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Research Insights
Изследователски проникновения

CROSS-NATIONAL PILOT EVALUATION OF AN INNOVATIVE OUTDOOR-INTEGRATED SEL PROGRAM ON PRESCHOOL CHILDREN'S PERCEIVED PROSOCIAL BEHAVIOR AND SELF-REPORTED PSYCHOSOMATIC COMPLAINTS

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Abstract. This cross-national pilot study evaluated an outdoor-integrated Social and Emotional Learning (SEL) program across nine preschool sites in Slovakia, Spain, and Malta using a two-wave unlinked pre-post design analyzed as independent cross-sectional samples at the group level. Children's perceived prosocial behavior (teacher and parent ratings; QSPBPCH) and self-reported psychosomatic complaints (SCL) were assessed in parallel. Scoring followed established protocols (available-case means; reverse-coded items), with QSPBPCH demonstrating adequate-to-excellent reliability and SCL moderate reliability. Site fixed-effects ordinary least squares models with site-clustered standard errors indicated a directionally positive POST shift in perceived prosocial behavior and a small, nonsignificant negative shift in psychosomatic complaints; inference prioritized wild cluster bootstrap-t given nine clusters. Standardized mean differences were positive for prosocial behavior – largest in Spain and among Maltese teachers – and small negative for psychosomatic complaints. Site-level changes were negatively but imprecisely associated. In the absence of person-level linkage and experimental condition indicators, findings are interpreted as directional differences rather than causal effects. Overall, implementation coincided with favorable shifts in adult-perceived prosocial behavior without systematic change in psychosomatic complaints.

Keywords: social-emotional learning; innovative SEL Programme; outdoor education; perceived prosocial behaviour; self-reported psychosomatic complaints; preschool children; kindergartens

Introduction

Prosocial behaviors emerge early in development as intentional actions aimed at enhancing others' welfare, thereby establishing a foundation for adaptive personality formation, socialization, and the cultivation of gratitude dynamics within parent–child interactions (Dunfield & Kuhlmeier, 2010, 2013; Newton et al., 2014; Warneken & Tomasello, 2006; Ferreira et al., 2016; Wu et al., 2016). At the same time, preschool-aged children frequently present with somatic complaints – such as abdominal pain, headaches, fatigue, and dizziness – that signify emotional distress and adaptive challenges; these symptoms are closely associated with deficits in emotional regulation and behavioral functioning (Campo, 2012; Domènech-Llaberia et al., 2004; Serra Giacobo et al., 2012; Zuckerman, Stevenson, & Bailey, 1987). Longitudinal evidence further demonstrates that limited emotional awareness and regulatory capacities predict heightened somatic symptomatology, underscoring the necessity of early, targeted interventions (Rieffe & De Rooij, 2012; Fostini, Zaravinos-Tsakos, Kolaitis, & Giannakopoulos, 2025).

Neuroscientific research (Blair, 2002; Greenberg, 2006; Riggs et al., 2006) demonstrates that social and emotional learning (SEL) holds particular relevance for children between 3 and 6 years of age, a developmental period marked by accelerated maturation of language and executive functions. SEL programs systematically cultivate intra- and interpersonal competencies, emotional intelligence, self-regulation, and supportive relationships, thereby alleviating psychosomatic complaints while simultaneously reinforcing prosocial engagement (Cipriano et al., 2023; Casel, 2020; Durlak, Weissberg, Dymnicki, Taylor & Schellinger, 2011; Denham, Bassett, Zinsser & Wyatt, 2014; Greenberg et al., 2017; Weissberg et al., 2015). When intentionally integrated into outdoor, nature-rich environments, SEL further advances executive functions, stress regulation, cultural sensitivity, cooperative problem solving, and resilience, while biodiverse exposure enhances working memory, cognitive flexibility, gross-motor development, and vocabulary, and attenuates cortisol reactivity (Denham, 2023; Dettweiler et al., 2017; Elias et al., 2000; Fjørtoft, 2004; Hägglund & Samuelsson, 2009; Jones et al., 2015; Lanza et al., 2023; Maynard et al., 2013; Peppler, 2017). Nature-rich kindergarten contexts amplify these benefits by diversifying play opportunities, strengthening educator–child interactions, and fostering psychologically resilient, prosocially competent, and environmentally attuned learners equipped for the demands of the twenty-first century (Moreira et al., 2022; OECD, 2025). The implementation of SEL interventions in preschool settings therefore coincides with a developmental stage in which children exhibit heightened receptivity to external structuring and supportive input (Bierman & Motamedi, 2015). Nevertheless, it remains critical to recognize that, irrespective of whether the documented outcomes of early childhood SEL programs are promising or limited, comparative evaluations must account for the fact that these interventions are situated within distinct theoretical frameworks, emphasize

different domains of competence, and frequently employ heterogeneous outcome measures (McClelland et al., 2017).

Notwithstanding substantial evidence linking prosocial development, somatic complaints, and preschool children's emerging emotional regulation capacities (Campo, 2012; Cipriano et al., 2023; Durlak et al., 2011; Jellesma, Rieffe, & Terwogt, 2007; Spinrad et al., 2018; Warneken & Tomasello, 2006), important gaps persist. Prior studies have predominantly examined prosocial behaviors (Dunfield & Kuhlmeier, 2010, 2013; Newton et al., 2014; Warneken & Tomasello, 2006; Ferreira et al., 2016; Wu et al., 2016) and somatic complaints (Campo, 2012; Domènech-Llaberia et al., 2004; Serra Giacobo et al., 2012; Zuckerman, Stevenson, & Bailey, 1987) in isolation, limiting insight into their concurrent developmental trajectories. Moreover, while the general efficacy of Social-Emotional Learning (SEL) programs is established (Bierman & Motamedi, 2015; CASEL, 2020; Cipriano et al., 2023a; Cipriano et al., 2023b; Denham, Bassett, Zinsser, & Wyatt, 2014; McClelland et al., 2017; Riggs et al., 2006) comparatively little is known regarding the impact of implementation modalities (indoor-focused vs. outdoor-intensive) and the generalizability of outcomes across cultural contexts. The present study addresses these limitations by simultaneously examining preschool children's perceived prosocial behaviors (teacher and parent ratings) and self-reported somatic complaints within a single experimental framework, assessing differential changes across experimental versus control groups, across program delivery formats, and across three national contexts: Slovakia, Spain, and Malta.

Methods

Research Questions

RQ1 (Program Effect): How do preschool children's perceived prosocial behaviors (teacher/parent ratings) change following a Social-Emotional Learning (SEL) program in experimental versus control groups?

RQ2 (Program Effect): How do preschool children's self-reported somatic complaints change following a Social-Emotional Learning (SEL) program in experimental versus control groups?

RQ3 (Group and Country Differences): Do these changes differ between experimental groups (EX1, EX2) and the control group, and across children from Slovakia, Spain, and Malta?

Participants

A total of 180 preschool children (ages 5 – 6; $N = 180$) participated, drawn equally from Slovakia ($n = 60$), Spain ($n = 60$), and Malta ($n = 60$). In each country, children were allocated to three groups of 20: Experimental Group 1, Experimental Group 2, and Control. Sex distributions were: Slovakia 26 males/34 females; Spain 29/31; Malta 12/48. Also involved were 21 preschool teachers ($N = 21$; Slovakia 8, Spain 10,

Malta 3; all female) and 225 parents of participating children (N = 225; Slovakia 69, Spain 67, Malta 89). Because person-level linkage identifiers were not available, PRE and POST samples were not matched at the individual level; accordingly, all between-wave comparisons reflect independent classroom/site-level cohorts rather than within-child longitudinal change.

Control (SK1, ES1, ML1) followed a traditional preschool program without the SEL outdoor-education intervention; children in these groups spent at most 1 hour/week outdoors. Experimental Group 1 (SK2, ES2, ML2) implemented the SEL outdoor-education program primarily indoors; outdoor time was likewise limited to at most 1 hour/week. Experimental Group 2 (SK3, ES3, ML3) implemented the SEL outdoor-education program predominantly outdoors; children spent at least 4 hours/day in natural outdoor environments.

Participant recruitment was governed by a pragmatic, accessibility-based sampling strategy. Countries were selected for analogous, structurally resonant pre-primary curricula. The study sought diachronic and synchronic differentials and loci of convergence across preschool systems, with analytic focus on how Social and Emotional Learning (SEL) and outdoor learning are instantiated and how these modalities exert pedagogically salient influences on children's developmental trajectories within the three national contexts.

Instruments/Measures

This study was implemented within an innovative educational program integrating outdoor education and Social and Emotional Learning (SEL). The program systematically cultivated emotional, cognitive, behavioral, personal, prosocial, and interpersonal competencies through structured play, experiential learning, inquiry-based and interactive activities, aesthetic engagement, practical nature-based tasks, and trial-and-error exploration. Teacher facilitation emphasized psychological safety, predictability, and acceptance; modeling of prosocial behavior; guided emotional reflection; stress regulation; constructive problem solving; interpretation of social cues; and the internalization of socially responsible values. The conceptual foundation aligns with developmental and experiential perspectives underscoring the importance of supportive environments for optimal growth (Davis-Berman & Berman, 2005; Maslow, 1954; Leberman & Martin, 2002; Kaplan & Kaplan, 1989; Mitten, 1999), as well as contemporary SEL scholarship documenting benefits for social-emotional competencies, academic functioning, and holistic development (Cipriano et al., 2023; CASEL, 2020; Murano et al., 2020; Greenberg et al., 2017; Weissberg et al., 2015).

Preschool children's perceived prosocial behavior was assessed using the Questionnaire to Assess Perceptions of Prosocial Behavior in Preschool Children (QSPBPCH). The instrument comprises 20 items describing everyday situations in which children may demonstrate prosocial behavior. Teachers (with ≥ 6 months'

familiarity with the child) and parents rated items on a 7-point Likert-type scale ranging from strongly disagree to strongly agree; two items are reverse-coded. The total score (0 – 60) reflects overall perceived prosociality, with higher scores indicating stronger prosocial tendencies. The measure captures multidimensional prosocial constructs, including altruism, compliant and public helping, responses to distress, comforting, sharing, empathy, absence of envy, cooperation, honesty, humility, respect, discipline, forgiveness, and acknowledgment of others' achievements, with selected items integrating multiple domains (e.g., humility–empathy–helping; respect–discipline). Conceptually, the QSPBPCH is grounded in positive psychology and established typologies of prosocial behavior and moral development (Anzenbacher, 1994; Carlo & Randall, 2002; Eisenberg & Sadovsky, 2004; Wispé, 1972; Penner et al., 2005). Prior validation research demonstrated excellent internal consistency ($\alpha = .95$). Construct validity was supported by exploratory factor analysis (Kaiser–Meyer–Olkin = .90; Bartlett's test of sphericity, $\chi^2(df) = 2{,}345.67$, $p < .001$), yielding four factors: basic perceived prosocial behaviors (52.61 % variance), advanced perceived prosocial behaviors (10.20 %), emerging prosocial behaviors (12.49 %), and resulting prosocial behaviors (12.49 %), consistent with theoretically defined dimensions of prosocial conduct.

Children's psychosomatic complaints were assessed using the Somatic Complaint List (SCL; Jellesma et al., 2007). The SCL is a 21-item self-report measure assessing the frequency of common somatic symptoms (e.g., headaches, abdominal discomfort, fatigue) rated on a 5-point Likert-type scale (1 = never, 5 = very often), with higher scores indicating greater symptom prevalence. Psychometric evaluation demonstrated strong internal consistency ($\alpha = .83$) and convergent validity via significant associations with the Children's Somatization Inventory – Child Form (CSI-C), parent-reported somatic complaints (CSI-P), and negative affect (Jellesma et al., 2007). The SCL exhibited stronger associations with parent-reported somatic symptoms than the CSI-C, indicating sensitivity in capturing psychosomatic manifestations. Validation studies with a large sample of school-aged children ($N = 717$; 365 fourth-grade, 352 fifth-grade; parent reports $N = 564$) confirmed temporal stability through six-month test-retest analyses. Although originally validated in school-aged samples, subsequent adaptations and integration of parent-reported data extended applicability to preschool populations, including children aged 3 – 6 years (Serra Giacobo et al., 2012). The SCL has also demonstrated sensitivity to associations between emotional regulation processes and psychosomatic symptomatology (Jellesma et al., 2011), supporting its relevance for developmental and educational research contexts. Given the preschool age of the participants, items were administered orally in an individual or small-group format, with trained classroom teachers reading each item aloud and recording children's verbatim responses in order to preserve comprehension while maintaining the natural classroom climate.

Procedure

We implemented a quasi-experimental two-wave evaluation (PRE and POST) across nine preschool sites in Slovakia (SK01 – 03), Spain (ES01 – 03), and Malta (ML01 – 03). Data were collected immediately before and after the implementation period. Data were collected in repeated pretest–posttest waves within the same preschool sites; however, in the absence of person-level linkage identifiers, PRE and POST observations were analyzed as unlinked samples, and statistical inference was restricted to site-level between-wave contrasts using cluster-robust procedures. The initial research protocol referenced experimental conditions (EX1, EX2, control) and an outdoor-education intensity index. These variables were not present in the delivered datasets and therefore were not incorporated into the analyses. Informants included parents and teachers (perceived prosocial behavior) and children (self-reported psychosomatic complaints). Administration occurred in situ following a uniform schedule across sites. Instruments were exported in .xlsx format and organized by country, site, wave, and informant; no additional identifiers were available. Datasets were ingested and analyzed as delivered. Quality control procedures verified item counts and permissible response ranges, removed fully empty rows, and retained all observed responses. No imputations, recoding, or scoring transformations were applied at the preprocessing stage. All data processing and statistical analyses were conducted using R and Python.

Data Analysis

Analyses relied exclusively on the delivered anonymized PRE and POST spreadsheets from nine sites across three countries. Data were collected in repeated pretest–posttest waves within the same preschool sites; however, because person-level linkage identifiers were unavailable, PRE and POST observations were analyzed as unlinked samples, and statistical inference was restricted to site- and country-level between-wave contrasts rather than within-child longitudinal change. Data matrices were ingested as delivered. Item columns were identified, and per-respondent indices were computed as available-case item means (primary metric) and sums (secondary metric) for QSPBPCH (parents, teachers; 20 items, scored 0 – 6) and SCL (children; 11 items, scored 0 – 2). Rows with all items missing were removed; no additional data alterations, imputations, or scoring transformations were performed. Internal consistency (Cronbach's α) was summarized by instrument × country × informant. Descriptive statistics (*M*, *SD*, median, interquartile range [IQR], range) were produced by country × wave and, for QSPBPCH, by informant. Site-level means and counts were retained for clustered inference. Wave effects were estimated using ordinary least squares models including a POST indicator and categorical covariates for Country (and Rater for QSPBPCH), with Site fixed effects and site-clustered standard errors. Higher-order interactions were excluded when rank-deficient. Given the small number of clusters ($k = 9$), inference prioriti-

zed wild cluster bootstrap-*t* procedures (Rademacher weights). Leave-one-site-out analyses were conducted to assess coefficient stability. Standardized mean differences (Hedges' *g*, POST–PRE; 95 % confidence intervals) were calculated for descriptive interpretation within countries (SCL) and within country × informant strata (QSPBPCH), using pooled standard deviations with small-sample correction. Cross-instrument covariation was examined via Pearson correlations of site-level deltas, with Fisher *z*-transformed confidence intervals ($n = 9$). Throughout, analytic decisions were constrained by the structure of the delivered datasets and the cross-sectional design; findings are therefore interpreted as directional between-wave differences rather than causal program effects.

Table 1. Internal consistency (Cronbach's α) by instrument, country, and informant

Instrument	Country	Informant	α
QSPBPCH	ES	Parent	.781
QSPBPCH	ES	Teacher	.901
QSPBPCH	ML	Parent	.827
QSPBPCH	ML	Teacher	.911
QSPBPCH	SK	Parent	.816
QSPBPCH	SK	Teacher	.938
SCL	ES	Child	.480
SCL	ML	Child	.646
SCL	SK	Child	.616

Grand means indicated higher post-implementation perceived prosocial behavior and slightly lower self-reported somatic complaints (item-mean scales): QSPBPCH PRE $M = 4.19$ (95% CI [4.12, 4.27]), POST $M = 4.56$ [4.49, 4.63]; SCL PRE $M = 0.35$ [0.31, 0.38], POST $M = 0.31$ [0.29, 0.34].

Results

Analyses used only the delivered files, derived from repeated pretest–posttest measurement within the same preschool sites. However, because person-level linkage identifiers were unavailable, PRE and POST observations were analyzed as unlinked samples; accordingly, all point estimates and 95% confidence intervals reflect between-wave contrasts at the site level rather than within-child longitudinal change and do not constitute definitive evidence of program effectiveness. QSPBPCH showed adequate – excellent internal consistency; SCL reliability was moderate across countries.

Table 2a. QSPBPCH – Parent ratings: country × wave item means (95% CIs)
n per cell = 60

Country	PRE *M* [95% CI]	POST *M* [95% CI]
ES	4.28 [4.14, 4.42]	4.71 [4.61, 4.81]
ML	4.30 [4.13, 4.46]	4.41 [4.25, 4.56]
SK	3.98 [3.85, 4.11]	4.27 [4.10, 4.43]

Parent-reported prosocial behavior is higher at POST in all countries (ES from 4.28 to 4.71; ML from 4.30 to 4.41; SK from 3.98 to 4.27). Spain shows non-overlapping 95% CIs, Malta and Slovakia show some overlap. Descriptively, parents observed higher prosocial behavior after the program period, with cross-country variation; given independent samples, these are between-sample contrasts rather than within-person change.

Table 2b. QSPBPCH – Teacher ratings: country × wave item means (95% CIs)
n per cell: ES = 50; ML = 60; SK = 60

Country	PRE *M* [95% CI]	POST *M* [95% CI]
ES	4.04 [3.77, 4.30]	4.53 [4.37, 4.69]
ML	4.23 [4.05, 4.41]	4.66 [4.47, 4.85]
SK	4.31 [4.08, 4.54]	4.79 [4.53, 5.04]

Teacher ratings increase from PRE to POST in every country (ES from 4.04 to 4.53; ML from 4.23 to 4.66; SK from 4.31 to 4.79). Spain and Malta display non-overlapping CIs; Slovakia's CIs touch. This pattern corroborates Table 2a, suggesting broadly higher perceived prosocial behavior post-period, with heterogeneity by country and informant, and the same interpretive limits.

Table 2c. SCL – Child self-reports: country × wave item means (95% CIs)
n per cell = 60

Country	PRE *M* [95% CI]	POST *M* [95% CI]
ES	0.32 [0.27, 0.37]	0.28 [0.23, 0.33]
ML	0.39 [0.32, 0.45]	0.37 [0.32, 0.43]
SK	0.33 [0.27, 0.40]	0.29 [0.25, 0.34]

SCL means are lower at POST in all countries (ES from 0.32 to 0.28; ML from 0.39 to 0.37; SK from 0.33 to 0.29), with overlapping CIs throughout. Descriptively, children reported slightly fewer psychosomatic complaints post-period, but changes are small and imprecise. Parsimonious OLS models with a POST indicator

and categorical Country (and Rater for QSPBPCH), including Site fixed effects and site-clustered standard errors, yielded:

Table 3. OLS POST effects with site-clustered SEs and wild cluster bootstrap-*t* p-values

Instrument	β̂ (POST)	SE	95% CI LL	95% CI UL	*p* (clustered)	*p*wild
QSPBPCH	0.367	0.158	0.057	0.676	.020	.531
SCL	− 0.034	0.035	− 0.102	0.034	.328	.559

Note. Wild cluster bootstrap-*t* uses Rademacher weights (B = 499) with nine site clusters.

With site fixed effects, the POST indicator is positive for QSPBPCH (β̂ = 0.367, 95% CI [0.057, 0.676], *p* (clustered) = .020) but is not supported under wild cluster bootstrap-*t* (*p* = .531). For SCL, POST is near zero and nonsignificant (β̂ = −0.034, 95% CI [−0.102, 0.034], *p* (clustered) = .328; *p* (wild) = .559). Conservative inference therefore does not confirm a robust overall POST effect. Sensitivity (leave-one-site-out). QSPBPCH POST coefficients ranged 0.26 – 0.44 (SE 0.13 – 0.18); SCL −0.054 to −0.016 (SE 0.03 – 0.04), preserving effect directions. Effect directions are stable across deletions (QSPBPCH positive; SCL negative), indicating no single site drives the patterns. This supports directional robustness, not statistical significance.

Table 4a. QSPBPCH – Hedges' *g* (POST − PRE) with 95% CIs (country × informant)

Country	Informant	*g*	95% CI LL	95% CI UL
ES	Parent	0.89	0.52	1.27
ES	Teacher	0.64	0.24	1.04
ML	Parent	0.17	− 0.18	0.53
ML	Teacher	0.59	0.23	0.96
SK	Parent	0.50	0.13	0.86
SK	Teacher	0.51	0.15	0.87

All *g* values are positive. CIs exclude zero for Spain (parents, teachers), Malta (teachers), and Slovakia (parents, teachers), but not for Malta (parents). Magnitudes are generally small-to-moderate, varying by country and informant, consistent with Tables 2a – 2b.

Table 4b. SCL – Hedges' *g* (POST − PRE) with 95% CIs (country)

Country	*g*	95% CI LL	95% CI UL
ES	− 0.23	− 0.59	0.12
ML	− 0.06	− 0.42	0.29
SK	− 0.20	− 0.55	0.16

All *g* values are negative across countries, and all CIs include zero, mirroring Table 3's null POST findings for SCL.

Table 5. Correlation of site-level deltas (ΔQSPBPCH vs. ΔSCL)

Metric	*r*	95% CI LL	95% CI UL	*n* sites
Pearson correlation (POST − PRE means)	− 0.32	− 0.81	0.44	9

At the site level, changes in perceived prosocial behavior and psychosomatic complaints were negatively associated ($r = -.32$, 95% CI [−.81, .44]); because the CI spans zero, this pattern is exploratory. Interpretation is constrained by missing variables: site mappings to EX1/EX2/control and outdoor-education intensity indices were absent and therefore unanalyzed. Synthesizing the research questions: RQ1—perceived prosocial behavior is descriptively higher at POST across countries and informants, but conservative inference does not confirm a robust overall POST effect; RQ2 – POST shifts in SCL are small and negative, not statistically supported; RQ3 – changes vary by country and informant, and direct contrasts among EX1, EX2, and control cannot be made without group mappings.

Discussion

Grounded strictly in the anonymized datasets and the independent cross-sectional PRE and POST structure, all findings are interpreted as directional between-wave differences rather than program effects. The absence of person-level linkage and experimental condition identifiers constrains causal inference and necessitates a design-bounded, descriptive interpretation.

Regarding RQ1, teacher and parent ratings of perceived prosocial behavior (QSPBPCH) were directionally higher at POST across sites. Site fixed-effects models with site-clustered standard errors yielded a positive POST coefficient, $b = 0.37$, 95 % CI [0.06, 0.68], $p = .020$ (Table 3). Given the small number of clusters ($k = 9$), small-sample-robust inference using wild cluster bootstrap-*t* procedures indicated that the POST coefficient was not statistically distinguishable from zero ($p = .530$). Leave-one-site-out analyses preserved the positive direction of the estimates, with *b* values ranging from 0.26 to 0.44. Standardized mean differences (Hedges'

g; POST-PRE) converged with these patterns (Tables 4a – 4b), with larger directional increases observed in Spain (Parents $g = 0.89$, 95 % CI [0.52, 1.27]; Teachers $g = 0.64$, 95 % CI [0.24, 1.04]) and among Maltese teachers ($g = 0.59$, 95 % CI [0.23, 0.96]), and smaller but consistently positive estimates in Slovakia (Parents $g = 0.50$, 95 % CI [0.13, 0.86]; Teachers $g = 0.51$, 95 % CI [0.15, 0.87]). From a pedagogical perspective, the directional increase in adult-perceived prosocial behavior aligns with established preschool SEL research. Randomized controlled trials of PATHS and REDI, as well as Tier-2 Preschool First Step, document improvements in adult-reported social competence and prosocial behavior (Domitrovich et al., 2007; Nix et al., 2016; Feil et al., 2015). Cluster-randomized and large-scale evaluations further demonstrate gains in prosocial play and teacher-rated social-emotional competence (Eninger et al., 2021; Humphrey et al., 2016). Syntheses of nature-based early childhood education and greenness research likewise support the plausibility of outdoor-integrated approaches contributing to socially constructive behaviors (Johnstone et al., 2022; Putra et al., 2020). Within the limits of the present design, convergence between directional POST-PRE differences and prior SEL and outdoor education evidence strengthens the educational interpretability of the observed patterns without implying causal attribution.

With respect to RQ2, children's self-reported somatic complaints (SCL) demonstrated small, directionally negative POST–PRE differences, $b = -0.03$, 95 % CI [− 0.10, 0.03], $p = .330$ (Table 3), with similarly nonsignificant small-sample-robust inference ($p = .560$). Country-level standardized differences were likewise small and negative (Spain $g = -0.23$, 95 % CI [−0.59, 0.12]; Malta $g = -0.06$, 95 % CI [− 0.42, 0.29]; Slovakia $g = -0.20$, 95 % CI [−0.55, 0.16]). Such patterns parallel preschool and early-primary SEL trials in which adult-rated social-emotional improvements occur without corresponding full-sample reductions in internalizing or health-related symptoms at immediate posttest (Eninger et al., 2021; Humphrey et al., 2016). Although validated, SCL internal consistency in young children ranged from .48 to .65 (α; Table 1), which may attenuate small effects and widen confidence intervals without introducing directional bias (Jellesma et al., 2007). Accordingly, the minimal change in somatic complaints should be interpreted in light of both developmental measurement constraints and the short temporal frame of assessment.

Regarding RQ3, the absence of EX1/EX2/control mappings precluded contrasts between implementation formats. QSPBPCH estimates exhibited country-by-informant heterogeneity, whereas SCL changes remained uniformly small and negative across contexts. Site-level POST–PRE deltas in QSPBPCH and SCL were negatively but imprecisely associated, $r = -0.32$, 95 % CI [−0.81, 0.44], $n = 9$ (Table 5), providing no determinate statistical evidence of cross-instrument coupling. Measurement characteristics contextualize these patterns: QSPBPCH demonstrated adequate to excellent internal consistency (α ranged from .78 to .94; Table 1), whe-

reas SCL reliability was moderate, and the small number of clusters necessitated conservative small-sample inference. Together, these features explain the coexistence of directionally positive prosocial ratings with statistically nonsignificant inferential tests and minimal SCL shifts.

The pedagogical implications are descriptive rather than prescriptive. Findings underscore the importance of triangulating teacher and parent ratings when evaluating prosocial development in early childhood contexts. For psychosomatic complaints, complementing child self-reports with brief observational indicators or caregiver checklists may enhance interpretive robustness. Documentation of site-level contextual factors remains essential when interpreting directional shifts within cross-national educational implementations. In summary, perceived prosocial behavior demonstrated directionally positive POST- PRE differences across sites and informants, whereas somatic complaints did not exhibit systematic change. Both outcomes varied by country and informant, and the overall pattern aligns with preschool SEL and nature-based early childhood education research emphasizing adult-rated social and prosocial gains alongside limited or mixed short-term internalizing or somatic effects (Eninger et al., 2021; Humphrey et al., 2016; Johnstone et al., 2022). These conclusions remain strictly bounded by the cross-sectional analytic structure and should be interpreted accordingly.

Conclusion

Anchored strictly in the delivered anonymized datasets and the independent cross-sectional PRE and POST structure, the present evidence indicates directionally positive between-wave differences in perceived prosocial behavior (QSPBPCH) and no systematic change in self-reported somatic complaints (SCL). In site fixed-effects models with site-clustered standard errors, QSPBPCH demonstrated a POST elevation, $b = 0.37$, 95 % CI [0.06, 0.68] (Table 3), consistent with standardized mean differences across country × informant strata, with larger estimates observed in Spain and among Maltese teachers (Tables 4a – 4b). In contrast, SCL differences were directionally negative and statistically nonsignificant, and standardized effects were uniformly small (Table 3; Table 4b). Given the small number of site clusters ($k = 9$), inference prioritized wild cluster bootstrap-t procedures; accordingly, interpretation emphasizes effect estimates and confidence intervals rather than dichotomous statistical thresholds. At the site level, the association between POST-PRE changes in QSPBPCH and SCL was negative but imprecise, $r = -0.32$, 95 % CI [−0.81, 0.44] (Table 5), providing no determinate statistical evidence of cross-instrument coupling. These conclusions are bounded by several design and measurement constraints: the absence of person-level linkage keys necessitating independent cross-sectional contrasts; unavailable EX1/EX2/control mappings and outdoor-education intensity indicators; the limited number of participating sites; and the moderate internal consistency of the SCL (Table 1). Within these constra-

ints, implementation coincided with average gains in adult-perceived prosocial behavior that varied across countries and informants, whereas self-reported somatic complaints did not exhibit systematic change. Future confirmatory research should incorporate person-level linkage identifiers and group or intensity indicators to enable within-person longitudinal analyses and moderation testing. Maintaining the documented SCL scoring specifications, including reverse-coded items, will be essential for adjudicating sensitivity to change and refining measurement precision in early childhood contexts.

Limitations

Interpretation is bounded by the file-delimited pretest–posttest structure without person-level linkage identifiers; although data were collected in repeated waves within the same preschool sites, PRE and POST observations were analyzed as unlinked samples, with inference restricted to site-level between-wave contrasts using clustered standard errors. The small number of clusters ($k = 9$) curtailed statistical precision and rendered higher-order interactions nonidentifiable, motivating parsimonious specifications and prioritization of wild cluster bootstrap-t inference with complementary leave-one-site-out checks. Group- and dose-specific inference was infeasible because site mappings (EX1/EX2/control) and any index of outdoor-education intensity were unavailable in the delivered files. Measurement constraints also temper claims: under the documented scoring protocol, SCL internal consistency was moderate, which limits precision, and QSPBPCH has not been evaluated for cross-cultural measurement invariance, constraining generalizability across countries and informants. Reliance on teacher and parent -reported instruments (and child self-report for SCL) may introduce rater-specific practices and susceptibility to subjective bias. Implementation fidelity for the 20-week nature-immersion program was assessed via practitioner reports following multi-hour training, without independent observational audits, and outcomes were collected one month post-intervention, precluding statements about durability. Although the original protocol contemplated more saturated models (e.g., mixed-design ANOVA), the absence of group/intensity variables and the small number of sites limited such modeling and power for higher-order effects. Consistent with these constraints, our inferences emphasize effect magnitudes and 95% confidence intervals obtained from parsimonious, site-clustered models and their small-k robustness checks.

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