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by Nofriyandi Nofriyandi

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Martial arts and psychosocial development in primary education: A systematic review of social-emotional learning (SEL)

Herdiansyah[abcde,*], **Herman Subarjah**[cd], **Agus Mahendra**[cd], **Muhammad Nur Alif**[bcd], & **Syaipul Hari Baharuddin**[bcd]

Universitas Pendidikan Indonesia, Indonesia

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ABSTRACT

Background: Social-emotional learning (SEL) competencies are critical for children's academic engagement and psychosocial well-being. Martial arts, which integrate structured practice, ethical instruction, and social interaction, are increasingly implemented in primary education; however, their effects on SEL outcomes in primary-school-aged children have not yet been systematically synthesized. **Objectives**: This systematic review aims to examine the effects of martial arts interventions on emotion regulation, executive function, and empathy among primary school children aged 6–12 years. **Methods**: This systematic review followed PRISMA 2020 guidelines. Literature searches were conducted in Scopus, PubMed, SAGE Journals, SpringerLink, and Emerald Insight up to August 2025. Eligibility criteria were established using the PICOS framework. Nine empirical studies published between 2015 and 2025 were included. Study selection, data extraction, and risk-of-bias assessment were independently performed by two reviewers using Covidence, with RoB 2 applied to randomized studies and the JBI checklist to non-randomized designs. Owing to methodological heterogeneity, findings were synthesized narratively. **Findings/Results**: School-based and curriculum-integrated martial arts interventions were associated with improvements in children's emotion regulation, executive functioning, and empathy. Positive outcomes were most evident in programs incorporating structured practice, reflective or mindfulness-based activities, cooperative learning, and autonomy-supportive pedagogy. Effects varied according to program duration, instructional fidelity, and pedagogical design, with limited or inconsistent findings reported for short-term or extracurricular interventions lacking explicit socioemotional components. **Conclusion**: Martial arts can be an effective pedagogical approach for enhancing SEL-related psychosocial competencies in primary education when delivered through structured, value-based programs. Future studies should prioritize standardized curricula, robust experimental designs, and longitudinal follow-up to determine the sustainability of intervention effects.

Keywords: Social-emotional learning; martial arts; psychosocial development; primary education

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Corresponding Author: Herdiansyah, Department of Sport Education, Postgraduate School, Universitas Pendidikan Indonesia, Bandung, Indonesia
herdiansyah@upi.edu

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INTRODUCTION

In today's era of globalization, the development of elementary school children involves not only cognitive competencies but also psychosocial skills that support academic success and overall well-being. The World Health Organization emphasizes that well-being must be viewed holistically, integrating physical, emotional, and social dimensions within environments that promote empowerment, inclusion, and resilience (WHO, 2024). Consistent with this perspective, the Collaborative for Academic, Social, and Emotional Learning (CASEL) identifies core SEL competencies—emotional regulation, social awareness, relationship skills, and responsible decision-making—as foundational for children's mental health and school adjustment (CASEL, 2020; Domitrovich et al., 2017).

However, rapid digitalization, declining physical activity, and increasing academic pressure have reduced opportunities for direct peer interaction, thereby making it harder for children to develop emotion regulation and social connectedness (Schmidt-Persson et al., 2024; Twenge & Campbell, 2018). Primary education is a critical developmental period during which children learn to regulate emotions, collaborate with peers, and build foundational self-control skills (Herdiansyah et al., 2024; Kaspar & Massey, 2023). As a result, schools require pedagogical approaches that combine movement, social interaction, and structured, value-based learning—elements increasingly recognized in martial arts education (Giardullo et al., 2024; Pinto-Escalona et al., 2024).

Martial arts, particularly Taekwondo, Karate, and Judo, provide structured environments in which children can cultivate discipline, perseverance, and self-regulation. These activities typically involve routines that require attentional control, emotional restraint, and respectful interactions with partners (Cho et al., 2018; Potoczny et al., 2022). Within the SEL framework, martial arts align with key competencies, including self-management, social awareness, and responsible decision-making, through techniques such as breath control, cooperative drills, and rule-based instruction. These features also resonate with Self-Determination Theory (Deci & Ryan, 2000), which posits that autonomy, competence, and relatedness support prosocial motivation and adaptive self-regulation—mechanisms commonly embedded in school-based martial arts programs.

Although research has increasingly demonstrated positive psychological and behavioral outcomes associated with martial arts participation, most studies have focused on adolescents, physical fitness, competitive performance, or aggression reduction (Lafuente et al., 2024; Pereira et al., 2022; Piepiora, 2025). Only a limited number of empirical studies have examined how martial arts contribute to specific SEL domains—such as emotion regulation, empathy, and executive functioning—among elementary school-aged children (Kozdras, 2019; Lima et al., 2017; Ng-Knight et al., 2022). Yet these studies are scattered, vary widely in methodological quality, and have not been systematically synthesized, making it difficult to draw clear conclusions for educational practice.

Despite growing evidence on the role of martial arts in youth development, systematic reviews focusing specifically on primary school-aged children within a social-emotional learning (SEL) framework remain scarce. Moreover, many discussions of SEL do not explicitly link its core competencies to martial arts pedagogy, leaving limited clarity on how value-oriented, movement-based practices may foster children's emotional and social growth (Alif et al., 2024; Krettenauer & Curren, 2020; Martinkova et al., 2019). To date, no systematic review has synthesized martial-arts interventions specifically mapped onto SEL frameworks among primary school populations, leaving unclear how these programs influence core SEL domains such as emotion regulation, empathy, and executive functioning. Therefore, this review aims to synthesize and evaluate empirical evidence on how martial arts influence emotional regulation, empathy, and executive functioning within primary education settings.

METHOD

Review Design

This study employed a systematic review approach to synthesize empirical evidence on the effects of martial arts on the psychosocial development of elementary school children. Psychosocial development was operationalized through the Social-Emotional Learning (SEL) domains of emotional regulation, empathy, and executive functioning, which served as the primary analytical focus of the review. The review process

followed the PRISMA 2020 reporting standards to ensure methodological transparency. Although this review was not preregistered in PROSPERO or OSF, methodological procedures were predefined and reported in accordance with the PRISMA 2020 checklist (Page et al., 2021).

Eligibility Criteria

The eligibility criteria for this review were structured using the PICOS framework to ensure methodological clarity and alignment with the review question (Higgins et al., 2019). Although PICOS includes a Comparison element, comparator conditions were recorded descriptively when present but were not used as inclusion criteria (Methley et al., 2014).

Table 1. Article Selection Criteria

PICOS Element	Description	Inclusion Criteria	Exclusion Criteria
Population (P)	Target participants or sample characteristics.	Elementary school children aged 6–12 years. Typically developing children in school or educational settings.	Children outside the 6–12 age range. Clinical populations or children with special needs (if exclusively targeted). Adolescents or adults.
Intervention (I)	Type of intervention or program examined.	Martial arts programs (e.g., Taekwondo, Karate, Judo, Aikido, Pencak Silat). Programs incorporating physical, behavioral, or SEL-related components.	Interventions not involving martial arts. Programs focused purely on competitive performance or elite training. Physical activities unrelated to martial arts.
Comparison (C)	Comparator condition.	Any comparator (e.g., no intervention, PE classes, waitlist, alternative activities). Comparator not required as an inclusion criterion.	None (comparison type not used to exclude studies).
Outcomes (O)	Primary outcomes relevant to SEL and psychosocial development.	SEL or psychosocial outcomes, including: emotional regulation, empathy, executive functioning.	Studies not reporting SEL or psychosocial outcomes. Outcomes limited to physical fitness, motor skills, or injury-related measures.
Study type (S)	Eligible methodological designs and publication characteristics.	Empirical quantitative studies (experimental, quasi-experimental, cross-sectional). Full-text accessible. Written in English. Published between January 2015 and July 2025. Studies meeting minimum quality appraisal standards (JBI or RoB2).	Non-empirical, qualitative-only studies or unpublished theses. Inaccessible full text. Non-English studies. Published outside January 2015 or July 2025. Not meeting quality appraisal thresholds.

Information Sources

A comprehensive search was conducted across five multidisciplinary databases: Scopus, PubMed, SAGE Journals, SpringerLink, and Emerald Insight. In line with PRISMA 2020 recommendations, additional manual searches were conducted by tracking citations in included studies and their reference lists. Although ERIC, PsycINFO, and Web of Science were excluded due to access restrictions, multidisciplinary databases were selected to maximize coverage and mitigate retrieval bias. Nevertheless, readers should interpret the findings with caution, as some relevant unpublished or education-focused studies may not have been captured.

Search Strategy

The search strategy integrated broad and specific keywords related to martial arts and psychosocial development, particularly SEL domains, in primary education settings. The term "martial arts" was used as the primary descriptor and was combined with psychosocial and educational terms using Boolean operators (e.g., AND, OR). To increase sensitivity, discipline-specific keywords such as karate, taekwondo, judo, and aikido were included to find studies that mentioned only a particular martial art rather than the general category. The detailed search strings for each database are shown in Table 2. All database searches were conducted on August 3, 2025.

Table 2. Search Results Based on Keywords Used in The Scopus and Pubmed Databases.

Databases	Keywords	Publication Years	Article Type
Scopus, PubMed, Sage Journals, SpringerLink, Emerald.	("martial arts" OR karate OR judo OR taekwondo OR aikido) AND (psychosocial OR "psychosocial development" OR "social-emotional learning" OR SEL OR "emotional regulation" OR "self-regulation" OR "executive functioning" OR empathy OR "social skills" OR resilience OR "prosocial behavior") AND (children OR pupils OR students OR "primary education" OR "elementary school").	2015-2025	Peer-Reviewed. Empirical Studies.

Study Selection

The search retrieved 534 records, which were screened following PRISMA 2020 guidelines. Duplicates were removed, and the remaining articles were initially screened by title and abstract according to the eligibility criteria shown in Table 1. Studies meeting these criteria were then reviewed in full text to assess their suitability for inclusion. Covidence supported the screening and study management process, with two reviewers independently conducting all stages. Discrepancies were resolved through discussion, and when necessary, a third reviewer provided clarification to maintain methodological rigor. In addition to database screening, manual reference screening was conducted by reviewing the reference lists of all included studies to identify any additional relevant publications; no automated citation-tracking tools were used. The final set of studies meeting the inclusion criteria is shown in the PRISMA flow diagram.

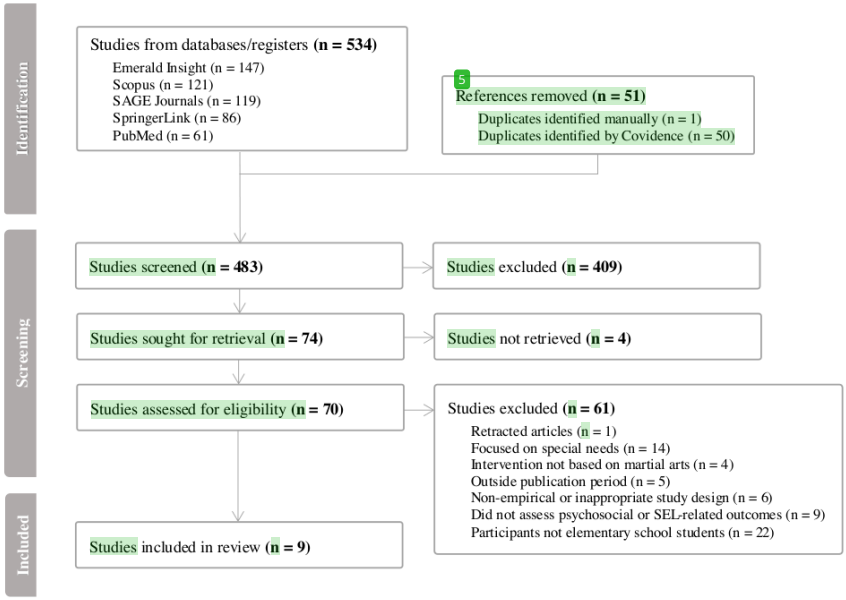

Figure 1. Diagram of the Study Screening Procedure

Risk of Bias Assessment

To ensure methodological rigor, the quality of the included studies was appraised using tools appropriate to each study design: the Cochrane Risk of Bias 2 (RoB 2) tool for randomized and cluster-randomized controlled trials, and the Joanna Briggs Institute (JBI) Checklist for Quasi-Experimental Studies for non-randomized and cross-sectional research (Sterne et al., 2019; Tufanaru et al., 2017).

Table 3. Methodological Quality Appraisal of Included Studies

Study (Year)	Appraisal Tool Used	Key Quality Indicators (summary of main domains)	Overall Risk of Bias / Study Quality
Lafuente et al. (2024).	JBI Checklist	Non-standardized club-based interventions; minimal control for confounding; outcome measures consistent but limited follow-up analysis.	High risk of bias (Low quality).
Giardullo et al. (2024).	JBI Checklist	No randomization; single group comparison; small sample; self-report outcomes; statistical analysis limited; reliability not reported.	High risk of bias (Low quality).
Ju et al. (2018).	JBI Checklist	Clear intervention–outcome relationship; control group included; same measurement pre–post; reliable eye-tracking methods; analysis appropriate.	Moderate quality.
Kozdras (2019).	JBI Checklist	Cause–effect sequence less clear; control group present; same outcome measure (QAACE); reliable instrument; statistical test appropriate.	Moderate quality.
Lima et al. (2017).	JBI Checklist	Clear cause–effect sequence; control group similar at baseline; pre–post comparison valid; reliable cognitive tests (Stroop, RT); appropriate ANOVA analysis.	Moderate quality.

Study (Year)	Appraisal Tool Used	Key Quality Indicators (summary of main domains)	Overall Risk of Bias / Study Quality
Montero-Carretero et al. (2021).	RoB 2	Allocation procedure not randomized but controlled; pre–post measures reliable; minimal attrition; outcomes assessed objectively (motivation, bullying).	Moderate risk of bias.
Ng-Knight et al. (2022).	RoB 2	Random sequence and cluster allocation described; intention-to-treat analysis applied; objective outcome (Flanker task); low attrition; clear reporting of all results.	Low risk of bias (High quality).
Pinto-Escalona et al. (2024).	RoB 2	Large-scale multi-site RCT; pre-registration and protocol adherence; appropriate statistical analysis; low missing data; cluster effects addressed.	Low risk of bias (High quality).
Roh et al. (2018).	RoB 2	Randomization process adequately described; no concealment reported; small sample; outcome measures objective but no blinding of assessors; minimal missing data.	Moderate risk of bias.

The methodological quality of the included studies was predominantly moderate, with several high-quality randomized trials providing robust causal evidence. Studies rated as moderate or low quality generally lacked randomization, standardized intervention protocols, or blinding of assessors. Despite these limitations, the collective evidence remains consistent across study types, supporting the positive impact of martial arts interventions on children's emotion regulation, executive functioning, and empathy.

Data Extraction

Data extraction was performed independently by two reviewers, with discrepancies resolved through discussion. Extracted information included study characteristics (authors, year, country, sample size, and participant age), intervention features (martial arts discipline, delivery format, instructional approach, duration, and session frequency), and study design (RCT, quasi-experimental, or cross-sectional). Outcomes relevant to the three SEL domains, emotion regulation, executive functioning, and empathy, were recorded alongside the measurement instruments used in each study. Key quantitative findings, including effect directions and significance levels, were extracted to support the narrative synthesis. Pedagogical and contextual attributes, such as value-based instruction or autonomy-supportive teaching elements, were also captured when reported. Risk-of-bias indicators derived from RoB 2 or JBI assessments were included to contextualize the strength of the evidence across studies.

Data Synthesis

Given the diversity of study designs, intervention formats, outcome measures, and statistical methods across the included studies, a narrative synthesis was employed. This approach allowed for the systematic organization, comparison, and interpretation of findings without requiring statistical pooling (Lisy & Porritt, 2016; Strain et al., 2024). The synthesis was conducted in several stages. First, key study characteristics, such as sample demographics, martial arts modality, intervention duration, and SEL-related outcomes, were extracted and summarized to provide a comparative overview. Second, the reported effects were examined and grouped according to the three primary SEL domains defined in this review: emotion regulation, empathy, and executive functioning.

RESULTS AND DISCUSSIONS

A total of nine studies published between 2015 and 2025 met the inclusion criteria and were included in this review. Collectively, the evidence demonstrates that martial arts interventions implemented in school or structured extracurricular settings contribute positively to three SEL-aligned psychosocial domains in primary-school-aged children: emotion regulation, executive function, and empathy. Although effect sizes and methodological strength vary across studies, the convergence of findings across RCTs and quasi-experiments indicates that martial arts offer a pedagogically meaningful context for cultivating discipline, attentional control, and prosocial behavior.

Table 4. Characteristics of Selected Research

Author (year)	Country	Type of MA	Instructional approach/key features	Age	Design & participants (n/group/duration)	Main findings
Lafuente et al. (2024).	Spain.	Judo and Karate (extracurricular, modern & traditional types).	Extracurricular club practice; program heterogenous across clubs (less standardisation).	9-12 years	Quasi-experimental longitudinal study (6 months); control vs. experimental groups.	Martial arts training (karate and judo) in sports clubs did not significantly reduce children's anger levels overall. Small effects were found only in specific anger components (anger-in and anger-out). Traditional programs emphasizing kata, philosophy, and meditation were noted in literature to have more impact. Non-specific, club-based interventions had minimal effects on anger management.
Giardullo et al. (2024).	Italy.	Karate (Game-based/Playful & Participatory Approach).	Playful/game-based Karate (Karate Game) integrating ethical principles; high instructor support and interactive tasks.	8-10 years.	Quasi-experimental educational intervention; 34 participants; ≈8 weeks (Karate Game); questionnaire-based evaluation + Chi-square test.	The "Karate Game" approach significantly enhanced children's motor perception, teamwork, and social interaction. 94.1% of participants reported high satisfaction and enjoyment. Significant correlations were found between teamwork improvement and overall satisfaction ($p = 0.006$). The method effectively promoted emotional engagement, collaboration, and martial arts values (respect, integrity, honor). The study highlights the value of playful, participatory karate instruction for holistic child development.
Ju et al. (2018).	Taiwan.	Combat Sports (Karate-based program).	Visuomotor/technical combat training designed by coach & motor specialist.	9-12 years.	Quasi-experimental pre–post design; 56 primary school students (30 CS group, 26 control); 8-week intervention, 2×40-min sessions/week.	The karate-based combat training significantly improved visuomotor coordination in children. Participants showed earlier saccade onset latency (primary and secondary), indicating faster visual

Author (year)	Country	Type of MA	Instructional approach/key features	Age	Design & participants (n/group/duration)	Main findings
						motor reaction and gaze control compared to the control group. Both groups improved general motor response times, but the combat training group showed superior enhancement in visual tracking efficiency. The program was particularly beneficial for developing perceptual motor integration and may support children with low motor coordination or developmental coordination disorder.
Kozdras (2019).	Poland.	Judo.	Long-term judo practice; coach-dependent humanistic/dialogic styles.	8-12 years.	Quantitative comparative (cross-sectional) study; 134 children (67 judo practitioners ≥ 2 years, 67 non-practitioners); QAACE questionnaire; t-test and Kruskal-Wallis analysis.	Children practicing judo for at least two years showed significantly higher empathy levels ($p < .05$) than non-practicing peers, especially in the affective dimension of empathy. Trainer style influenced empathy outcomes instructors emphasizing open dialogue, emotional awareness, and fairness fostered greater empathy. Findings suggest that judo, taught with humanistic values, supports emotional self-regulation, social sensitivity, and moral development in children.
Lima et al. (2017).	Brazil.	Karate.	Regular karate practice; dojo setting.	8-11 years.	Quasi-experimental cross-sectional (ex post facto); 66 children (36 karatekas, 30 non-practitioners); Reaction Time and Stroop Tests; ANOVA 2-way and 3-way.	Karate practitioners showed significantly faster reaction times and better selective attention/conflict resolution than non-practitioners across ages 8–10 ($p < 0.001$). No significant differences were found at age 11. Findings indicate that karate

Author (year)	Country	Type of MA	Instructional approach/key features	Age	Design & participants (n/group/duration)	Main findings
						enhances executive functions, particularly processing speed, attention control, and cognitive flexibility in children. Regular karate practice was associated with earlier maturation of neural and cognitive processes related to motor and perceptual coordination.
Montero-Carretero et al. (2021).	Spain.	Judo.	SDT-informed A-Judo program; PETs received 20 h training; autonomy-supportive teaching emphasized.	11 ± 0.5 years.	Quasi-experimental pilot study; 79 primary school students (40 girls, 39 boys); 10 sessions of 50 min (2×/week for 5 weeks); based on Self-Determination Theory (SDT); measures: Basic Psychological Needs, motivation, tolerance/respect, moral identity, bullying.	The A-Judo program significantly improved basic psychological needs, self-determined motivation, tolerance and respect, and moral identity, while reducing bullying and victimization levels among students. Teacher training (20h) in SDT principles led to more autonomy-supportive teaching styles, enhancing prosocial behavior and school climate. Judo was effective as a pedagogical tool for fostering well-being and moral education in PE settings.
Ng-Knight et al. (2022).	United Kingdom.	Taekwondo.	School-implemented Taekwondo with explicit self-regulation content (reflection, expectancy-value tasks). High acceptability among pupils.	7-11 years.	Randomized field experiment; n≈240 primary pupils; 11-week beginner Taekwondo; multiple sessions (school PE substitution).	Taekwondo significantly improved children's self-regulation, attention control, and emotion regulation. The intervention group showed enhanced executive function and social-emotional outcomes compared to the control group. Mediation analyses revealed that improvements in self-regulation were driven by increased emotional awareness and self-monitoring.
Pinto-Escalona et al. (2024).	Spain, Italy, Chile,	Karate.	Curriculum-integrated program; teacher training; culturally	7-10 years.	Multi-country cluster RCT; n≈721 children; 1-year	A year-long school-based karate intervention improved

Author (year)	Country	Type of MA	Instructional approach/key features	Age	Design & participants (n/group/duration)	Main findings
	UK, and Poland (multi-country).		adapted Karate Mind & Movement (pedagogical guidance for PE teachers).		Karate Mind & Movement (PE replacement).	children's psychosocial functioning particularly social skills and behavioral adjustment compared to control groups. No significant gains were found in academic achievement or overall fitness, though some subgroups showed fitness improvements. The study highlighted the importance of program structure, duration, and cultural adaptation in maximizing psychosocial outco[56].
Roh et al. (2018).	South Korea.	Taekwondo.	Traditional Taekwondo curriculum with explicit social skills emphasis; group drills and instructor-led discipline/morale teaching.	8-12 years.	Randomized controlled pilot; n=30 (15 TG / 15 CG); 12–16 weeks; 60 min/session (school/community).	The study examined the effects of a 12-week Taekwondo intervention on children from multicultural f[5]ilies. Results showed significant improvements in mood state (reduced tension, depression, and anger) and enhanced[52] sociability compared to the control group. The authors concluded that structured Taekwondo training fosters positive emotional regulation and social adaptation in children, especially those from diverse cultural backgrounds.

Emotion Regulation

The reviewed studies consistently demonstrate that martial arts interventions positively affect children's emotion regulation, a key SEL competency within the CASEL (2020) framework that includes impulse control, emotional modulation, and stress management. Evidence from randomized controlled trials shows that programs combining structured physical activity with [2]eflective or mindfulness-based components produce the greatest improvements in emotiona[22]egulation (Ng-Knight et al., 2022; Pinto-Escalona et al., 2024). These pedagogical strategies align with Social Learning Theory, which suggests that children learn emotional control by observing and imitating instructors who demonstrate calmness, respect, and disciplined behavior (Bandura & Walters, 1977).

Neuropsychological perspectives further support these findings. Repeated practice of rule-based martial arts sequences has been shown to activate prefrontal regulatory systems responsible for inhibitory control, thereby improving children's ability to regulate emotional responses (Diamond, 2013). In addition, Self-Determination Theory (Deci & Ryan, 2000) suggests that autonomy-supportive instructional styles such as reflective dialogue, opportunities for self-paced progression, and constructive feedback enhance intrinsic motivation for self-regulation. Overall, these mechanisms indicate that emotional benefits arise from the combination of structured motor practice, value-based modeling, and supportive teaching environments.

Table 5. Comparison of Emotion Regulation Findings

Author (year)	Main emotion regulation result (effect size / p)	Practical implications for SEL & schools
Lafuente et al. (2024).	Mixed/small effects: some reductions in anger subscales (STAXI-NA) but not universal; gender differences reported (stronger in boys).	Extracurricular MA may reduce trait anger when programs are standardized and include values training schools should ensure standardized pedagogy or prefer curriculum-embedded models.
Giardullo et al. (2024).	High participant satisfaction; significant increases in perceived social interaction and teamwork (χ^2 tests; p=0.006). Emotional engagement increased (self-report).	Playful, participatory MA versions are feasible for PE lessons to boost engagement and social interaction good for short-term SEL goals
Ju et al. (2018).	Improved visuomotor timing (earlier saccade onset); emotion measures not central no direct mood changes reported.	Useful for visuomotor and attentional capacities combine with explicit SEL components for emotion regulation benefits.
Kozdras (2019).	Higher affective empathy among judo practitioners (QAACE); coach teaching style moderated outcomes.	Coach pedagogy strongly moderates empathy outcomes coach training recommended to maximize social-emotional benefits.
Lima et al. (2017).	Karate practitioners faster RT and better Stroop performance at ages 8-10 (indicator of improved cognitive control → related to emotion regulation). Exact p reported.	Evidence suggests cognitive control gains with karate PE programs including karate elements may enhance attention and conflict control.
Montero-Carretero et al. (2021).	Moderate-to-large improvements in tolerance, respect, moral identity and bullying reduction (effect sizes reported in paper).	Teacher training + autonomy-supportive delivery is key train teachers and monitor teaching style to transfer SEL benefits.
Ng-Knight et al. (2022).	Improved attentional control (Flanker task) and reduced conduct problems; mediation via expectancy/value for self-regulation (statistical mediation reported). Specific p/d reported in article.	Strong evidence for school-based short course (≈11 wks) improving attentional regulation recommend integrating as targeted SEL module with fidelity monitoring.
Pinto-Escalona et al. (2024).	Small but significant reduction in conduct problems (d ≈ -0.28, p≈0.003) and small improvement in academic achievement (d≈0.16, p≈0.003); no effect on other psychosocial subscales.	Best evidence for long-duration, curriculum-embedded MA: implement via PE curricula with teacher training and 1-year exposure for stable behavioural gains.
Roh et al. (2018).	Significant improvements in mood (↓ tension, ↓ depression; ↑ vigor) and sociability vs control. Exact p reported in paper; sample small so effects preliminary.	Pilot RCT suggests even low-dose, well-structured MA can improve mood/sociability pilot evidence supports small-scale school implementations with evaluation.

Despite these positive trends, results vary across studies due to differences in methodological rigor and program implementation. Only four of the included studies employed randomized or cluster-randomized designs (Roh et al., 2018; Ng-Knight et al., 2022; Pinto-Escalona et al., 2024; Montero-Carretero et al., 2021), providing stronger causal evidence. In contrast, quasi-experimental and cross-sectional studies with small samples or limited control conditions (Giardullo et al., 2024; Lafuente et al., 2024) often reported modest or inconsistent effects. These differences indicate that emotional outcomes are sensitive to program fidelity, duration, and the explicit integration of emotion-focused components.

As shown in Table 5, the greatest improvements in emotion regulation were observed in school-based or curriculum-integrated programs that explicitly taught self-regulatory strategies. Ng-Knight et al. (2022)

reported improved attentional control and reduced conduct problems after an 11-week Taekwondo program, while Pinto-Escalona et al. (2024) showed decreases in conduct difficulties across a large multi-country sample. Pilot experimental research by Roh et al. (2018) supported these results, indicating reductions in tension and depressive symptoms among children involved in Taekwondo training. Conversely, extracurricular or short-term interventions without standardized SEL components, such as those studied by Lafuente et al. (2024) and Giardullo et al. (2024), yielded limited or inconsistent emotional outcomes.

Overall, the converging evidence shows that martial arts interventions can meaningfully support children's emotional self-regulation when delivered through structured, SEL-informed pedagogies. Programs integrated into the school curriculum and facilitated by trained instructors appear particularly effective in helping primary school students develop consistent, transferable emotional-regulation skills.

Executive Function

The evidence reviewed shows that martial arts interventions consistently support the development of executive functions (EF), including inhibitory control, working memory, and cognitive flexibility. Within the CASEL (2020) framework, these skills are part of responsible decision-making, which involves attention regulation and behavioral control. Programs incorporating kata, poomsae, or other structured technical sequences seem especially effective because they require sustained focus and goal-oriented motor planning, reflecting embodied cognition principles where motor patterns strengthen cognitive organization (Lima et al., 2017).

From a social learning perspective, martial arts environments offer repeated opportunities for children to observe and imitate disciplined, goal-oriented behaviors modeled by instructors and peers (Bandura & Walters, 1977). At the same time, autonomy-supportive teaching climates such as those implemented in the A-Judo program enhance intrinsic motivation and engagement, thereby fostering stronger EF (Montero-Carretero et al., 2021; Deci & Ryan, 2000). These combined mechanisms help explain why longer, curriculum-based martial arts programs tend to produce more lasting improvements in EF than shorter or unstructured extracurricular programs.

The magnitude of EF improvements varies according to program duration, frequency, and instructional fidelity. Interventions lasting at least 12 weeks and delivered two or more times per week consistently show stronger effects (Lima et al., 2017; Giordano et al., 2021), whereas shorter or less structured programs yield mixed or minimal outcomes (Ju et al., 2018). Notably, Lima et al. (2017) found that children practicing Karate outperformed controls on reaction time and Stroop tasks, indicating better selective attention and conflict monitoring.

These findings support developmental research indicating that primary school years are a critical period for EF development (Best & Miller, 2010). Martial arts' combination of rule-based structure, attentional challenges, and moral reasoning appears to provide an ideal developmental stimulus, fostering neural changes linked to self-regulation (Lakes & Hoyt, 2004; Yao et al., 2021). When implemented within school settings, these programs also increase equitable access and strengthen SEL goals related to self-management and responsible decision-making (Krettenauer & Curren, 2020; Vasconcellos et al., 2020).

Nevertheless, methodological variability across studies warrants caution. While several RCTs provide strong causal evidence for EF benefits (Roh et al., 2018; Ng-Knight et al., 2022; Pinto-Escalona et al., 2024; Montero-Carretero et al., 2021), many quasi-experimental and cross-sectional studies lack rigorous controls, limiting generalizability. Standardized EF measures (e.g., Stroop, Flanker, Tower of London, N-back) and longitudinal follow-ups are needed to strengthen future findings. Overall, the consistent results suggest that martial arts improve executive-function capacities by combining cognitive-control demands, structured motor routines, and reflective learning within cohesive pedagogical interventions.

As shown in Table 6, the most consistent improvements involve inhibitory control, attentional regulation, and academic performance, driven by repetitive rule-based practice that activates prefrontal and attentional networks associated with self-regulation (Diamond, 2013; Johnstone, 2021). Programs that incorporate mindfulness, response-inhibition exercises, and sequential form practice, such as *kata* or *poomsae*, demonstrate particularly strong outcomes, consistent with embodied cognition theories (Diamond & Ling,

2020; Vazou et al., 2020). In contrast, brief or poorly structured interventions tend to produce limited or inconsistent effects, highlighting the importance of program fidelity and sufficient exposure for meaningful EF gains.

Table 6. Comparison of EF Findings

Author (year)	Main EF result (effect size / p)	Practical implications for SEL & schools
Lafuente et al. (2024).	Minor improvements in anger regulation; no EF-specific outcomes .	Limited EF outcomes; underscores need for explicit cognitive aims.
Giardullo et al. (2024).	↑ Perceived motor control & social coordination p = .006 (χ^2 test).	Suggests improvement in cognitive-motor planning and working memory through playful engagement.
Ju et al. (2018).	Improved visuomotor coordination; earlier saccade onset latency ($p < .05$).	Enhanced visuomotor attention; supports embodied EF training in PE.
Kozdras (2019).	Higher empathy; EF not measured directly.	Coach's pedagogy may indirectly strengthen attentional and moral EF.
Lima et al. (2017).	Karate group faster reaction time & better Stroop performance (p < .05).	Demonstrates improved inhibition & attentional flexibility suggestive neural benefits from repetitive cognitive-motor demands.
Montero-Carretero et al. (2021).	↑ Motivation & tolerance, ↓ bullying; indirect EF improvement via self-determined behavior.	Motivation-driven EF improvement via moral decision-making; supports SDT integration.
Ng-Knight et al. (2022).	↑ Executive attention (Flanker task, $p < .01$); mediation by expectancy-value beliefs.	Strongest evidence of EF enhancement via attention and motivation mechanisms; supports school-based SEL.
Pinto-Escalona et al. (2024).	↑ Academic achievement (d = 0.16, $p = .003$); ↓ conduct problems (d = -0.28, $p = .003$).	Year-long structured Karate fosters cognitive control & academic EF transfer; scalable in formal PE curriculum.
Roh et al. (2018).	↑ Cognitive function & academic self-efficacy ($p < .05$).	Demonstrates small-sample evidence linking MA to EF and motivation.

Empathy

Studies indicate that martial arts interventions have significant potential to enhance empathy and prosocial behavior in primary-school-aged children—core components of social awareness and relationship skills within the CASEL (2020) framework. Programs that explicitly incorporate moral reasoning, cooperative partner activities, and instructor-modelled ethical behavior tend to achieve the strongest outcomes, consistent with Social Learning Theory, which states that children learn prosocial behavior through modeling, guided participation, and reinforcement in social settings (Bandura & Walters, 1977).

Motivational processes also play a crucial role. When instructors adopt autonomy-supportive teaching methods, children experience a stronger sense of relatedness and competence, two psychological needs central to Self-Determination Theory (Deci & Ryan, 2000). These environments encourage children to reflect on peers' emotions, collaborate during paired exercises, and internalize values such as respect, compassion, and fairness. Traditional martial arts philosophies, including concepts such as *rei*, *do*, and *bushido*, further strengthen empathic tendencies by fostering moral reflection and the development of prosocial identity (Cynarski, 2017; Martinkova et al., 2019). Therefore, empathy develops not just through physical techniques but through pedagogical designs that combine value-based teaching, cooperative learning, and ethical modeling.

As summarized in Table 7, the most apparent empathy-related benefits were seen in programs that intentionally included ethical instruction and cooperative practice. Studies by Montero-Carretero et al. (2021) and Pinto-Escalona et al. (2024) reported significant improvements in tolerance, respect, and prosocial behavior. In contrast, long-term judo practice was associated with increased affective empathy. In contrast, interventions lacking socioemotional skills produced mixed results, showing that empathy is not an automatic outcome of martial arts participation but relies on deliberate teaching methods and the instructor's relational style.

Table 7. Comparison of Empathy Findings

Author (year)	Main empathy-related result (effect size / p)	Practical implications for SEL & schools
Lafuente et al. (2024).	Mixed results: no significant global anger reduction; partial improvements in prosocial behavior ($p < .05$ for karate boys).	Club contexts show limited empathy effects; underscores need for structured, SEL-oriented curriculum.
Giardullo et al. (2024).	↑ Cooperation, teamwork, and social perception (χ^2, $p = .006$).	Playful cooperative formats strengthen peer connection and social awareness gateway to empathy development.
Kozdras (2019).	Judo group scored higher on affective empathy (QAACE); $p < .05$.	Demonstrates link between sustained MA participation and empathy; highlights importance of coach relational style.
Montero-Carretero et al. (2021).	↑ Tolerance, respect, moral identity, ↓ bullying ($\eta^2 > .06$); reflects improved social–emotional empathy.	Empathy grows when moral and reflective elements are integrated into instruction; suitable for PE settings.
Ng-Knight et al. (2022).	↑ Self-regulation and attention; secondary effects on peer relations ($p < .05$).	Indirect support that EF and self-regulation mechanisms mediate empathy growth in group contexts.
Pinto-Escalona et al. (2024).	↓ Conduct problems ($d = -0.28$, $p = .003$); trend toward ↑ prosocial behaviour.	Demonstrates school-based MA can enhance behavioural self-control and peer relations.
Roh et al. (2018).	↑ Sociability and mood regulation ($p < .05$) → proxy for social empathy.	Suggests that socially oriented MA can enhance peer affiliation and empathic tendencies in schools.

Note: Only studies from the systematic-review dataset (n = 9) that reported direct or indirect empathy/prosocial outcomes are included here (n = 7). Additional conceptual sources (e.g., Martinkova et al., 2019) are discussed in the narrative section for contextual interpretation.

Overall, the synthesized evidence indicates that martial arts can serve as an effective context for nurturing children's empathy and prosocial skills when delivered through structured, relational, and value-based methods. Programs that incorporate cooperative learning, ethical discussions, and instructor modeling offer valuable opportunities for perspective-taking and emotional connection, reinforcing key SEL competencies related to social awareness and relationship-building.

Implications for Policy and Practice

The findings of this review offer several significant implications for educational policy, curriculum development, and instructional practice. First, martial arts programs should be recognized not merely as physical activities but as structured pedagogical settings that can promote key SEL competencies in primary education. When intentionally integrated into the physical education curriculum, martial arts can support children's emotional regulation, executive functioning, and empathy by providing opportunities for self-control, cooperative interaction, and ethical reflection.

Second, the effectiveness of martial-arts-based SEL programs largely depends on the quality of instruction. Schools should ensure that teachers or instructors receive proper training in autonomy-supportive pedagogy, value-based methods, and classroom management strategies aligned with Self-Determination Theory and Social Learning Theory. Training modules that emphasize reflective dialogue, constructive feedback, and modeling respectful behavior are crucial for achieving optimal psychosocial outcomes.

Third, curriculum developers should consider integrating structured martial arts units—such as simplified *kata*, *poomsae*, or cooperative drills into national or school-level PE standards. These units ought to include clear SEL objectives, age-appropriate self-regulation practices, and culturally sensitive moral components that align with traditional martial arts philosophies. This approach enhances consistency with CASEL's SEL framework and promotes holistic child development.

Finally, from a policy perspective, school-based martial arts programs can serve as cost-effective, scalable interventions for promoting children's well-being and social adjustment, particularly in diverse or resource-limited settings. Integrating these programs into formal schooling improves equitable access, prevents exclusivity associated with private clubs, and ensures that SEL-oriented pedagogy is implemented with fidelity. Policymakers might therefore view martial arts as a practical component of broader school wellness and SEL initiatives aimed at fostering adaptive behavior, prosocial relationships, and academic readiness.

Limitations of the Review

Although the present review offers a comprehensive synthesis of the psychosocial effects of martial arts interventions in primary education, several limitations should be acknowledged. First, the search strategy did not include databases such as ERIC, PsycINFO, and Web of Science due to access restrictions. Consequently, some education-focused or psychology-based studies may have been missed, potentially narrowing the scope of the available evidence.

Second, the studies included showed significant variation in intervention formats, duration, instructional approaches, and outcome measures. This variability limited the ability to compare findings across studies and prevented conducting a quantitative meta-analysis. Differences in program structure—such as the integration of SEL components, instructor qualifications, or training intensity—also complicate the interpretation of intervention effectiveness.

Third, the methodological quality varied significantly across the reviewed articles. Although several randomized or cluster-randomized trials were identified, many studies employed quasi-experimental or cross-sectional designs with limited control over confounding variables. Small sample sizes, convenience sampling, and inadequate blinding further hinder causal inference and limit the generalizability of the results. Furthermore, many studies relied heavily on self-report questionnaires to assess constructs such as empathy and emotion regulation, which increases the risk of response bias, particularly among young children. Objective behavioral or neurocognitive measures were used inconsistently, reducing the reliability of cross-study comparisons.

In several included studies, the intervention duration was relatively short (e.g., 5-8 weeks), which may be insufficient to produce lasting psychosocial change or to detect long-term developmental effects. The lack of longitudinal follow-up across studies also prevents conclusions about the sustainability of improvements in emotion regulation, executive functioning, or empathy. Taken together, these limitations indicate that the current findings should be interpreted cautiously and underscore the need for more rigorous, standardized, and long-term research designs to strengthen the evidence supporting martial arts and SEL development in primary-school-aged children.

Future Directions

Future research on martial arts interventions in primary education should prioritize more rigorous, standardized designs to strengthen the evidence base regarding their psychosocial effects. Large-scale randomized or cluster-randomized controlled trials are needed to establish clearer causal relationships, especially regarding emotion regulation, executive functioning, and empathy. These studies should include sufficient sample sizes, robust control conditions, and transparent reporting to enhance replicability and minimize bias.

Second, researchers should develop standardized, SEL-oriented martial arts curricula that outline key components, including reflective dialogue, cooperative tasks, mindfulness practices, and structured technical routines. Standardization would enable more explicit comparisons across interventions and help identify the active pedagogical elements that influence psychosocial outcomes. Third, future studies should employ multi-method assessment approaches that extend beyond just self-report measures. Including behavioral tasks, neurocognitive tests, observational coding, and teacher or peer evaluations will enhance measurement accuracy and provide a more comprehensive picture of children's socioemotional development.

Longitudinal research is also crucial for assessing the sustainability of intervention effects. Tracking children's development over months or school years would clarify whether improvements in self-regulation, social awareness, or prosocial behavior persist beyond the intervention and translate into real-world functioning. Additionally, future studies should explore how factors such as gender, cultural backgrounds, training intensity, and teaching methods influence outcomes. Examining these differences would help develop more targeted and culturally sensitive programs. Qualitative or mixed-methods studies could provide deeper insights into children's lived experiences, instructors' perspectives, and classroom dynamics. These approaches would reveal how martial arts influence social-emotional learning and identify contextual features that support successful implementation in school environments.

CONCLUSION

The synthesis of the reviewed studies demonstrates that martial arts interventions can meaningfully enhance children's emotional regulation, executive functioning, and empathy when implemented through structured and value-based pedagogies. Across interventions, programs that combined clear technical routines with cooperative learning, reflection activities, and explicit instruction in respect and self-control tended to produce the strongest social-emotional outcomes. These findings indicate that martial arts serve not only as physical training but also as holistic learning environments in which children develop discipline, emotional balance, and interpersonal sensitivity.

Overall, the effectiveness of martial arts depends largely on instructional quality, program duration, and the extent to which activities are intentionally aligned with social-emotional learning goals. School-based and curriculum-integrated programs, particularly those delivered consistently over multiple weeks, demonstrated more reliable outcomes than short-term or competition-oriented formats. These patterns highlight the potential of martial arts to foster children's self-awareness, cooperation, and behavioral regulation within primary education settings.

Given these benefits, martial arts hold practical value for educational planning. Programs facilitated by trained instructors who model respectful behavior and encourage autonomy can support children's motivation and social development. Integrating martial arts into the primary physical education curriculum may therefore serve as an effective and culturally adaptable tool for promoting holistic child development. Although the evidence is promising, several limitations must be acknowledged, including small sample sizes, varied study designs, and limited long-term follow-up. Future research should employ more rigorous experimental methods and consistent program standards to clarify the durability of effects over time. When thoughtfully designed and ethically delivered, martial arts education offers a meaningful approach to nurturing children's emotional, cognitive, and social growth, extending beyond physical skill acquisition.

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CONFLICT OF INTEREST

The authors affirm that no conflicts of interest are associated with the publication of this manuscript.

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