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The Impact of Physical Education on Preschoolers` Social and Emotional Competencies: A Systematic Review of Randomized Controlled Trials

El impacto de la educación física en la competencia social y emocional de niñas y niños de edad prescolar: una revisión sistemática de ensayos controlados aleatorios

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Abstract

Introduction: Due to different psychological problems during adolescence, developing social and emotional competencies from early childhood could be of special interest. The purpose is to analyse those preschool-based Physical Education (PE) intervention programs that have evaluated their effects on preschoolers' emotional and social competencies evaluated through randomized controlled trial design.

Method: A systematic review of relevant articles was performed using PubMed, Web of Sciences, and ProQuest Central on January 24, 2024.

Results: From 113 studies initially found, 12 were included in the qualitative synthesis. Included studies have shown that programs developed during preschool`s PE are effective for improving social and emotional competencies.

Conclusions: Working in pairs or small groups, as well as structured play, has demonstrated positive effects to enhance social competence. On the other hand, multicomponent-based activities (suggestions and activities such as role-playing) for improving self-regulation skills, planned and instructor-led exercises meant to enhance self-control, the combination of exercise-based interventions with mindfulness for improving emotional well-being and playfulness, and programming interactive lessons and support for the application of socio-emotional competency are encouraged.

Keywords: early childhood, intervention programs, psychomotricity, social competence, emotional competence.

Resumen

Introducción: Debido a los diferentes problemas psicológicos que se presentan durante la adolescencia, el desarrollo de las competencias social y emocional desde los primeros años de vida podría ser de especial interés. El objetivo es analizar los programas de intervención de Educación Física (EF) en Educación Infantil que han evaluado, mediante ensayos controlados aleatorios, sus efectos en las competencias social y emocional.

Método: Se realizó una búsqueda sistemática el 24 de enero de 2024, utilizando las bases de datos de PubMed, Web of Sciences y ProQuest Central.

Resultados: De los 113 estudios inicialmente encontrados, 12 se incluyeron en la síntesis cualitativa. Los estudios mostraron que los programas basados en EF en Educación Infantil son efectivos para mejorar la competencia social y emocional.

Conclusiones: El trabajo en parejas o grupos pequeños, así como el juego estructurado, ha demostrado tener efectos positivos en la mejora de la competencia social. Por otro lado, las actividades multi-componentes (recomendaciones y actividades como juegos de rol) para mejorar las habilidades de autorregulación, los ejercicios planificados y dirigidos por el instructor para mejorar el autocontrol, la combinación de intervenciones basadas en ejercicios con mindfulness para mejorar el bienestar emocional y las ganas de jugar, y la programación de lecciones interactivas y apoyo para la aplicación de la competencia socioemocional son recomendadas.

Palabras clave: infancia, programas de intervención, psicomotricidad, competencia social, competencia emocional.

Introduction

The brain exhibits a capacity for modification throughout the lifespan in response to experiences (Ekerdt et al., 2020; Galván, 2010). This phenomenon, understood as brain plasticity or neuroplasticity, refers to the capacity of the nervous system to undergo change through neural connections. In fact, these experiences could create new synaptic connections that will guide the behaviour of the person experiencing them in the future (Bei et al., 2024; Brault, Foisy, & Duval, 2020). This concepts assume a crucial interest during the first years of a person`s life (Jolles & Jolles, 2021).

In this sense, the preschool years are a critical time for considerable mental development because experiences during this stage help to establish the basic pillars in the formation of the human personality (Medrano Mir, 2023). In fact, the brain development is believed to be characterized by a thriving nature during this time, exhibiting some of its most intricate and dynamic morphological and physiological changes (Ekerdt et al., 2020). For this reason, educational actions in the first years of life should be aimed at stimulating children's cognitive, emotional, language, physical, motor, social, moral and sexual development (Martinez-Merino & Rico-González, 2024; Martín-García & Rico-González, 2023).

In this educational stage, physical education (PE) enables children to learn how to navigate their life experiences by enhancing the four main competencies through play and enjoyment, affecting all subsequent learning process (Constantin, 2021). Thus, PE stimulation can be used to enhance sensory, perceptual, social, and affective motor experiences (Goncalves, 2010; Martinez-Merino & Rico-González, 2024; Martín-García & Rico-González, 2023; Zorrilla-Silvestre et al., 2019). In fact, PE is crucial because it oversees all learning processes, assisting children in comprehending their surroundings and completing tasks with quality outcomes (Cruz & Pottker, 2017). In this scenario, PE teachers try to develop preschool children's four main competencies: social competence (SC), emotional competence (EC), motor competence, and cognitive competence (Martinez-Merino & Rico-González, 2024; Martín-García & Rico-González, 2023). Among them, SC and EC has experienced exponential grown, maybe, because their development have been related, among others, to positive outcomes in academic performance, daily life skills, shaping friends, or prosocial behaviour (Jiang & Shi, 2024; Mu & Du, 2024; Rico-González et al., 2024; Gil-Moreno & Rico-González, 2023; Serrano Sarmiento & Sanz Ponce, 2019).

In this way, scientific literature has analyzed the consequences of persons during their lifespan looking SC and EC-related development, highlighting critical consequences supported by different meta-analytical comparisons. For example, a meta-analysis related, across 148 studies (308,849 participants), the development of social relationships to mortality. The random effects weighted average effect size indicates a 50% increased likelihood of survival for participants with stronger social relationships (Holt-Lunstad et al., 2010). These findings remain with more recent scientific literature, which has continue showing that a lack of positive peer relationships is related to negative effects on children' mental health (Husky et al., 2020; OECD, 2024; Orson et al., 2020; Pollak et al., 2023; Schwartz-Mette et al., 2020), which could suppose a problem since mental health has become a global pandemic (GBD 2019 Mental Disorders Collaborators, 2022). Interestingly, scientific literature has found that these findings remain consistent across age, sex, initial health status, cause of death, and follow-up period (Holt-Lunstad et al., 2010). It is really a critical problem when analysing that these effects could continue through lifespan, In fact, the overall random effect size of another meta-analysis indicate that elderly people with discordant social relationships has a 57% likelihood increase of suicidal ideation (Chang et al., 2017). These ideas reinforced the fact that SC should be a main matter for professionals working in early childhood.

Further, since EC in related to SC, the results of different meta-analysis do not vary through scientific literature. For example, emotional regulation showed where prior self-injurious thoughts and behaviors confer risk for later suicidal thoughts and behaviours (Ribeiro et al., 2016), which remain in children (Richard et al., 2022). In this way, a meta-analysis about emotion dynamics in children and adolescent related emotion dynamics and mental health-related outcomes (Reitsema et al., 2022).

In this way, and considering that a high percentage of pre-schoolers attending preschools or kindergartens, PE in early childhood has been highlighted such an important opportunity to improve SC and EC. In this sense, a recent meta-analysis indicated that the moods of children and adolescents who participate in physical activity significantly improved compared with the moods of those who do not participate in physical activity. The age, exercise type, and exercise duration of adolescents are important factors influencing the positive emotions resulting from physical activity interventions (Li et al., 2022). In this regard, a recent systematic review has highlighted the development of both SC and EC as a central role in preventing bullying (Rico-González et al., 2024).

However, to the best of the author's knowledge, no systematic review about randomized controlled trials (RCTs) has been published where the authors analyze how PE impact on preschoolers' social and emotional development. Thus, the purpose of this systematic review is to provide an overview of the PE-based intervention programs that have been examined in order to provide to teachers at this educational step some programs to being used during the first years of children life aiming to enhance these important competences. In addition, since some teachers in other educational steps have requested more support and formation about these competencies (Martinez Saura et al., 2024), this article could help to implement strategies for improving them.

Method

Experimental Approach to the Problem

A systematic review was performed in accordance using PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Page, McKenzie, Bossuyt, Boutron, Hoffmann, Mulrow, Shamseer, Tetzlaff, Akl, et al., 2021; Page, McKenzie, Bossuyt, Boutron, Hoffmann, Mulrow, Shamseer, Tetzlaff, & Moher, 2021; PRISMA-S Group et al., 2021) and guidelines for conducting systematic reviews in sports sciences (Rico-González et al., 2022). The systematic review was registered on PROSPERO (PROSPERO: CRD420251103693).

Information Sources

A systematic search of three central databases—PubMed, Web of Science, and ProQuest Central—was performed to identify studies published before January 24, 2024.

Search Strategy

The PICO (Patient, Problem or Population – Intervention or Exposure – Comparison, Control or Comparator – Outcome[s]) design was explicitly used to state the question. The search strategy was used in the databases mentioned above. Where possible, the search was limited to scientific studies/journals and language (see exclusion criteria number 6). No lower date limit was applied for publication. The following search terms were used:

> (preschool* OR pre-school* OR kindergarten OR "early childhood") AND (psychomot* OR "physical education" OR play* OR Montessori) AND (emotion* OR "intrapersonal skills" OR "interpersonal skills" OR "adaptation skills" OR "self-regulation" OR social* OR friendship OR socioemotional OR socio-emotional) AND ("randomized controlled trial*")

Selection Process: Inclusion and Exclusion Criteria

The authors followed these steps for performing eligibility criteria:

- Running out the search in each database.
- Identify title, authors, date, and database of each of the included article and download to an Excel spreadsheet (Microsoft Corporation, Redmond, WA, USA).
- Remove duplicates.
- Screen each of the remaining article according to inclusion/exclusion criteria (see the Table 1). In the process, if the two authors disagreed on whether an article should be included or excluded, it was solved through a deep analysis performed by two authors at the same time. This situation appears in two time, and the final decision was to include both studies.

Assessment of study methodology

Using randomly selected intervention group (INT) and control group (CON), the methodological quality of pre-test-post-test studies was evaluated using the Physiotherapy Evidence Database (PEDro) scale. On a scale from 0 (poor methodological quality) to 10 (high methodological quality), the internal study validity is scored. The quality score assigned to each segment ranges from 0 ("no") to 1 ("yes"), contingent upon the number of points earned. The scale has ten measuring components (see Table 2).

Table 1

Inclusion/exclusion criteria of included randomized controlled trials

Item	Inclusion	Exclusion	Coherence with Search Terms
Population	Children attending preschools or kindergartens	Children from other educational stages	preschool* OR pre-school* OR kindergarten OR "early childhood"
Intervention or Exposure	Children enrolled in physical education programs	Children not involved in physical education classes	psychomot* OR "physical education" OR play* OR Montessori
Comparation	No restriction	-	
Outcome[s]	Measures related to social or emotional competence	Variables not related to emotional or social competencies	emotion* OR "intrapersonal skills" OR "interpersonal skills" OR "adaptation skills" OR "self-regulation" OR social* OR friendship OR socioemotional OR socio-emotional
Type of study	Randomized controlled trials	Non-randomized controlled trials	"randomized controlled trial*"
Other criteria	Original studies, written in English or Spanish, that have been evaluated through peer review process	Non peer reviewed studies or studies written in other languages	-

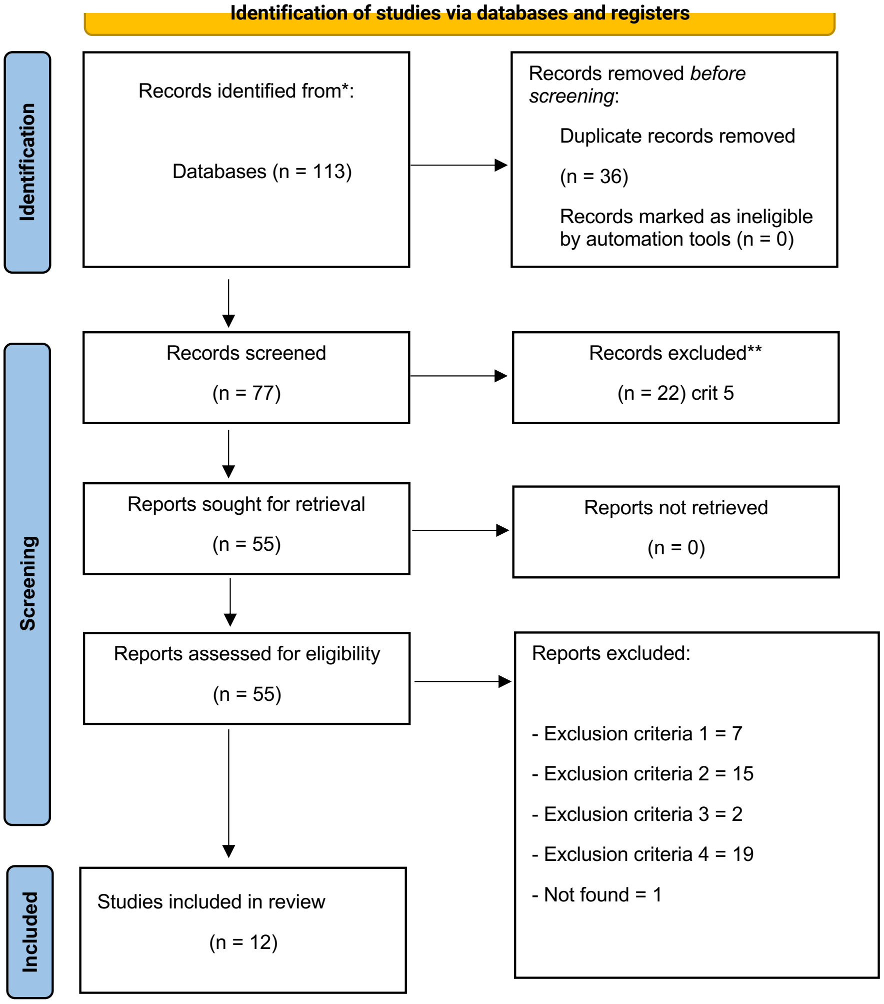
Results

Identification and selection of studies

From the initial 113 articles, the authors reviewed the titles and abstracts of the remaining 77 articles after eliminating 36 duplicates. Out of these, 22 articles were disqualified for not meeting the fifth inclusion criterion. Seven, fifteen, two, and nineteen articles from the remaining fifty-five were discarded because they did not satisfy the first, second, third, and fourth inclusion criteria, respectively. As a result, the qualitative synthesis of the systematic review contained 12 randomized controlled trials (Figure 1).

Figure 1

Studỳ s flow diagram



Quality assessment

The quality assessment for this systematic review can be found in Table 2.

Table 2

Methodological assessment of the included studies

Reference	1	2	3	4	5	6	7	8	9	10	Score
Aadland et al. (2020)	1	0	1	0	0	1	1	1	1	1	7/10
Lee et al. (2020a)	1	1	1	1	1	1	1	1	1	1	10/10
Boyd et al. (2018)	1	1	1	0	0	1	1	1	1	1	8/10
Caldwell et al. (2023a)	1	0	1	0	0	0	1	1	1	1	6/10
Diamond et al. (2019)	1	0	0	0	0	0	1	1	1	1	5/10
Eninger et al. (2021)	1	0	1	0	0	0	1	1	1	1	6/10
Moore et al. (1984)	1	0	0	0	0	0	1	1	1	1	5/10
Lumeng et al. (2017)	1	1	1	0	0	1	1	1	1	1	8/10
Kaale et al. (2012)	1	1	1	1	1	1	1	1	1	1	10/10
Solomon et al. (2018)	1	0	1	0	0	1	1	1	1	1	7/10
Mulvey et al. (2020)	1	0	0	0	0	0	1	1	1	1	5/10
Aboud, (2006)	1	0	1	0	0	0	1	1	1	1	6/10

Note. 1: Random allocation; 2: Concealed allocation; 3: Baseline comparability; 4: Blind participants; 5: Blind therapists; 6: Blind assessors; 7: Adequate follow-up; 8: Intention-to-treat analysis; 9: Between-group comparisons; 10: Point estimates and variability.

Study characteristics

12 articles were found and included in the qualitative synthesis. These articles were divided into two sections: SC and EC. It could be possible that some of them appear into both sections because they evaluated results from both competencies.

Social competence

Quantitative analysis: eight articles have been found aimed to measure the effects of PE on preschool children's SC (Aadland et al., 2020; Aboud, 2006; Boyd et al., 2018; Caldwell et al., 2023; Diamond et al., 2019; Lee et al., 2020; Moore et al., 1984; Mulvey et al., 2020). These articles have discussed different aspects: social communication, confidence/motivation, sociability, problem solving, self-concept, conduct problems, and gender friendships. The evaluated programs are: *Tools of the Mind* (TOOLS), *Early Childhood Preschool Program*, *Successful Kinesthetic Instruction for Preschoolers* (SKIP), *Active Learning Norwegian* (ACTNOW), *The Physical Literacy in the Early Years* (PLEY), *Capon Perceptual-Motor Program*, and *Advancing Social-Communication and Play* (ASAP).

Analysis of the results: most of the intervention programs (i.e. TOOLS, Early Childhood Preschool Program, SKIP, ACTNOW, PLEY, Capon Perceptual-motor Program, and ASAP) have shown positive effects on different variables of SC, as well as in preschoolers with autism spectrum disorder.

Emotional competence

Quantitative analysis: six articles have been found aimed to measure the effects of PE on preschool children's EC (Aadland et al., 2020; Eninger et al., 2021; Kaale et al., 2012; Lee et al., 2020; Lumeng et al., 2017; Moore et al., 1984; Solomon et al., 2018). All of them analyze EC in general, while three of them extracted results related to self-regulation skills. The evaluated programs are: *Preschool Obesity Prevention Series (*POPS), *Promoting Altern Thinking Strategies* (PATHS), *Supporting Wellness in Early Learning Environments* (SWELE), *Active Learning Norwegian* (ACTNOW), *Playing to Learn* (PTL), joint attention (JA) program.

Analysis of the results: the evaluated intervention programs (i.e. POPS, PATHS, SWELE, ACTNOW, PTL, JA-intervention) have shown positive effects on preschool children`s EC. Two of the proposed programs (i.e. HS+POPS+IYS and TOOLS) have shown positive effects in self-regulation, while others have been centered in others EC-related variables (self-esteem, emotional wellbeing and playfulness, and emotional knowledge and anxiety), showing positive effects.

The information of each of the included article was extracted and detailed in the Table 3.

Table 3

Effects of Physical Education on Preschool-aged Childrenѐ s Social and Emotional Competencies

Reference	Aim	Sample	Intervention		
			Name/Groups	Intervention	Duration
SOCIAL COMPETENCE					
Boyd et al. (2018)	Efficacy of the ASAP Intervention for Preschoolers with ASD	Nº children: 161 Schools: 78 Country: EEUU Range: 4 years	INT (n=85) This group followed the ASAP intervention method, with the aim of improving the socio-communicative of these children with ASD. CON (n = 73) Business as usual (BUA)	INT: This group followed the ASAP intervention method, with the aim of improving the socio-communicative of these children with ASD. CON: Continued with their standard practice	Both groups performed two trainings. First training 4–6 h Second training 2–3 h
Caldwell et al. (2023)	To analyze the effects of PLEY intervention	Nº children: 209 Schools: 19 Country: Canada. Range: 3–5 years	INT (n=115) PLEY program CON (n=94) Usual outdoor play	INT : Playtime outdoors with a variety of loose parts, including buckets and lids, rope and pulleys, milk crates, hose tubes, over twenty balls of various sizes and weights, wood pieces, bread trays, large cardboard tubes, funnels of various sizes, tarps, five-foot planks, five-foot PVC tubing (4” and 2” diameter), rocks, and tires. CON: Usual outdoor play	6 months
Lee et al. (2020)	Analyze the effectiveness of instructured loose parts and mindfulness against to usual play	Nº children: 42 Schools: 2 Country: Hong Kong Range: 4–6 years	INT (n = 20) Supporting Wellness in Early Learning Environments (SWELE) CON (n =20) Followed their established routines	INT: Unstructured play with non-directional loose parts and daily mindfulness CON: Usual playtime routine, playing with toys and stationary materials in the school hall	5 days 45 min each day
Diamond et al. (2019)	To analyze the effectiveness of a program for reducing bullying and peer ostracism	Nº children: 351 Schools: 18 Country: Canada Mean age 5.2 years Range: 5-6 years	INT (n = 172) Tools of the Mind (Tools) CON (n = 180) Kindergarten curricula in British Columbia currently in use plus additional workshops	INT: Independent play in couples or small groups. CON: Playing in supervised classes with more group’ activities	25-30 min

Results			Conclusions
Test instrument	Variables	Results	
Observational coding of children’s social-communication. and ADOS-G and The Caregiver-Teacher Rating Form	Social communication (joint attention, social interaction and requesting) skills for children with ASD	Regarding the primary results of the kids' social communication game, there were no discernible variations between the groups	Children in the ASAP group participated more actively in class
ADOS-G	Confidence and Motivation	Playing with loose parts outdoors favored social development	The goal of the intervention program was to improve preschoolers’ perceptions of and progress toward physical literacy
Yamaz Digi-Walker CW-701 and The Smiley Face Likert Scale and The Penn Interactive Peer Play Scale	Variables related to social wellbeing. Level of happiness and aspects of playfulness	No detailed information about socioemotional outcomes	Students' happiness and playfulness are effectively fostered by experimental intervention, which supports their mental health and wellbeing amid stressful events like transition and separation
Prosocial conduct, including social inclusion	Sociability	Tools improves self-control and it reduces children being ostracized or excluded	Kindergarten kids in more conventional classrooms had less bullying and peer ostracism and more compassion and helpful behavior than those in a curriculum that focused on play, fostering relationships, working together, and supporting one another

Reference	Aim	Sample	Intervention		
			Name/Groups	Intervention	Duration
Moore et al. (1984)	Determine the benefits of self-concepts of children taking part in the Capon Perceptual-motor Program	Nº children: 85 Schools: 4 Country: EEUU Range: ND	INT (n = 66) Capon Perceptual-Motor Program. CON (n = 47) Undirected PA on the playground	INT: Every session comprised three stations with progressively distinct developmental tasks, and was based on Capon's perceptual-motor lesson plans (3). At each station, the kids received assistance from teachers and trained helpers. Throughout the time, the kids went from station to station. Every day, the lesson for the first subgroup was finished before the lesson for the second subgroup started. CON: Children in the control group used the playground's balls, swings, slides, and seesaws for 30 minutes of unstructured physical exercise	Daily in 30-min. lessons for 12.5 wk. (a total of 63 lessons)
Aboud (2006)	Whether preschoolers' everyday play experiences with classmates and materials would help them reach increasingly sophisticated social and cognitive play levels	Nº children: 400 Schools: 6 Country: Bangladesh Mean age: 4.5 and 6.5 years	INT (n = 188) Preschoolers CON (n=213) Non-preschool children	Early childhood preschool program.	6 days a week 5 years

Results			Conclusions
Test instrument	Variables	Results	
The Tests of Basic Experience (TOBE)	Sociability	Major effects for the group and group interactions were not statistically significant	No differences in group interactions were found between the two programs
Play Observation Scale	Sociability (solitary, parallel, and interactive) for 4 cognitive levels of play (functional, constructive, dramatic, and games with rules)	Preschoolers performed better during play in some areas of social development	Children performing program improved their social competence

Reference	Aim	Sample	Intervention		
			Name/Groups	Intervention	Duration
Aadland et al. (2020)	To explore how the professional development of preschool staff influences child development outcomes	Nº children: 1.2000 Schools: 60 Country: Norway Range: 3-5	INT (n = 600) Changed preschool practice CON (n = 600) Increased child PA and see the developmental effects	INT: Changed preschool practice with a 7-month professional development with the deliver the intervention's components and lead a development process in the staff group. CON: This group will try to improve child physical, socio-emotional, and cognitive development, and reduce social inequality in health and human capital	Between 7 and 18 months.
Mulvey et al. (2020)	Tested the hypothesis that gender-integrated friendships among preschool-aged children are fostered by the physical education teacher-led intervention known as Successful Kinematic Instruction for Preschoolers (SKIP)	Nº children: 93 Schools: 1 Country: EEUU Mean age : 47.38	INT (n = 56) SKIP CON (n = 37) Free play	INT: The kids in the intervention group received 600 minutes of total time from the twice-weekly, 30-minute sessions of the SKIP intervention, which took the place of usual recess. The next three days of the week were spent with participants having regular recess. CON: Participants enjoyed 30 minutes of free recreation each weekday without formal motor skills instruction. Kids all had access to a huge open area where kids could play tag games and use different materials including bean bags, playground balls, and hula hoops, as well as fixed outdoor play equipment like the jungle gym, slides, and toy cars	6.21 months.

Results			Conclusions
Test instrument	Variables	Results	
Peer Problems Scale; and Prosocial Scale	Factors associated with conduct problems, hyperactivity, peer difficulties and prosocial behavior	The program does not guarantee succeed	There is no assurance that ACTNOW will be implemented successfully or result in favorable consequences for children's development
Intergroup relations	Gender-integrated friendships	After the intervention, there was a higher likelihood of reporting gender-integrated friendships in the SKIP condition compared to the control free-play condition	These results highlight how interventions focused on motor competence can also generate benefits in the socio-emotional domain

Reference	Aim	Sample	Intervention		
			Name/Groups	Intervention	Duration
EMOTIONAL COMPETENCE					
Lee et al. (2020)	Examine how well organized loose parts and mindfulness compare to typical play	Nº children: 42 Schools: 2 Country: Hong Kong Range: 4–6 years	INT (n = 20) SWELE CON (n =20) Followed their established routines	INT: Daily mindfulness and unstructured play with non-directional loose components CON: Usual playtime routine, playing with toys and stationary materials in the school hall	5 days 45 min each day
Eninger et al. (2021)	To investigate the results of encouraging alternative thinking techniques	Nº children: 285 Schools: 26 Country: Sweden. Mean age 4.8 years Range: 4-5 years	INT(n = 140) PATHS Curriculum CON (n=145) Normal classroom activities	INT: Children's books are used to provide modeling and support during interactive lessons (such as stories), puppets, and role-play. In addition, they include activities that help children apply what they have learned outside of formal intervention time, such as information for parents, teacher-led extension activities (projects and games), and emotional coaching during teachable moments CON: Usual classes	6 months.
Lumeng et al. (2017)	To evaluate the effects of an obesity prevention program combined with an intervention aimed at enhancing emotional and behavioral self-regulation on the incidence of obesity and related behaviors in preschoolers	Nº children: 697 Schools: 6 Country: EEUU Mean age 4.1 years	INT group 1 (n= 221) HS + Preschool Obesity Prevention Series (POPS) INT group 2 (n= 255) HS + POPS + IYS INT group 3 (n= 218) HS	POPS, based on social cognition theory, was developed to offer obesity prevention messages that are coordinated, evidence-based and developmentally and culturally appropriate for preschool children and their families. In contrast, IYS applies observation, learning and reinforcement techniques, focusing on strategies to change behavior, such as providing detailed feedback on the child's actions, role-playing and conducting training to encourage and model positive behaviors	4 academic years from 2011 to 2015

Results			Conclusions
Test instrument	Variables	Results	
Yamaz Digi-Walker CW-701 and The Smiley Face Likert Scale and The Penn Interactive Peer Play Scale	Variables related to emotional Level of happiness and aspects of playfulness	No detailed information about socioemotional outcomes	Students' happiness and playfulness are effectively fostered by experimental intervention, which supports their mental health and wellbeing amid stressful events like transition and separation
Child task—Emotional knowledge—The Assessment of Children's Emotional Skills	Changes in child social problem solving, prosocial play (SEM)	Experimental group demonstrated gains in prosocial play and hyperactive behaviors. On the other hand, girls in the INT exhibited improved emotional understanding and decreased anxiety	The program is more beneficial than usual activities to improve emotional knowledge and reduced anxiety
Social Competence and Behavior Evaluation and The General Adaptation T-score	Emotional and behavioral regulation	When HS+POPS+IYS was compared to HS+POPS and HS, results showed how the first enhanced teacher-reported self-regulation	HS+POPS+IYS improves teacher-reported self-regulation

Reference	Aim	Sample	Intervention		
			Name/Groups	Intervention	Duration
Solomon et al. (2018)	The purpose of the study was to determine whether the TOOLS program—as opposed to Playing to Learn (YMCA PTL)—leads to more improvements in self-regulation	Nº children: 260 Schools: 20 Country: Canada Range: 3-4 years	INT group 1 (n= 195) TOOLS INT group 2 (n = 65) TOOLS and YMCA PTL	Both groups participated in the normal YMCA PTL curriculum as well as the TOOLS segment A program called TOOLS consists of planned, instructor-led exercises meant to enhance self-control. Every day, a large portion of the time is spent playing simulation games, where teachers assist the kids in creating a written game strategy	15 months. 30 min.
Aadland et al. (2020)	To examine how preschool staff professional development affects kids' physical activity levels and developmental outcomes	Nº children: 1.2000 Schools: 60 Country: Norway Range: 3-5	INT (n = 600) Changed preschool practice CON (n = 600) Increased child PA and see the developmental effects	INT: Changed preschool practice with a 7-month professional development with the deliver the intervention's components and lead a development process in the staff group. CON: This group will try to improve child physical, socio-emotional, and cognitive development, and reduce social inequality in health and human capital	Between 7 and 18 months.

Results			Conclusions
Test instrument	Variables	Results	
SCBE-30	Self-regulation.	In comparison to their YMCA PTL peers, children who took part in the TOOLS program performed higher on a behavioral exam. But only for the kids whose parents had previously labeled them as hyperactive or inattentive was this distinction noteworthy	YMCA PTL and TOOLS could be good curriculum options for a preschool classroom with a diverse student body. TOOLS seems to have no obvious cost to students who are less challenged in this area, making them useful in classes where students are having more difficulty with self-regulation
Emotional Symptoms Scale	Variables related to emotional symptoms	No detailed information about emotional outcomes.	There is no assurance that ACTNOW will be implemented successfully or result in favorable consequences for children's development

Reference	Aim	Sample	Intervention		
			Name/Groups	Intervention	Duration
Kaale et al. (2012)	Evaluate the impact of a JA proposal centered in preschools	Nº children: 61 Schools: 34 Country: Norway Mean age 26–60 months	INT (n = 34) JA-intervention CON (n = 27) Ordinary preschool program only	INT: The goal of the intervention was to increase the child's capacity to start more advanced joint attention play activities, like pointing, demonstrating, and handing over. Every 20-minute session included five minutes of training on a training table to prepare the kid for JA skills and fifteen minutes of floor play to help them generalize these abilities in an engaging context. CON: Receiving ordinary preschool program only	Eight weeks, twice a day (five days a week)
Moore et al. (1984)	Determine the benefits of self-concepts of children taking part in the Capon Perceptual-motor Program	Nº children: 85 Schools: 4 Country: EEUU Range: ND	INT (n = 66) Capon Perceptual-Motor Program. CON (n = 47) Undirected PA on the playground	INT: Every session comprised three stations with progressively distinct developmental tasks, and was based on Capon's perceptual-motor lesson plans (3). At each station, the kids received assistance from teachers and trained helpers. Throughout the time, the kids went from station to station. Every day, the lesson for the first subgroup was finished before the lesson for the second subgroup started. CON: Children in the control group used the playground's balls, swings, slides, and seesaws for 30 minutes of unstructured physical exercise	Daily in 30-min. lessons for 12.5 wk. (63 lessons)

Note. ACTNOW= Active Learning Norwegian; ASAP=Advancing social-communication and play; CAMHC= Child and Adolescent Mental Health Clinics; ECERS-R= Early Childhood Environment Rating Scale; ESCS= Early Social Communication Scale; HS= Head Start; JA intervention= joint attention program; TOBE= The tests of Basic Expercience; IYS=Incredible Years Series; PA = physical activity; PATHS=Promoting Altern Thinking Strategies;

Results			Conclusions
Test instrument	Variables	Results	
Early Social Communication Scale and Videotaped	Joint attention and self-regulation	The results indicated a noteworthy distinction between the control group and the intervention group, with the intervention group demonstrating higher levels of joint attention skill initiation during teacher interactions. With the moms, the impact expanded to a noticeably longer duration of JE	There have been extensive and positive results of preschool intervention in JA
Level K General Concepts Test	Self-concept	The self-concept test revealed substantial impacts (= 8.06, p <.01). From the pretest to the posttest, both groups' results improved. Self-concept received no further gain from the perceptual-motor program	No differences in self-concept were found between the two programs

PLAY= Promoting Lifelong Activity in Youth; PLEY=The Physical Literacy in the Early Years; POPS=Preschool Obesity Prevention Series; PTL= Play to Learn; SKIP= Successful Kinesthetic Instruction for Preschoolers; SCBE-30: Social Competence and Behavior Evaluation Scale; SWELE = Supporting Wellness in Early Learning Environments; TOOLS= Tools of the Mind.

Discussion

The present article aims to systematically summarize the effects of PE programs, evaluated through RCT design, on preschool-aged children`s social and emotional competencies. The discussion has been divided in two sections: the influence of PE on preschoolers` SC and the influence of PE on preschoolers` EC.

Looking the concepts, it can be seen that both are strongly related. In fact, EC refers to the ability to perceive, internalize, understand, and regulate one's own and others' emotions (Mayer & Salovey, 1997), including both intrapersonal and interpersonal relationships (Goleman, 1995). Looking both definitions, intrapersonal relationship means the ability to identify, understand, and control one's emotions, which is a crucial basis to foster interpersonal relationship, that means, the ability to identify and understand other people's emotions and the ability to establish relationships with others in a positive way (Goleman, 1995; Mayer & Salovey, 1997, 1997). For this reasons, some articles have evaluated both competencies and they have been included in both sections.

The influence of PE on Preschoolers' Social Competence

Included studies have discussed the effects of PE on preschoolers` social communication, confidence/motivation, sociability, problem solving, conduct problems, and gender friendships. Due to the heterogeneity of the included articles, these variables have been used to divide the discussion.

In general, most of the articles found positive effects in SC, except Aadland et al. (2020), who investigated the effects of ACTNOW program and highlighting that they cannot ensure the positive effects of the program. On the contrary, looking the remaining articles found positive effects of PE interventions on sociability (a concepts related to solitary, parallel, and interactive concepts). First, Diamond et al. (2019) analyzed whether the intervention program TOOLS foster sociability, analyzing whether the program reduces bullying and peer ostracism in classroom. The authors split 352 kids into two groups: INT (n = 172), where kids worked more independently in pairs or small groups, and CON (n = 180), where kids played in classes that were unusually supervised. The findings demonstrated how there was a reduced trend of planning in CON. In contrast, Aboud (2006) created a preschool program in order to assess if it enhances sociability. After dividing children in INT (n = 188) and in CON (n = 213), the results showed how those children participating in *Early Childhood Preschool Program* are less solitaries and interact more. Therefore, both programs are effective for improving children sociability. In this way, a third study aimed for improving sociability, in this case between peers from different gender. In this way, the question of whether the PE teachers' program SKIP encourages preschool-aged kids to form gender-integrated friendships was investigated by Mulvey et al. (2020). With this aim, the authors divided children in INT (n = 56) and CON (n = 37). The intervention consisted in playing free for CON, while children in INT performed SKIP programs twice a week and free-play recess the others three week-days. As in the previous articles, the authors highlighted positive effects of SKIP program. In another study, Moore et al. (1984) aimed to determine the benefits of sociability of children participating in the *Capon Perceptual-motor Program*. The INT group (n = 66) consisted in three stations with a different developmentally sequenced task at each. Trained aides and teachers assisted the children at each station. The children rotated to each station during the period. Each day the first subgroup completed its lesson before the other group began. Meanwhile CON (n = 47) did an undirected physical activity on the playground. Although improvements were found, the results showed no statistical differences between two interventions.

Interestingly, one article analyze the effects of a program with preschoolers with special needs. In this way, Boyd et al. (2018) looked into how well toddlers with autism spectrum disorder responded to the advanced social-communication and play intervention (ASAP). To perform the investigation, the authors divided participants into an INT (n = 85), performing the program aimed to improve socio communication skills, and a CON (n = 73), doing the usual classes. The results showed improvements on preschoolers belonging to the INT.

Thus, most of the intervention programs (i.e. TOOLS, Early Childhood Preschool Program, SKIP, ACTNOW, PLEY, Capon Perceptual-motor Program, and ASAP) have shown positive effects on different variables of SC, as well as in preschoolers with Autism Spectrum Disorder. Among different strategies, supervised learning seems highly recommended, also in combination with free-play.

The Influence of PE on Preschoolers' Emotional Competence

Among the studies that have evaluated EC, Aadland et al. (2020) recruited 1200 kids and divided them into two groups in order to evaluate how the proposed program influences, among other variables related to SC, the emotional symptoms. However, the authors cannot recommend the implementation of ACTNOW program, at least, for improving evaluated variables. However, the remaining articles found positive effects on preschoolers' EC. These articles have been divided into: self-regulation skills and other variables related to EC.

Self-regulation is a psychological construct that includes a variety of critical competencies, such as the ability to manage emotions, engage in positive interactions with others, refrain from inappropriate or aggressive behavior, and engage in self-directed learning (Pandey et al., 2018). This variable has been evaluated by Lumeng et al. (2017), who separated children in different intervention arms: (1) HS+POPS+IYS, (2) HS+POPS, and (3) only HS. The results encourage programs based on social cognition theory, combining evidence-based information messages with observation, learning, and reinforcement techniques aimed to change behavior, such as providing detailed feedback on the child's actions, role-playing, and conducting training to encourage and model positive behaviors. Similarly, Solomon et al. (2018) determine whether the TOOLS program—as opposed to Playing to Learn (YMCA PTL)—leads to more improvements in self-regulation. A program called TOOLS consists of planned, instructor-led exercises meant to enhance self-control. Every day, a large portion of the time is spent playing simulation games, where teachers assist the kids in creating a written game strategy. The results showed how both programs might make good curriculum choices for a preschool classroom with a diverse student body. However, TOOLS could be helpful in classes where kids are having more trouble with self-control, and they won't seem to hurt the kids who aren't as bad off.

Among others, one study evaluated the effects of PE on preschoolers EC, in general. In this article, Kaale et al. (2012) sought to evaluate the impact of a preschool-based JA-intervention. While the CON (n = 27) is receiving merely a standard preschool program, the INT (n = 34) received an intervention focused on increasing child initiation of higher order JA. The outcomes demonstrated positive effects of JA intervention program. However, other studies have specified that they tested specific variables such as: self-esteem, emotional wellbeing and playfulness, and emotional knowledge and anxiety. In this regards, the oldest study was aimed to determine the benefits of self-concepts of children participating in the *Capon Perceptual-motor Program* (Moore et al., 1984). The INT group (n = 66) consisted in three stations with a different developmentally sequenced task at each. Trained aides and teachers assisted the children at each station. The children rotated to each station during the period. Each day the first subgroup completed its lesson before the other group began. Meanwhile CON (n = 47) did an undirected physical activity on the playground. The results showed non-significant main effects for group and interactions of group by tests. However, significant effects were found for the self-concept test = 8.06, $p < .01$, although the positive effect was showed in the same way in CON. Therefore, there was no further gain to self-concept from the perceptual-motor exercise. In another study, the effects of PE on preschoolers` emotional wellbeing and playfulness was tested after applying an intervention based on unstructured loose parts playing together with mindfulness intervention (Lee et al., 2020). In the study, INT (n=20) did unstructured play with non-directional loose parts (outdoor, 1 hour/day) with 10 minutes of mindfulness session each day, while the CON (n=20) engage children in usual recess. The findings demonstrated that kids who participated in INT emphasized the advantages for kids' emotional intelligence. Third, regarding emotional knowledge and subsequent outcomes related to mental-health, Eninger et al. (2021) evaluated the immediate results of PATHS, dividing children into INT (n = 140) and CON (n = 145) groups. While the students in CON engaged in regular classroom activities during the study, the lessons for INT are interactive and utilize modeling and support for the application of socio-emotional competency. The authors highlighted that PATHS methodology is more beneficial than normal standard activities, showing improvements on preschoolers` emotional knowledge and reduced anxiety.

In brief, intervention programs (i.e. HS+POPS+IYS and TOOLS) have shown positive effects on preschool children`s self-regulation skills, while other proposed programs (i.e. JA-intervention, the Capon Perceptual-motor Program, an intervention based on unstructured loose parts playing together with mindfulness intervention, and PATHS) have shown positive effects on children`s different emotional competence-related variables such as self-esteem, emotional wellbeing and playfulness, and emotional knowledge and anxiety. Among possible strategies for educational implications, multicenter strategies could be recommended (information messages and activities such as role-playing or instructor-led exercises meant to enhance self-control) for improving self-regulation skills, while both unstructured and structured activities, even with the combination with mindfulness intervention, could be suitable for developing other EC-related variables.

Study Limitations

Although this systematic review recruited all articles that have evaluated the effects of PE on preschoolers` SC and EC using RCT design, the authors would like to include some limitations aimed at enhancing the methodological transparency of the present systematic review.

On the one hand, the authors encourage reader and professionals working in early childhood education that caution should be taken into account due to the amount of articles found. Further, when looking different studies, there is a clear heterogeneity found among nature of interventions (exercise-based interventions or mindfulness-based interventions) and different sample characteristics such as children with special educational needs (children with Autism Spectrum Disorder diagnosis) or children with a typical neurological development. This fact makes it difficult to draw clear conclusions beyond the positive effects that PE seems to have on preschoolers` both SC and EC.

On the other hand, the authors would like to highlight that although PEDro Scale includes some items that are difficult to be applied in some educational contest during an investigation, caution should be taken into account due to some articles do not consider all the items included in the PEDro Scale. For this reason, it is important to acknowledge that certain risks of bias may still be present and could influence the overall findings. Notably, several studies did not report blinding of participants, instructors, or outcome assessors—common limitations in educational and behavioral interventions involving children in early childhood. The absence of blinding increases the likelihood of performance and detection bias, which may overestimate the reported effects of the interventions on social and emotional competencies. In addition, beyond the evaluation using this tool, readers should consider potential sources of bias or limitations in the included RCTs beyond the PEDro score. For example, through PEDro Scale, the publication bias or performance bias is not addressed. Therefore these methodological weaknesses should be considered when interpreting the results, as they may reduce the internal validity and generalizability of the conclusions.

Conclusions

The present systematic review draws some conclusions that could be consider by professionals working in early childhood, or at least, with preschool-aged children. Regarding SC, professionals working with young children could consider different intervention programs to foster preschoolers' social relationships, even with children with special educational needs (TOOLS, Early Childhood Preschool Program, SKIP, ACTNOW, PLEY, Capon Perceptual-motor Program, and ASAP). In the same way, different intervention programs HS+POPS+IYS, TOOLS, JA-intervention, the *Capon Perceptual-motor Program*, an intervention based on unstructured loose parts playing together with mindfulness intervention, and PATHS) could enhance self-regulation skills, self-esteem, emotional wellbeing and playfulness, and emotional knowledge and anxiety.

Practical Applications

After analyzing the included articles and discuss between evaluated variables and extracted outcomes, some practical applications have been extracted to draw a brief list of recommendations aimed to be read by professionals working with preschool children. It could be of interest since SC and EC could be related to mental health along person lifespan:

Working more independently in pairs or small groups are more likely to reduce bullying and peer ostracism than those kids played in classes that were unusually supervised (Diamond et al., 2019).

Programing classes with supervision seems to be reinforced by other studies that highlighted that combining supervised learning and free-play seems more effective than those children playing free every days.

Since another study has found improvements in both supervised and free-play interventions, free-play could be also further investigated. These findings that support the supervised strategies for improving SC, instead of free-play that should be further investigated, meet with another systematic review (Martín-García & Rico-González, 2023). It could be because supervised programs could ensure group-based activities, which have been suggested for improving SC in another systematic review (Martinez-Merino & Rico-González, 2024).

Self-regulation skills has been improving using the combination of different programs based on social cognition theory. These programs combine evidence-based information messages with observation, learning, and reinforcement techniques aimed to change behavior, such as providing detailed feedback on the child's actions, role-playing, and conducting training to encourage and model positive behaviors.

Planned and instructor-led exercises (a large portion of the time is spent playing simulation games, where teachers assist the kids in creating a written game strategy) meant to enhance self-control have also shown.

Combining exercise-based interventions with mindfulness-based interventions seems to be suitable for improving emotional wellbeing and playfulness.

The interactive lessons and support for the application of socio-emotional competency could be suitable for improving EC.

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