positive randomized findings are confined to a small number of trials with modest samples and highly variable outcome measures—converges with the present appraisal, and that convergence is informative precisely because the two reviews differ in outcome scope, admissible designs, and search window. Where the present review extends that account is in covering the five CASEL competency domains alongside mental health indicators, in restricting inclusion to randomized and cluster-randomized trials, and in extending the evidence base to August 2026.

4.3. Digital Technologies as Vehicles for SEL Development

The integration of technology into schools has created new opportunities for scaling social–emotional learning interventions. Traditional SEL programs often require extensive teacher training, dedicated time during the school day, and substantial resources to implement. Digital technologies may help address some of these challenges by improving accessibility, flexibility, engagement, and scalability. The reviewed studies suggest that digital environments can offer several mechanisms supporting social–emotional development. Serious games and gamified activities provide active involvement, motivation, and repeated opportunities to practice social–emotional skills. Mobile and tablet-based applications allow students to engage with learning content flexibly, while virtual reality interventions

offer immersive opportunities to practice emotion regulation and social decision-making in realistic yet safe environments.

Serious games and gamified interventions may be effective because they draw on principles of experiential learning and active engagement. Digital games can provide repeated practice, immediate feedback, emotional engagement, and adaptive learning, all of which have been associated with improved social–emotional development [12,67,68]. Similarly, virtual reality environments can facilitate emotional learning by immersing students in situations where they practice skills such as emotion regulation and interpersonal decision-making under realistic but controlled conditions. These observations are consistent with earlier research suggesting that interactive technologies support experiential learning, individualized learning pathways, immediate feedback, and active engagement—features widely regarded as important for social–emotional development. The reviewed studies therefore support the view that digital technologies can serve not only as delivery vehicles but also as learning environments that foster meaningful social–emotional growth. Similar findings have been reported in earlier reviews and systematic mappings, indicating the potential of digital tools to foster self-regulation and broader socio-emotional abilities in children and adolescents [13,69].

Technology alone, however, is unlikely to explain the effectiveness of these interventions. Rather, successful programs appear to incorporate evidence-based SEL principles, developmentally appropriate learning experiences, and opportunities for meaningful reflection and application. The pedagogical design of digital interventions may therefore be more important than the technology itself.

4.4. The Role of Human Support: An Open Question

Whether human support adds to the effects of digital SEL interventions is a central question for school practice, but the present evidence cannot answer it. The twenty-two blended interventions tended to report benefits across a broader range of interpersonal outcomes, whereas the thirteen fully digital interventions more often targeted individual-level outcomes, although several recent fully digital trials also measured empathy and prosocial behaviour [28,52,53]. This pattern, however, compares different groups of trials rather than delivery formats within trials. Blended trials measured a broader set of outcomes, were more often conducted with younger children, relied more on teacher ratings, and used longer programs; any of these differences could produce the observed pattern without any effect of delivery format. Results were also heterogeneous within both groups, the proportion of trials reporting at least one between-group benefit was not higher among blended trials (16 of 22) than among fully digital trials (9 of 13), and no trial compared fully digital with blended delivery of the same program.

Theoretical considerations nonetheless make the question worth testing. Teachers, peers, and family members can offer emotional support, social modeling, feedback, and opportunities to apply skills in real-world contexts. Socioecological perspectives hold that social–emotional abilities develop through interactions across multiple contexts, including schools, families, peer groups, and communities [70], and socio-constructivist theory emphasizes the role of social interaction, guided participation, and collaborative learning in cognitive and socio-emotional development [71]. Because social–emotional skills are inherently relational, they may require opportunities for communication, cooperation, and reflection that digital interaction alone may not fully provide. The available within-trial comparisons, however, point in a different direction: when digital and non-digital versions of similar content were compared, outcomes did not differ significantly between the two versions, and in some comparisons the digital version performed better [27,44]; because these

comparisons were not powered to test non-inferiority, they suggest, but do not establish, that well-designed technology can itself create opportunities for social practice.

Many blended interventions incorporated classroom discussions, cooperative learning activities, guided reflection, or parental involvement, features that may help transfer skills to everyday social situations. Related evidence is consistent with this possibility: for example, Bono et al. [72] found that adolescents who used a mobile app alongside classroom-based activities reported higher gratitude, lower anxiety, and improved subjective well-being. Trials that randomize students or classes to the same digital program with and without structured human support are needed to test this hypothesis directly.

Overall, digital technology may be best understood as a complement to, rather than a replacement for, educators, peers, and families in the promotion of social–emotional learning and mental health, but this view currently rests on theory and indirect evidence rather than on direct comparisons within trials.

4.5. Digital SEL and the Promotion of Mental Health

In addition to social–emotional competencies, several of the reviewed interventions examined indicators of mental health and psychological well-being. Between-group improvements in emotion regulation were reported in a few trials [19,26,31,33,35,36,38,39], and reductions in anxiety or depressive symptoms in five trials [19,33,36,43,54], one of which randomized only two schools [43]. These findings are consistent with the growing recognition that social–emotional learning and mental health are closely intertwined. Protective factors such as emotion regulation, self-awareness, and interpersonal skills have increasingly been linked to enhanced psychological well-being and reduced vulnerability to mental health problems in childhood and adolescence.

These observations are broadly consistent with international recommendations from organizations such as the World Health Organization (WHO), OECD, and UNESCO, which emphasize social–emotional competencies as fundamental life skills contributing to academic success and mental health promotion. From this perspective, digital SEL interventions may serve not only educational goals but also broader public health objectives. Emotion regulation was the most frequently examined mental health-related outcome across the reviewed studies, although between-group improvements were reported in only a minority of the trials that measured it. Findings from SEP are consistent with a mechanistic role, as children's emotion regulation mediated gains in teacher-rated social competence among preschool children [35], although mediator and outcome were assessed at the same time point.

Emotion regulation has been identified as a key mechanism underlying psychological adjustment, resilience, social functioning, and mental health across development [73]. If the improvements observed in some trials are confirmed in larger studies, emotion regulation could be one of the pathways through which digital SEL programs influence well-being. Several interventions targeted protective factors—such as emotional awareness, adaptive coping, and emotional self-efficacy—that are associated with positive developmental trajectories, rather than focusing solely on reducing symptoms. Digital SEL programs may therefore become a useful component of comprehensive school-based mental health promotion strategies, particularly as preventive rather than remedial interventions, once their effects on mental health outcomes are more firmly established.

4.6. Developmental Considerations Across Age Groups

The included trials spanned preschool to late adolescence, and age is likely to shape both how digital SEL is delivered and what it can achieve. Six of the seven trials in preschool and kindergarten relied on adults to deliver the program—counsellor-led lessons with

an app [40], a teacher-delivered curriculum supported by web-based teacher and parent training [35], teacher-led emotion lessons with an app [31], teacher-led activities with digital media [39], educator-delivered app-based mindfulness [57], and web-based teacher training [47]—and mostly on teacher or assessor ratings; in the fourth, pre-kindergarten children played tablet games individually under adult supervision, and outcomes combined blinded child assessments with parent and teacher ratings [53]. In the primary grades, most trials were classroom-based and blended, with technology embedded in psychologist- or researcher-led sessions [38,45,61], teacher-led whole-class activities [55], teacher-supported online episodes [17], gamified lessons [42], or teacher-delivered cooperative learning [63,64], whereas Little Hero and The Social Express were completed individually [46,52]; outcomes combined self-report, teacher ratings, and performance-based or behavioural tasks. In adolescence, students more often used programs independently—therapeutic games, apps, web-based programs, audio, and VR [26–29,33,34,37,58–60]—and most outcomes were self-reported.

These differences are developmentally plausible. Young children's emotion knowledge and self-regulation depend heavily on adult scaffolding, and their capacity to use technology independently and to report on their own emotional states is limited, so adult-mediated delivery and adult-rated outcomes are to be expected. Adolescents can engage with self-directed digital tools and report on internal states, and they may value the privacy and autonomy that individual digital use allows, although their self-reports are also subject to response biases. Because delivery format, age, and informant overlapped substantially in the present sample, the broader range of interpersonal outcomes reported by blended programs may reflect developmental stage and measurement as much as delivery format. Findings should therefore not be generalized across age groups: evidence on fully digital delivery comes mainly from older children and adolescents, with a single pilot trial in pre-kindergarten [53], and evidence for preschool and kindergarten children comes from seven trials, one of them at high risk of bias [31]. Future trials should compare delivery formats within, rather than across, developmental stages.

4.7. Recommendations for Schools, Educators, and Policymakers

The present findings align with international policy frameworks that increasingly regard social–emotional competencies as critical twenty-first-century abilities and as central to quality education, well-being, and lifelong learning. First, schools may wish to consider integrating digital SEL interventions into broader approaches to student well-being. Between-group benefits have been reported mainly for relationship skills and, less consistently, for self-management, social awareness, and emotion regulation, whereas evidence for anxiety and depressive symptoms is limited. Digital technologies can facilitate the implementation of SEL programming across diverse educational settings, which may be especially helpful for schools that lack sufficient time, staff, or specialist mental health services.

Second, the results underscore the continuing role of educators in the implementation process. Although digital technologies can foster engagement and provide opportunities to practice skills, teachers play an important role in creating a supportive learning environment, encouraging reflection, stimulating discussion, and helping students apply social–emotional skills to everyday situations. Although the present review cannot show that blended delivery is more effective, several of the larger trials with positive findings used teacher-led designs [17,35,62,63], although positive findings were also reported for programs that students completed largely on their own [27,52,60], illustrating that digital resources can be integrated into ordinary teaching. This interpretation is consistent with evidence suggesting that exposure to digital media alone may be insufficient to promote broader social–emotional development. For example, long-term participation in digital learning environments has

been found to improve self-regulation in digital contexts but not necessarily social skills [74], leading the authors to conclude that purposeful teacher guidance, instructional design, and opportunities for interpersonal connection remain key components of healthy social–emotional development. The use of digital SEL should therefore emphasize educational quality and social connection rather than technological proficiency alone.

Third, policymakers may view digital SEL programs as potentially scalable tools for supporting student well-being at the population level. None of the included trials evaluated costs, so their cost-effectiveness is unknown, and the certainty of evidence for mental health outcomes is very low; implementation should be guided by evidence-based frameworks and supported by adequate professional development for educators. Social–emotional skills are also associated with academic growth in addition to mental health and well-being [3]; gains in self-regulation and social–emotional skills have been linked to improvements in academic performance, underscoring the interconnected nature of social–emotional and educational outcomes [75]. At the policy level, initiatives such as the EU-SELF platform reflect growing international efforts to support the implementation of evidence-based social and emotional learning through accessible digital resources, assessment tools, and intervention frameworks [76]. Such initiatives may promote the wider dissemination of high-quality SEL practices and greater consistency across educational institutions.

Finally, the findings support international recommendations by CASEL, OECD, UNESCO, and WHO to embed social–emotional competencies within education systems as core developmental outcomes rather than optional additions to the academic curriculum. Digital technologies could facilitate this integration by offering engaging, accessible, and adaptive learning experiences that complement existing school-based programs.

4.8. Strengths and Limitations of the Review

The present review has several strengths. First, it was limited to randomized and cluster-randomized controlled trials, and its outcome-level synthesis distinguished between-group from within-group effects; nevertheless, because of risk of bias, inconsistency, and imprecision, the certainty of evidence was moderate for only one outcome domain and low or very low for the others (Table 6). Second, the review examined both social–emotional learning competencies and mental health outcomes, offering a broader picture of the effects of digital SEL interventions across a range of outcomes, including emotion regulation, anxiety, depression, communication, and social competence. Third, the review encompassed a wide range of technological approaches—serious games, gamified interventions, virtual reality environments, mobile and tablet-based programs, online learning platforms, and technology-supported cooperative learning systems—allowing for a broad exploration of how different technological formats may support social–emotional development.

Despite these strengths, the review has several limitations. First, intervention designs, technologies, comparators, participant profiles, implementation procedures, and outcome measures varied considerably; this heterogeneity precluded a formal meta-analysis (Section 2.7), and the fully digital versus blended comparison is descriptive and confounded by age, outcomes measured, and informant. Second, related reports had to be handled by judgment. Two included studies [18,34] evaluated distinct digital adaptations of the same parent program (Project TRAC), which may limit the independence of findings when interpreting patterns across the reviewed literature. Flynn et al. [17] report the combined results of two cohorts of a single efficacy trial, the first of which had been published separately [65]; only the combined report was included, in order to avoid double-counting participants. Similarly, three included trials evaluated the same cooperative learning platform (PeerLearning.net), and the self-reported outcomes of the Italian trial were published separately [64]; that trial was counted once.

Third, the search was restricted to peer-reviewed studies published in English, and no grey literature sources were searched; relevant findings published in other languages or in the grey literature may therefore have been missed, and the evidence base may be biased toward studies reporting beneficial effects. The restrictions of the earlier ERIC, Scopus, and Web of Science searches were removed when these searches were repeated during peer review, but article-level records of the earlier full-text exclusions were not retained, so the earlier records were re-screened instead (Table S3c), and the full texts of three potentially eligible articles could not be retrieved. Effect direction was sometimes derived from unadjusted group means rather than from adjusted between-group estimates, and the 70% threshold used to summarize each domain is conventional rather than empirically derived. The review was registered retrospectively, the coding rules for delivery format and the SWiM and GRADE analyses were specified after the included studies were known, ERIC and the later search updates were not part of the registration (Section 2.7), and publication bias could not be assessed formally because there was no pooled estimate and few trials per domain. Finally, studies published after 11 August 2026 could not be considered.

4.9. Limitations of the Included Studies

The included studies also have limitations that constrain the conclusions of this review. First, the modest number of eligible randomized trials reflects the early stage of development of this field, and several were pilot or exploratory trials with small samples—for instance, 38 participants in Bardhoshi et al. [40], 45 in Bowrin et al. [42], 70 in Gómez-Restrepo et al. [41], and 88 across the two studies reported by Wang et al. [44]—one of which was explicitly underpowered for inferential analysis; their findings should be interpreted with corresponding caution. In addition, two trials randomized only one cluster per arm [40,43], one did not report the unit of randomization clearly [31], and four evaluated a single session [26–29]; the robustness of the conclusions to these trials is examined in Section 3.8.

Second, the evidence relies heavily on self-report measures and on unblinded teacher ratings. Although most studies employed validated instruments, these data are susceptible to response bias and social desirability effects, a concern reflected in the risk-of-bias assessment (Section 3.7). Future trials should incorporate multiple informants, behavioral and observational measures, and other objective assessments of social–emotional functioning.

Third, only nine of the 35 trials (26%) were prospectively registered [35,36,41,42,53,54,57,58,62], two were registered after enrolment had begun [19,33], and for the remaining 24 trials (69%) no registration was reported or could be found (Table S6). Without a prespecified protocol, selective reporting of outcomes, time points, and analyses cannot be ruled out, even where risk of bias for selection of the reported result was judged low on the information available. The low rate of prospective registration is therefore a significant limitation of the current body of evidence, and future trials of digital SEL interventions should be registered before enrolment and report all prespecified outcomes.

Moreover, thirteen of the thirty-five trials were conducted in the United States and most of the others in Europe and Asia; eight were conducted in middle-income countries (Argentina, China, Colombia, Iran, and Malaysia) [19,27,28,31,41,44,45,60], and none in low-income countries. The extent to which the findings generalize to these settings and to culturally diverse educational contexts therefore remains unclear. In addition, one included intervention (RENEW [42]) was explicitly faith-infused and delivered in a religious school setting, which may further limit the generalizability of its findings to secular or culturally different educational contexts. Finally, few studies included long-term follow-up assessments, and the persistence of intervention effects over time is therefore not well understood. Future studies should examine the delivery of digital SEL interventions across varied cultural and socioeconomic settings and incorporate longer-term follow-up.

4.10. Recommendations for Further Research

This review points to several relevant avenues for future research. First, more large-scale randomized controlled trials are needed to strengthen the evidence base for digital school-based SEL interventions. Future work should incorporate longer follow-up periods to establish whether changes in social–emotional abilities and mental health outcomes are sustained over time. Second, greater attention should be paid to understanding the factors that drive intervention effectiveness. Future studies should investigate which technical features, pedagogical approaches, and implementation components are associated with the strongest positive effects, as such knowledge would support the design of more efficient and theoretically grounded interventions.

Third, future research should test blended implementation strategies directly. The present review found no trial that compared fully digital with blended delivery of the same program. Trials that randomize students or classes to the same digital program with and without structured teacher facilitation, peer interaction, classroom discussion, guided reflection, or family involvement, ideally within specific age groups and using multiple informants, are needed to establish whether, and for whom, human support adds to the effects of digital SEL.

Fourth, future research should examine the integration of artificial intelligence, adaptive learning systems, affective computing, conversational agents, and social robots into school-based SEL programs. These technologies are largely absent from the current evidence base but could provide personalized learning pathways, real-time emotional feedback, adaptive support, and emotionally responsive learning experiences that may enhance social–emotional competencies and mental health outcomes. A key priority for future study is understanding how such emerging technologies can be embedded within evidence-based educational frameworks. Future studies could also address digital well-being, social media literacy, and emotional digital competencies. As children and adolescents increasingly navigate emotionally complex online environments, an emerging area of investigation concerns how technology can support healthy emotional functioning in digital settings. Given growing evidence that self-regulation, appropriate online behavior, and social–emotional functioning are interconnected in digital contexts [77], future SEL interventions may benefit from incorporating elements of digital citizenship, social media literacy, online empathy, conflict resolution, and self-regulation in digital contexts.

Finally, future research should examine the implementation factors that influence scalability and sustainability in real-world educational settings. Understanding issues such as teacher training, implementation fidelity, access, digital equity, and cost-effectiveness will be critical for translating research findings into mainstream educational practice.

5. Conclusions

This systematic review examined digital school-based social and emotional learning interventions for children and adolescents, drawing on evidence from thirty-five randomized and cluster-randomized controlled trials. Overall, the results suggest that digital technologies have the potential to support the development of social–emotional competencies and, to a more limited extent, mental health outcomes. Effects were most consistent in direction for composite social–emotional competence (moderate certainty) and for relationship skills, self-awareness, self-management, and social awareness (low certainty); evidence on anxiety and depressive symptoms came from eight trials with inconsistent results, including no effect in the largest fully digital trial, and serious risk-of-bias concerns, and was of very low certainty, and effects were not uniform across interventions or outcomes.

Twenty-two of the thirty-five interventions combined technology with adult-led sessions or teacher-led delivery, and these trials reported a broader range of interpersonal

outcomes than the thirteen fully digital trials. Because no trial compared the two formats directly, and because format overlapped with age, outcomes measured, and informants, this difference cannot be attributed to delivery format. Whether human support enhances the effects of digital SEL therefore remains an open question for future trials.

Taken together, digital technologies appear to be a promising complement to educators and supportive relationships, particularly when grounded in evidence-based educational and developmental principles. As the need for innovative approaches to student well-being grows, digital SEL interventions may offer a viable means of supporting social–emotional development and promoting mental health in contemporary educational settings—provided they are implemented thoughtfully and supported by robust, longer-term, prospectively registered evidence.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/children13111607/s1. Table S1: PRISMA 2020 checklist; Table S2: Database-specific search strings, search dates, and records retrieved; Table S3a: Reasons for exclusion at the full-text stage (n = 75), with operational definitions; Table S3b: Full-text articles excluded after the searches repeated during the second round of peer review (n = 13); Table S3c: Full-text articles assessed when the records of the earlier searches were re-screened against the revised eligibility definitions (second round of peer review; n = 32); Table S4: Outcome-level results of the included trials; Table S5: Direction-of-effect coding by trial and outcome domain; Table S6: Registration status of the included trials. References [78–113] are cited in the Supplementary Materials.

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Abbreviations

The following abbreviations are used in this manuscript:

CASEL	Collaborative for Academic, Social, and Emotional Learning
cRCT	cluster-randomized controlled trial
ERIC	Education Resources Information Center
OSF	Open Science Framework
PICOS	Population, Intervention, Comparison, Outcomes, and Study Design
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCT	randomized controlled trial
RoB 2	revised Cochrane Risk of Bias tool for randomized trials
SEL	social and emotional learning
SEP	Social–Emotional Prevention Program
VR	virtual reality

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