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Structured Joint Music–Movement Activities in Early Childhood Education: Associations With Teacher-Perceived Prosocial Behavior and Situational Peer Cooperation

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Abstract

The present study examined associations between repeated structured collective joint music–movement activities and prosocial behavior in preschool children across two complementary levels of analysis: teacher-perceived generalized prosocial behavior and situationally observed cooperative behavior. A naturalistic quasi-experimental design was employed with $N = 77$ preschool children (34 girls, 43 boys; aged 4–6 years) from early childhood education institutions in Slovakia. Perceived prosocial behavior was assessed at pre- and post-assessment across an 8-week period involving 12 collective joint music–movement sessions using the *Questionnaire to Assess Perceptions of Prosocial Behavior in Preschool Children* (QSPBPCH; Author, 2021; Cronbach's $\alpha = .93$), whereas situational cooperative behavior was evaluated across 782 observational records derived from structured joint-action tasks informed by Kirschner and Tomasello (2010). No significant overall change in QSPBPCH scores was observed at the full-sample level, $t(76) = 1.34$, $p = .184$, Cohen's $d = 0.15$. Gender-stratified analyses revealed a significant increase among girls, $t(33) = 2.92$, $p = .006$, Cohen's $d = 0.50$, whereas boys demonstrated negligible change (Cohen's $d = -0.04$). A significant gender difference favoring girls emerged at post-assessment, Welch's $t(74.79) = 4.93$, $p < .001$. Within the structured joint-action task, girls were significantly more likely than boys to achieve successful coordinated task completion, $\chi^2(1, N = 782) = 4.07$, $p = .044$, $\varphi = .07$. Findings suggest variability in associations between collective joint musical engagement and prosocial functioning across behavioral domains and gender subgroups.

Introduction

Music is a universal human behavior present across societies and throughout the lifespan (Merriam, 1964; Trehub, 2001), functioning not only aesthetically but as a socially embedded practice that synchronizes behavior and promotes social cohesion (Cross, 2005; McNeill, 1995). Developmental research suggests that collective musical engagement may be associated with children's socioemotional and prosocial development, although the conditions governing these associations remain insufficiently understood (Ilari et al., 2020; Schellenberg et al., 2015). Prosocial behavior—encompassing helping, sharing, comforting, and cooperation—emerges through affective responsiveness, shared intentionality, and social-contextual processes, and is closely intertwined with empathy, a multidimensional construct comprising affective, cognitive, and motivational components (Decety, 2015; Dunfield, 2014; Padilla-Walker & Carlo, 2014; Warneken & Tomasello, 2009). Empathy functions as a developmental precursor of prosocial behavior and a protective factor against antisocial developmental trajectories (Eisenberg & Miller, 1987), and remains responsive to environmental and educational experiences throughout early childhood (Davidov et al., 2013; McDonald & Messinger, 2011).

Music represents a particularly relevant context for prosocial development, as collective engagement requires shared attention, interpersonal coordination, and mutual responsiveness (Clarke et al., 2015; Cross et al., 2012). Synchronized movement and rhythmic entrainment are proposed to reduce perceived self–other boundaries and strengthen social connectedness through mechanisms of interpersonal synchrony (Rabinowitch & Meltzoff, 2017; Tarr et al., 2014; Tunçgenç & Cohen, 2016), and experimental

studies with preschool-aged children confirm that brief episodes of joint musical engagement can increase helping and cooperative behavior relative to comparable non-musical interactions (Cirelli et al., 2014; Kirschner & Tomasello, 2010).

Longitudinal and school-based studies provide more ecologically valid evidence, although findings remain inconsistent: some report improvements in empathy and socioemotional functioning following sustained group musical activities (Rabinowitch et al., 2013; Schellenberg et al., 2015), whereas others yield null or inconsistent effects, raising concerns regarding methodological heterogeneity (Alemán et al., 2017; Ilari et al., 2018; Schellenberg, 2004). Consequently, the extent to which repeated collective joint musical engagement is associated with generalized prosocial functioning within naturalistic preschool settings remains insufficiently understood.

Against this background, the present study examined associations between repeated structured collective joint music–movement activities and prosocial behavior in preschool children within routine educational contexts, across two complementary levels of analysis: (a) teacher-perceived generalized prosocial behavior and (b) situational cooperative behavior observed during structured peer-based joint-action tasks. Rather than testing directional causal hypotheses, the study adopted an exploratory question-driven framework aimed at clarifying patterns of association between collective joint musical engagement, teacher-perceived prosociality, and context-embedded cooperative behavior in preschool children.

Research Questions

Building on prior theoretical and empirical work on joint musical engagement, interpersonal synchrony, and prosocial functioning in early childhood, the present study adopted an exploratory, question-driven framework. Consistent with its non-experimental, ecologically embedded character, the study focused on clarifying patterns of association across two analytically distinct yet theoretically interconnected levels of analysis—(a) teacher-perceived generalized prosocial behavior across everyday preschool situations and (b) situational cooperative behavior during context-embedded peer interaction tasks—without advancing directional causal hypotheses. The study addressed the following research questions:

RQ1. How is participation in repeated structured collective joint music–movement activities associated with teacher-perceived prosocial behavior in preschool children across everyday preschool situations, as assessed using the *Questionnaire to Assess Perceptions of Prosocial Behavior in Preschool Children* (QSPBPCH)?

RQ2. How is participation in repeated structured collective joint music–movement activities associated with preschool children's observable situational cooperative behavior during structured peer interaction tasks requiring mutual responsiveness and coordinated joint action?

Participants

The study sample comprised preschool children enrolled in public early childhood education institutions in the Prešov Region, Slovakia. Participants were recruited from kindergartens selected on the basis of institutional willingness to participate and the practical feasibility of implementing repeated structured joint music–movement activities within the existing preschool routine. Recruitment was guided by ecological and procedural considerations consistent with the naturalistic design of the study.

Eligibility criteria required that participating children had been continuously enrolled in the respective preschool institution for a minimum of two years prior to data collection, ensuring sufficient familiarity with the educational environment, peer group, and teaching staff. Children with identified developmental disorders or sensory impairments that could substantially interfere with participation in rhythmically coordinated collective activities were not included.

The final sample consisted of *N* = 77 preschool children, including 43 boys and 34 girls, aged 4–6 years. All participating children attended preschool on a full-time basis at the time of data collection. Demographic information was obtained from institutional records provided by the participating preschool institutions.

In addition to child participants, data were obtained from eight preschool teachers, all of whom were women, aged 23–63 years. Regarding educational attainment, two teachers had completed secondary-level pedagogical education, five held a bachelor's degree (*B.A.* equivalent), and one held a master's degree (*M.A.* equivalent) in a relevant field of teacher education. All participating teachers had known the children in their respective classrooms for a minimum of two years, ensuring sustained exposure to children's everyday social functioning within the preschool environment. Teachers served as the primary evaluators of children's generalized prosocial behavior within routine educational contexts.

Instruments / Measures

Perceived prosocial behavior was assessed using the *Questionnaire to Assess Perceptions of Prosocial Behavior in Preschool Children* (QSPBPCH; Author, 2021), an instrument designed to evaluate teacher-perceived prosocial behavior in preschool-aged children on the basis of sustained naturalistic observation within educational contexts. In the present study, the QSPBPCH was completed exclusively by preschool teachers who had known the respective child for a minimum of six months, ensuring that evaluations reflected prolonged exposure to children's everyday social functioning.

The QSPBPCH comprises 20 items describing common social situations in which preschool children may display prosocial tendencies, rated on a modified 7-point response scale. Responses are scored as follows: *completely disagree* = 0.5, *disagree* = 1.0, *rather disagree* = 1.5, *uncertain* = 0, *rather agree* = 2.0, *agree* = 2.5, and *completely agree* = 3.0. Items 2 (*"The child helps others only when asked"*) and 3 (*"The child helps others only in the presence of others"*) are reverse-coded prior to score computation. Composite total scores are calculated by aggregating item responses, yielding a theoretical range of 0 to 60, with higher scores indicating greater teacher-perceived prosocial behavior. The instrument reflects a

multidimensional conceptualization encompassing helping, sharing, comforting, empathy, collaboration, honesty, humility, respect, discipline, forgiveness, and prosocial responsiveness, with selected items integrating multiple relational dimensions (e.g., humility–empathy–helping; respect–discipline). The QSPBPCH is explicitly conceptualized as a measure of perceived prosociality rather than direct behavioral observation.

Conceptually, the instrument is grounded in positive psychology and a strengths-based developmental framework, drawing on Carlo and Randall's (2002) typology of prosocial behavior, Eisenberg and Sadovsky's (2004) conceptualization of prosocial responding, Wispe's (1972) account of prosocial behavior, Penner et al.'s (2005) framework of prosocial personality, and Anzenbacher's (1994) account of moral dispositions. In the original validation study, psychometric evaluation demonstrated excellent internal consistency (Cronbach's α = .95), and construct validity was supported through exploratory factor analysis (Kaiser–Meyer–Olkin = .90; Bartlett's Test of Sphericity, $p < .001$), yielding four interpretable factors: basic, advanced, emerging, and resulting perceived prosocial behaviors (Author, 2021). In the present sample, internal consistency remained high at both measurement points (Cronbach's α = .93).

Situational cooperative behavior was assessed through a structured joint-action task informed by paradigms examining interpersonal synchrony and cooperative behavior in early childhood (Kirschner & Tomasello, 2010). The task was designed to elicit observable cooperative behavior within brief dyadic interactions requiring temporal coordination, mutual responsiveness, and coordinated engagement toward a shared goal. Behavior was evaluated using two predefined observational indicators: responsiveness to a partner's actions and successful joint task completion. A composite cooperation score was computed as the sum of these two indicators. The task was administered under standardized conditions across all sessions. This observational measure was explicitly intended to capture situationally embedded cooperative behavior within constrained peer interactions, treated analytically as a context-dependent behavioral manifestation complementary to, but conceptually distinct from, adult-perceived prosocial behavior measured through the QSPBPCH.

Structured Joint Music–Movement Activities

The study involved repeated structured collective joint music–movement activities implemented within the regular preschool educational setting. Activities were designed to engage children in rhythmically and temporally coordinated collective participation accompanied by music, emphasizing shared timing, mutual responsiveness, and synchronized engagement rather than individual performance. Sessions were conducted by regular classroom teachers familiar with the children and the broader educational context, without explicit instruction, reinforcement, or behavioral regulation targeting prosocial behavior.

The structured activity sequence was implemented over an 8-week period, comprising 12 collective joint music–movement sessions conducted approximately twice weekly in classroom-based group settings, each lasting 5–7 minutes. Each session included combinations of singing, body percussion, rhythmic

synchronization, coordinated movement to music, and the use of rhythmic and melodic instruments, emphasizing synchronized temporal coordination and shared collective participation.

Immediately following each collective music–movement session, children participated in a brief structured joint-action task conducted in dyads (described in detail in the Instruments section). To minimize the influence of stable interpersonal preferences, child pairings were systematically alternated across sessions, ensuring that identical dyads were not repeatedly maintained throughout the activity period.

To promote procedural consistency across classrooms, all activities followed a predefined implementation framework specifying structure, sequence, frequency, and duration of sessions. Teachers' involvement was limited to organizing session progression and ensuring adherence to the predefined structure, without evaluating, prompting, or reinforcing specific prosocial behaviors during the activities.

Implementation fidelity was monitored throughout the study period. Teachers documented the occurrence, frequency, and duration of completed sessions and confirmed adherence to the prescribed structure. These records served exclusively to verify procedural consistency and comparable activity exposure across participating classrooms and were not treated as outcome variables in subsequent analyses.

Design and Procedure

The study employed a quasi-experimental pre–post design conducted in a naturalistic preschool setting, with data collection embedded within regular classroom environments to preserve ecological validity and minimize disruption to everyday educational activities. Preschool teachers were informed about the general procedural aspects of the study but were not provided with information regarding specific research hypotheses related to prosocial behavior.

Prior to the commencement of the structured collective joint music–movement activity sequence, a pre-assessment of perceived prosocial behavior was conducted using the QSPBPCH, completed independently by each child's classroom teacher. The structured collective joint music–movement activity sequence was subsequently implemented as part of the regular daily classroom routine over an 8-week period. Structured activities were delivered by regular preschool teachers in accordance with the predefined activity framework, without additional training aimed at influencing children's social behavior and without evaluating or reinforcing specific social outcomes during the activities.

Following completion of the activity period, a post-assessment of perceived prosocial behavior was conducted using the QSPBPCH under identical conditions to the pre-assessment. Both assessments were completed independently by teachers who had known the respective child for a minimum of six months, ensuring that ratings reflected sustained observation across everyday contexts rather than isolated or recent events.

Situational cooperative behavior was assessed following each collective music–movement session using a structured joint-action task administered under standardized conditions. Children were paired with familiar peers to reduce potential effects of social novelty, and the task was conducted in a quiet area within the preschool environment by trained researchers adhering to a fixed protocol.

Data collection followed a predetermined sequence: QSPBPCH pre-assessment preceded program implementation; joint-action task observations were conducted throughout the activity period immediately following each session; and QSPBPCH post-assessment was administered upon program completion. Records of implementation fidelity were compiled throughout the program period and reviewed prior to data analysis to verify procedural consistency across classrooms.

Statistical Analysis Plan

Statistical analyses were conducted using procedures appropriate for the quasi-experimental repeated-measures design and the psychometric and distributional characteristics of the study variables. Prior to inferential analyses, the dataset was systematically screened for completeness, scoring accuracy, distributional consistency, and the presence of univariate outliers. Reverse-coded items were recoded prior to computation of composite scores. Descriptive statistics, including means, standard deviations, and observed score ranges, were calculated to provide an initial characterization of the data.

Internal consistency of the QSPBPCH was evaluated separately at pre- and post-assessment using Cronbach's alpha coefficients to verify the reliability of composite scores within the present sample.

Changes in teacher-perceived prosocial behavior were examined using paired-samples *t*-tests comparing pre- and post-assessment QSPBPCH total scores. Exploratory subgroup analyses were conducted separately for boys and girls to examine potential gender-related differences in score patterns across the assessment period. Between-group gender differences at both measurement points were evaluated using independent-samples Welch's *t*-tests. Effect sizes were reported as Cohen's *d* for all *t*-tests to support interpretation of the practical magnitude of observed effects independent of sample size.

Situational cooperative behavior observed during the structured joint-action tasks was analyzed using descriptive and nonparametric inferential procedures appropriate for the categorical and distributional characteristics of the observational variables. Frequencies and proportions were calculated for responsiveness, task completion, and composite cooperation scores. Gender-related differences in observational outcomes were examined using Pearson's chi-square tests for dichotomous indicators and the Mann–Whitney *U* test for the composite cooperation score. Effect sizes were reported as Cramér's φ for chi-square analyses.

Given the naturalistic and nonrandomized character of the design, all inferential findings were interpreted conservatively as associative patterns within the observed data rather than as evidence of causal relationships. All tests were two-tailed with the significance threshold set at $\alpha = .05$. No post hoc modifications to the analytical strategy were undertaken following inspection of results.

All analyses were conducted using IBM SPSS Statistics (Version 29.0; IBM Corp., 2023).

Results

Preliminary Analyses and Reliability

*Sensitivity analysis conducted using G*Power 3.1 (Faul et al., 2007) indicated that the available sample size (N = 77) provided adequate statistical power ($1 - \beta = .83$) to detect effects of medium magnitude (d = 0.50) at $\alpha = .05$. Gender-stratified analyses were interpreted as exploratory because of reduced statistical power within subgroup samples (girls: n = 34; boys: n = 43).

Pre-assessment screening confirmed no substantial missing data, and all 77 cases met the predefined inclusion criteria. Score distributions indicated acceptable variability at both assessment points, with no evidence of pronounced floor or ceiling effects. Internal consistency of the QSPBPCH was excellent at both pre-assessment (Cronbach's α = .93) and post-assessment (Cronbach's α = .93), supporting the reliability of composite scores in subsequent analyses.

Changes in Teacher-Perceived Prosocial Behavior (QSPBPCH)

Descriptive statistics for QSPBPCH total scores are presented in Table 1. Pre-assessment scores ranged from 13.00 to 53.00 (M = 37.71, SD = 9.24), whereas post-assessment scores ranged from 20.00 to 55.00 (M = 39.70, SD = 9.02). Both means exceeded the instrument's average benchmark (score of 30; Author, 2021), indicating above-average teacher-perceived prosocial behavior at both time points.

A paired-samples t-test for the full sample (N = 77) revealed a non-significant increase in teacher-perceived prosocial behavior, $t(76) = 1.34$, $p = .184$, Cohen's d = 0.15, 95% CI [−0.97, 4.95], indicating limited overall change across the activity period.

Exploratory gender-stratified analyses revealed differentiated patterns. Among girls (n = 34), QSPBPCH total scores increased from pre-assessment (M = 39.37, SD = 8.77) to post-assessment (M = 44.56, SD = 6.62), reaching statistical significance, $t(33) = 2.92$, $p = .006$, Cohen's d = 0.50, 95% CI [1.57, 8.81], representing a medium effect (Cohen, 1988). Boys (n = 43) demonstrated stable scores (pre: M = 36.41, SD = 9.48; post: M = 35.86, SD = 8.87), $t(42) = -0.27$, $p = .790$, Cohen's $d = -0.04$, 95% CI [−4.66, 3.56].

Between-group comparisons using Welch's independent-samples t-tests indicated no significant gender difference at pre-assessment, Welch's $t(73.10) = 1.42$, $p = .160$, Cohen's d = 0.32. At post-assessment, girls demonstrated significantly higher scores than boys, Welch's $t(74.79) = 4.93$, $p < .001$, Cohen's d = 1.09. The larger between-group effect estimate at post-assessment (d = 1.09) relative to pre-assessment (d = 0.32), despite the absence of a significant baseline difference, suggests gender-differentiated patterns of association with teacher-perceived prosocial behavior.

Table 1 *Descriptive Statistics for QSPBPCH Total Scores by Gender and Assessment Point*

Assessment point	Girls (*n* = 34) *M* (*SD*)	Boys (*n* = 43) *M* (*SD*)	Total (*N* = 77) *M* (*SD*)
Pre-assessment	39.37 (8.77)	36.41 (9.48)	37.71 (9.24)
Post-assessment	44.56 (6.62)	35.86 (8.87)	39.70 (9.02)

Note. QSPBPCH = Questionnaire to Assess Perceptions of Prosocial Behavior in Preschool Children (Author, 2021). Total scores are reported on a 0–60 scale (0 = low, 30 = average, 60 = high teacher-perceived prosocial behavior). Cronbach's α = .93 at both assessment points.

Within-group comparisons (paired-samples *t* tests):

Girls: $t(33) = 2.92$, $p = .006$, $d = 0.50$, 95% CI [1.57, 8.81]

Boys: $t(42) = -0.27$, $p = .790$, $d = -0.04$, 95% CI [−4.66, 3.56]

Total sample: $t(76) = 1.34$, $p = .184$, $d = 0.15$, 95% CI [−0.97, 4.95]

Between-group comparisons (Welch's independent-samples *t* tests):

Pre-assessment: Welch's $t(73.10) = 1.42$, $p = .160$, $d = 0.32$

Post-assessment: Welch's $t(74.79) = 4.93$, $p < .001$, $d = 1.09$

Gender-stratified analyses were interpreted as exploratory.

Joint-Action Task: Situational Cooperative Behavior

Situational cooperative behavior was assessed across 782 observational records from repeated structured joint-action tasks administered immediately following each collective joint music–movement session (girls: *n* = 343; boys: *n* = 439). Three behavioral indicators were examined: responsiveness, successful coordinated task completion, and a composite cooperation score. Descriptive statistics and inferential comparisons are presented in Table 2.

Across all indicators, girls demonstrated descriptively higher cooperative behavior: responsiveness (girls: $M = 0.82$, $SD = 0.39$; boys: $M = 0.77$, $SD = 0.42$), completion (girls: $M = 0.86$, $SD = 0.34$; boys: $M = 0.81$, $SD = 0.39$), and composite cooperation score (girls: $M = 1.68$, $SD = 0.62$; boys: $M = 1.57$, $SD = 0.72$).

The association between gender and responsiveness did not reach significance, $\chi^2(1, N = 782) = 3.36$, $p = .067$, $\varphi = .07$, whereas the association with task completion was statistically significant, $\chi^2(1, N = 782) = 4.07$, $p = .044$, $\varphi = .07$, indicating that girls were more likely than boys to achieve successful joint task completion; both effects were small ($\varphi < .10$). The Mann–Whitney *U* test for the composite cooperation score yielded a non-significant result, $U = 79{,}941.50$, $p = .055$, with the directional pattern consistent with individual indicators.

Across observational indicators, girls showed descriptively higher levels of situational cooperative behavior, with statistically significant differences observed only for successful coordinated task completion and with uniformly small effect magnitudes.

Table 2 *Descriptive Statistics and Gender Comparisons for Joint-Action Task Behavioral Indicators*

Behavioral Indicator	Girls (*n* = 343) *M* (*SD*)	Boys (*n* = 439) *M* (*SD*)	Statistical Comparison
Responsiveness	0.82 (0.39)	0.77 (0.42)	$\chi^2(1, N = 782) = 3.36$, $p = .067$, $\varphi = .07$
Completion	0.86 (0.34)	0.81 (0.39)	$\chi^2(1, N = 782) = 4.07$, $p = .044$, $\varphi = .07$
Cooperation total	1.68 (0.62)	1.57 (0.72)	$U = 79{,}941.50$, $p = .055$

Note. Responsiveness and Completion are dichotomous indicators (0 = absent, 1 = present). Pearson chi-square analyses use the standard uncorrected χ^2 statistic. φ = Cramér's phi. Cooperation total is a composite score (range 0–2). The Mann–Whitney *U* test (two-tailed) was applied given the ordinal character of the composite variable. *N* = 782 records across 12 sessions. Because repeated observational records were nested within participants, inferential findings should be interpreted cautiously and as descriptive associative patterns rather than independent estimates of behavioral effects.

Discussion

The present study examined associations between repeated participation in structured collective joint music–movement activities and prosocial behavior in preschool children across two complementary levels of analysis. At the full-sample level, participation was not associated with a statistically significant overall change in teacher-perceived prosocial behavior (Cohen's $d = 0.15$). This null finding is consistent with literature documenting conditional and sample-specific prosocial effects of musical engagement (Schellenberg, 2004; Schellenberg et al., 2015), a pattern corroborated by large-scale studies yielding null or inconsistent findings (Alemán et al., 2017; Ilari et al., 2018).

The gender-stratified analyses revealed differentiated patterns across subgroups. Girls demonstrated a statistically significant medium-effect increase across the activity period (Cohen's $d = 0.50$), whereas boys demonstrated negligible change ($d = -0.04$). The between-group effect magnitude increased from pre- ($d = 0.32$) to post-assessment ($d = 1.09$) despite the absence of a significant baseline difference. Consistent with developmental evidence of greater female responsiveness to affiliative and cooperative contexts at preschool age (Eisenberg & Fabes, 1998; Hastings et al., 2007),

the stronger pattern observed among girls may tentatively reflect differential alignment between synchronized collective music-making and socioemotional orientations more characteristic of girls at

this developmental stage, or differential sensitivity to relational cues embedded in shared musical coordination (Cirelli et al., 2014; Rabinowitch et al., 2013). These explanations remain speculative; the observed gender differences should be regarded as exploratory findings warranting replication rather than established regularities.

At the behavioral level, the joint-action task data revealed consistently high cooperative engagement, with a statistically significant gender difference for task completion ($\varphi = .07$) and directionally consistent, though non-significant, patterns for responsiveness and composite cooperation. The directional consistency across all indicators, combined with the QSPBPCH findings, strengthens the credibility of the gender-differentiated pattern as an empirical signal. The QSPBPCH captures stable, multi-contextual prosocial dispositions as perceived by adults (Author, 2021), whereas the joint-action task indexes situationally specific cooperative responding (Kirschner & Tomasello, 2010); their convergence across methodologically distinct measures carries interpretive weight despite modest effect magnitudes.

The theoretical framework of Kirschner and Tomasello (2010) provides the most directly relevant interpretive reference point. Their experiment demonstrated that joint music making promoted spontaneous prosocial behavior over and above comparable non-musical interaction, attributing effects to intuitive, affectively grounded responses. Consistent with this account, several domain-general mechanisms may contribute: positive affect facilitating prosocial responding (Thompson et al., 2001); interpersonal synchrony and behavioral mimicry associated with affiliation (Chartrand & Bargh, 1999; van Baaren et al., 2004); and attenuation of self–other boundaries through rhythmic entrainment (Cirelli et al., 2014; Tarr et al., 2014). Furthermore, collective joint music–movement activities sustain shared intentionality—a constant representation of the collective goal of vocalizing and moving together in time (Kirschner & Tomasello, 2010)—which is foundational to cooperative action (Tomasello et al., 2005). Repeated engagement across 12 structured sessions may have provided repeated opportunities for affiliative orientations and coordinated interactional experiences associated with subsequent prosocial expressions in peer contexts.

Taken together, the findings indicate that repeated structured collective joint music–movement activities constitute a socially embedded interactional context whose associations with prosocial functioning in early childhood are conditional and potentially shaped by individual developmental characteristics. The gender-differentiated pattern—medium within-group effect among girls ($d = 0.50$), negligible change among boys ($d = -0.04$), and a large post-assessment between-group difference ($d = 1.09$)—underscores that prosocial effects of collective joint musical engagement are not uniform across the preschool population. Future research employing randomization, active non-musical comparison conditions, and longitudinal multi-informant assessment will be necessary to clarify the conditions under which structured collective joint music–movement activities may be associated with prosocial functioning in early childhood.

Conclusion

The present study investigated associations between repeated participation in structured collective joint music–movement activities and prosocial behavior in preschool children (N = 77) within a naturalistic quasi-experimental design, employing two methodologically distinct outcome measures: the QSPBPCH (Author, 2021), a validated teacher-report instrument assessing perceived prosocial behavior across everyday contexts, and a structured joint-action task adapted from Kirschner and Tomasello's (2010) experimental paradigm, yielding 782 observational records of situational cooperative behavior. At the full-sample level, participation in the 8-week structured collective joint music–movement activity sequence was not associated with a statistically significant overall change in teacher-perceived prosocial behavior, $t(76) = 1.34$, $p = .184$, Cohen's $d = 0.15$. This finding is consistent with the broader pattern of conditional and context-dependent prosocial associations documented within the developmental music psychology literature (Alemán et al., 2017; Ilari et al., 2018; Schellenberg, 2004) and further underscores the absence of a universal or deterministic relationship between collective musical engagement and prosocial development during early childhood.

The most substantive empirical contribution resides in the gender-differentiated pattern observed across both outcome measures. Among girls, teacher-perceived prosocial behavior increased significantly from pre- to post-assessment, $t(33) = 2.92$, $p = .006$, Cohen's $d = 0.50$, representing a medium effect, whereas boys demonstrated negligible and non-significant change, $t(42) = -0.27$, $p = .790$, Cohen's $d = -0.04$. Between-group comparisons indicated a small-to-medium gender difference at pre-assessment, Welch's $t(73.10) = 1.42$, $p = .160$, Cohen's $d = 0.32$, increasing to a large significant difference at post-assessment, Welch's $t(74.79) = 4.93$, $p < .001$, Cohen's $d = 1.09$. This pattern was corroborated at the behavioral level: girls were significantly more likely than boys to achieve successful coordinated task completion, $\chi^2(1, N = 782) = 4.07$, $p = .044$, $\varphi = .07$, with directionally consistent but non-significant trends for responsiveness ($\varphi = .07$, $p = .067$) and the composite cooperation score ($U = 79{,}941.50$, $p = .055$). The convergent directionality across two methodologically independent measures strengthens empirical credibility, even as the uniformly small joint-action task effect magnitudes ($\varphi \leq .07$) and the exploratory character of gender-stratified analyses necessitate considerable interpretive restraint.

Theoretically, the findings contribute to a differentiated understanding of conditions under which collective joint music-making may be associated with prosocial functioning in early childhood. Grounded in the frameworks of Kirschner and Tomasello (2010) and Author (2021), the results suggest that structured collective joint music–movement activities constitute socially meaningful interactional contexts whose associations with prosocial behavior are neither universal nor equivalent across population subgroups. The concentration of significant associations among girls—across both dispositional and situational measures—is consistent with evidence for gender-related variability in responsiveness to affiliative and synchrony-based social contexts (Cirelli et al., 2014; Eisenberg & Fabes, 1998; Rabinowitch et al., 2013) and advances the proposition that individual developmental characteristics shape the social consequences of collective musical engagement. From an applied perspective, the findings do not support broad implementation claims but suggest that structured joint music–movement activities may represent a contextually appropriate complement to prosocial

education in preschool settings, particularly when gender-differentiated responsiveness is acknowledged in program design and evaluation.

Limitations and Methodological Considerations

The most consequential methodological limitation is the quasi-experimental design implemented without random assignment and without an active non-musical control condition. The absence of a control group matched for social contact, temporal coordination, shared goals, and verbal interaction precludes the isolation of music-specific effects from those attributable to general shared group participation or repeated social engagement. This distinction is of direct theoretical relevance: Kirschner and Tomasello (2010) employed precisely such a control to establish that joint music making promotes prosocial behavior over and above structurally comparable non-musical activity. Without an equivalent comparison arm, the observed significant findings cannot be causally attributed to the musical features of the activities, and it is not possible to determine whether the null overall effect reflects the absence of a music-specific contribution, the presence of an effect masked by between-group variability, or both. Observed associations should therefore be understood as context-embedded patterns warranting experimental follow-up rather than as evidence of causal influence.

A second limitation concerns the exploratory and post-hoc character of the gender-stratified analyses. Gender stratification was not specified as a primary confirmatory hypothesis prior to data collection, and the gender-differentiated pattern should accordingly be interpreted as exploratory and hypothesis-generating rather than confirmatory. The subgroup sample sizes (n = 34 and n = 43) limit statistical power for detecting small-to-medium effects within each stratum, and the possibility of Type I error associated with multiple subgroup comparisons cannot be excluded in the absence of *a priori* power calculations and alpha correction. The large between-group effect size at post-assessment (Cohen's d = 1.09) should be interpreted cautiously given these modest subgroup sizes; small-sample effect size estimates are susceptible to upward inflation, and corrected estimates (Hedges' g) may be somewhat smaller. Future research should specify gender as a prospectively formulated moderator variable with adequately powered samples.

Third, the primary prosocial outcome relied on teacher-report data capturing perceived rather than directly observed behavior. Although the QSPBPCH (Author, 2021) was completed by teachers with sustained familiarity with each child, providing an ecologically grounded perspective, such instruments remain susceptible to informant-specific perceptions and contextual framing effects that may not fully reflect the frequency or motivational underpinnings of children's actual prosocial behavior. The partial convergence with the behavioral joint-action task data provides a degree of cross-method consistency; however, the small joint-action effect magnitudes ($\varphi \leq .07$) underscore that the two measures tap partially distinct dimensions of prosocial functioning and are not interchangeable.

Fourth, the joint-action task is subject to two interrelated limitations. Cooperative performance within constrained dyadic contexts may not generalize to children's spontaneous prosocial behavior in

naturalistic environments, and task-based indicators should be interpreted as context-specific rather than as generalizable indices of children's prosocial repertoires. Additionally, observational records were nested within individual participants, such that multiple behavioral observations were contributed by the same children across sessions. Consequently, observations cannot be assumed to represent fully independent analytical units, and the applied chi-square and Mann–Whitney analyses do not explicitly model this hierarchical structure. Future studies employing multilevel or repeated-measures modeling would allow more precise estimation of within-child and between-child variability.

Fifth, the activity sequence was implemented by eight regular preschool teachers within routine classroom settings, introducing variability attributable to classroom dynamics, instructional style, and interactional factors difficult to fully standardize. Fidelity monitoring captured structural and procedural dimensions of implementation rather than qualitative aspects of the interpersonal and musical experience, potentially introducing uncontrolled variability in the primary predictor.

Sixth, the sample was drawn from a single administrative region of Slovakia using convenience-based recruitment (N = 77; 34 girls, 43 boys; aged 4–6 years), limiting external validity. The sample does not constitute a probability-based representative sample, and cross-cultural generalizability cannot be assumed given evidence that prosocial development and the social effects of musical engagement are sensitive to cultural context and institutional norms (Alemán et al., 2017; Ilari et al., 2018). Replication in larger, more diverse, and probability-sampled populations is necessary before findings can be considered broadly generalizable.

Finally, the multidimensional composite structure of the QSPBPCH (Author, 2021; range 0–60; Cronbach's α = .93) limits the analytical precision with which specific prosocial subcomponents can be isolated. It is not possible to determine whether the observed significant increase among girls reflects change across the full spectrum of assessed prosocial dimensions or is concentrated within a specific subcomponent—such as cooperation, empathy, or responsiveness—more proximally linked to the synchrony-based affordances of collective joint music–movement activities. Future research would benefit from subscale-level analyses combined with narrowly targeted behavioral indices to disentangle associations between distinct prosocial processes and specific features of collective joint musical engagement.

Declarations

Compliance with Ethical Standards

Funding: No external funding was received for the preparation of this manuscript.

Conflict of Interest: The authors declare that they have no competing financial or non-financial interests in relation to the research, authorship, or publication of this article.

Ethical Approval: The study was approved by the Research Ethics Committee of the University of .... All research procedures were conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Informed Consent: Written informed consent was obtained from the parents or legal guardians of all participating children prior to data collection.

Data Availability: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contribution

A. Vladimír Fedorko: Conceptualization, Methodology, Investigation, Formal analysis, Visualization, Writing—original draft, Writing—review and editing. B. Martin Dzurilla: Writing—review and editing, Supervision. C. Pavol Brezina: Writing—review and editing, Supervision.All authors read and approved the final manuscript.

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