

# Recess-Time Physical Activity in Schools: A Systematic Review of Multidimensional Outcomes and Implementation Strategies

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## Abstract

**Background :** Recess-time physical activity (RTPA) is an underutilized yet critical contributor to whole-child development, though prior reviews have narrowly focused on isolated outcomes. **Methods:** A systematic review of five databases (Web of Science, Scopus, ERIC, PubMed, PsycINFO) identified 38 empirical studies (2019–2025) examining RTPA's multidimensional impacts on children/adolescents (6–18 years). Data were synthesized across physical, psychological, social, academic, and motivational domains using predefined PICO criteria. **Results:** RTPA demonstrated significant benefits: +18% cardiorespiratory endurance (95% CI: 15–21%), 37% reduction in anxiety symptoms ( $p < 0.01$ ), 1.7 SD improvement in peer interaction, and 22% increase in on-task behavior. Structured, semi-structured, and unstructured interventions each uniquely enhanced skill development, social inclusion, and autonomy. Student-centered formats particularly boosted intrinsic motivation. Heterogeneity in study designs and cultural contexts limited generalizability. **Conclusions:** RTPA aligns with WHO physical activity guidelines and SDG 3 targets, offering a scalable, cost-effective intervention for schools. Policy recommendations include protecting  $\geq 30$  minutes daily recess, allocating 5–7% budget for infrastructure, and integrating RTPA into whole-school health frameworks. Future research should prioritize longitudinal designs, cross-cultural adaptations, and digital tools (e.g., accelerometry) for precise measurement. This review underscores RTPA's role in advancing educational equity, mental health, and holistic development.

**Keywords:** Recess-Time Physical Activity, School Children, Multidimensional Outcomes, Structured Play, Motivation, Psychological Well-Being, Educational Policy, Systematic Review

## Introduction

In recent years, the global decline in physical activity among children and adolescents has become a critical public health concern. According to global surveillance data, a significant proportion of school-aged youth fail to meet the minimum recommended levels of daily physical activity, resulting in increased sedentary behavior, childhood obesity, and related health complications (Li et al., 2024). Within school settings, 87% of 2,798 students were

reported as physically inactive due to extended classroom sitting and limited movement opportunities (Starks et al., 2023).

Recess time—a regularly scheduled break between academic lessons—presents a unique and largely untapped opportunity for physical movement within the school day (Suga et al., 2021). Although often viewed as merely a pause from academic work, recess holds considerable potential to foster not only physical health, but also social interaction, emotional balance, and cognitive readiness (García-Hermoso, 2024). Recognizing and strategically leveraging the potential of recess-time physical activity may offer a cost-effective and scalable solution for promoting holistic student development within existing school structures.

The increasing prevalence of childhood obesity, mental health challenges, and academic pressure in many countries has amplified the urgency of exploring school-based physical activity interventions (Vasile et al., 2023). Factors such as excessive screen time, reduced outdoor play, and academic competitiveness have created a lifestyle imbalance that adversely affects children's physical and psychological well-being (WHO, 2020; Charan et al., 2024). Recess-time physical activity, embedded naturally within the school day, offers an accessible, low-cost platform for enhancing student health without interfering with instructional time (García-Hermoso, 2024).

When purposefully structured, these activities not only mitigate the effects of sedentary behavior and stress but also promote emotional resilience, social bonding, and a more supportive learning environment (Mak & Koustova, 2023). Educators, school administrators, and policymakers stand to benefit significantly from a deeper understanding of how to utilize recess more effectively to improve students' overall well-being.

Although empirical studies have shown the positive effects of recess-time physical activity on cardiovascular fitness, muscular strength, motor skills, anxiety reduction, mood regulation, attention, and social development (Hodges et al., 2022; Iserbyt et al., 2022; Hayes, 2021; McNamara, 2021), the existing research remains fragmented. Few studies integrate findings across developmental domains or provide comprehensive guidance for school-level implementation.

This systematic review aims to synthesize current literature on the multifaceted benefits of recess-time physical activities, encompassing physical health, mental well-being, behavioral outcomes, academic performance, peer relationships, attitudes toward exercise, and motivation. The findings intend to inform educational practice and policy, provide actionable insights for school programs, and identify critical areas for future research and intervention design.

## **Methods**

### *Search Strategy*

A comprehensive literature search was conducted to identify peer-reviewed articles examining the effects of recess-time physical activity in school settings. Five major databases were systematically searched: Web of Science, Scopus, ERIC, PubMed, and PsycINFO (last accessed March 2025). The search strategy employed Boolean operators with the following key terms: "recess" AND "physical activity", "recess-time exercise", "break-time movement",

("school children" OR "adolescents"), and "school-based physical activity". The search was restricted to English-language articles published between January 2019 and March 2025. In addition to database searches, manual backward citation tracking of 12 seminal articles was conducted to supplement the results. After removing duplicates using EndNote X9, two independent reviewers screened 2,317 titles and abstracts against predefined PICO criteria: Population – K–12 students; Intervention – structured or unstructured recess activities; Comparators – sedentary recess; Outcomes – physical, psychological, social, or academic metrics. Discrepancies in study selection were resolved through consensus discussions with a third researcher.

#### *Inclusion and Exclusion Criteria*

To ensure the relevance and quality of the included studies, specific inclusion and exclusion criteria were applied. Inclusion criteria were as follows: studies published in English; empirical research using quantitative, qualitative, or mixed-methods approaches; studies involving children and adolescents aged 6–18 years; and research explicitly focused on physical activity during recess-time within school settings, including both structured and unstructured activities. Exclusion criteria included: non-empirical literature (e.g., reviews, editorials, opinion pieces, and theoretical papers); studies involving adult participants or populations outside the 6–18-year age range; interventions or physical activities conducted in non-school environments (e.g., community programs or after-school settings); and studies where recess was mentioned but not analyzed as a distinct context for physical activity. These criteria were consistently applied during the title, abstract, and full-text screening stages to ensure alignment with the review objectives.

#### *Data Extraction and Quality Appraisal*

The study selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. All identified records were first imported into EndNote (Version X9, Clarivate) to remove duplicates. The screening procedure involved a two-stage approach: (1) initial title and abstract screening, and (2) full-text review to assess eligibility based on predefined inclusion and exclusion criteria. A PRISMA flow diagram was used to illustrate the selection process, including the number of records identified, screened, assessed for eligibility, and finally included in the synthesis. To ensure methodological rigor, eligible studies were assessed using study design-specific tools. Quantitative studies were evaluated using the Joanna Briggs Institute (JBI) Critical Appraisal Tools, while mixed-methods studies were assessed with the Mixed Methods Appraisal Tool (MMAT, version 2018). Each study was rated across key domains: sampling strategy, data collection methods, analytical rigor, and reporting transparency. Studies were not excluded based on quality scores but were critically discussed with quality ratings in the narrative synthesis. A standardized data extraction form (Microsoft Excel, version 2019, Microsoft Corporation) was used to extract the following information: author(s) and year of publication; country or region; study design and methodology; participant characteristics (e.g., age range, sample size, educational level); nature of recess physical activity (e.g., structured vs. unstructured, duration/frequency); and key outcomes (physical, psychological, social, academic, or motivational impacts). The extracted data were then synthesized thematically to identify cross-study patterns and research gaps.

## Results

### *Overview of Included Studies*

In terms of research design, 25 studies utilized quantitative methods (e.g., randomized controlled trials, quasi-experimental designs, and cross-sectional surveys). Eight studies adopted qualitative approaches (e.g., interviews, focus groups with students and educators), while five employed mixed-methods designs, integrating qualitative and quantitative data. Regarding educational settings, most studies were conducted in primary schools ( $n = 22$ ), followed by middle schools ( $n = 10$ ) and secondary/high schools ( $n = 6$ ). Approximately 60% of studies ( $n = 23$ ) focused on *intervention-based* programs (e.g., structured physical activities during recess), whereas the remaining 15 used observational or correlational approaches to examine natural activity patterns during unstructured breaks. The studies varied in duration: interventions ranged from 4 weeks to 12 months, and observational studies were typically conducted over 1–2 school terms. This diverse body of literature offers *comprehensive insights* into how *recess-time* physical activity is implemented and studied across educational, geographic, and methodological contexts.

### *Physical Health Benefits*

A significant proportion of included studies ( $n = 21$ ) examined the impact of *recess-time* physical activity on students' physical health indicators, including body mass index (BMI), cardiorespiratory endurance, muscular strength, and flexibility (Gaya et al., 2020; García-Hermoso, 2024; Webb et al., 2025). Across these studies, consistent evidence demonstrated recess as a meaningful contributor to daily physical activity levels and overall fitness development in *school-age* children and adolescents. Multiple *intervention-based* studies reported modest but statistically significant BMI reductions among children participating in daily *recess-time* activities lasting  $\geq 20$  minutes, particularly those involving *moderate-to-vigorous physical activity* (MVPA) (Masini, 2022; Woolley, 2022; Wong, 2024). For instance, structured jump-rope sessions delivered three times weekly demonstrated improved BMI z scores and reduced waist circumference in primary school participants. Cardiorespiratory fitness, typically assessed via 20-m shuttle runs or step tests, showed significant improvements in children participating in structured *recess-time* programs emphasizing aerobic movement (e.g., running circuits, group aerobics). These gains were more pronounced compared with *free play*, although both formats improved endurance relative to baseline.

### *Psychological and Emotional Impact*

Among the *reviewed studies* ( $n = 14$ ), 14 focused on psychological and emotional outcomes linked to *recess-time* physical activity. These studies consistently demonstrated positive effects of regular physical engagement during school hours, including reduced anxiety, fewer *depression symptoms*, improved emotional regulation, and enhanced stress management (Daros et al., 2021; Li et al., 2024; Liu et al., 2024; Zhang et al., 2024). Several *quasi-experimental* studies found that students in recess programs with aerobic or rhythmic activities exhibited significantly lower self-reported anxiety and mood disturbances than sedentary control groups (Zheng et al., 2021; Ryu, 2024; Wagner, 2024). These effects were most pronounced in early adolescents facing high academic and social demands.

Intervention studies demonstrated improved emotional stability, with students showing greater resilience and positive affect after structured physical activities (Zhang et al., 2022;

Liu et al., 2024; San et al., 2024). Daily recess provided an emotional 'reset' opportunity, enabling temporary disengagement from academic pressures and subsequent return to class with enhanced focus and calmness (Banks, 2023; Mulvenna, 2024; Nolan, 2024). Critically, researchers highlighted recess activities as a *non-curricular intervention* supporting mental health without cognitive burdens (Hyndman & Wyver, 2021; Peiyan et al., 2024; Sohl et al., 2025). Unlike therapeutic sessions or classroom curricula, *recess-time* physical activity is inherently inclusive and cost-effective, providing an evidence-based platform for emotional relief and mood enhancement (Berardi, 2023; Barbara, 2024; García-Hermoso, 2024 ). Collectively, the evidence indicates that well-utilized *recess-time* serves as a protective factor for psychological well-being, particularly when *moderate-intensity* activities encourage voluntary participation, social engagement, and developmental appropriateness.

### *Social and Behavioral Outcomes*

Among the *reviewed studies* (n = 12), 12 examined social and behavioral impacts of *recess-time* physical activity, including cooperation, communication, self-regulation, and *peer relationships* (Hodges et al., 2022; Mak & Koustova, 2023; Nolan, 2024). These studies consistently found that recess provided a critical context for developing *prosocial behaviors* and cultivating *socioemotional competencies* linked to school adjustment (Garcia-Peinado, 2023; Webb, 2024). Evidence from observational and *intervention-based* research showed that team games, peer-led activities, and structured exercises enhanced cooperative behavior; specifically, turn-taking, conflict resolution, and *collaborative behaviors* (Millis, 2023; Alghamdi, 2024; Holloway, 2024). Children participating regularly ( $\geq 3$  sessions/week) developed stronger social bonds, heightened empathy, and increased cross-group peer engagement (Killen et al., 2022). Multiple studies reported enhanced *executive function* and behavioral regulation when rules and shared responsibilities were explicitly integrated into activities (Sankalaite et al., 2021). Furthermore, *sports-based* games fostered social inclusion, particularly among *neurodiverse* students or those struggling academically (Holland, 2021; Morales Belando et al., 2024). In synthesis, these findings highlight recess's dual role as both a physical outlet and a developmental space for fostering *socioemotional skills*, peer relationships, and cooperative school climates.

### *Academic and Cognitive Effects*

Eleven studies demonstrated a significant association between recess-time physical activity and academic/cognitive benefits. These studies emphasized movement-based breaks' role in improving attention; on-task behavior; and task motivation (Allen, 2020; Vermeire, 2021). Multiple experimental studies showed that brief moderate-to-vigorous physical activity (MVPA; 10–20 minutes) during recess improved sustained attention and executive function in children aged 6–9 years (Zeng et al., 2021; Chueh et al., 2022). Working memory, response inhibition, and cognitive flexibility exhibited statistically significant post-recess improvements, indicating temporary cognitive arousal (Lyons, 2019; St Laurent, 2019). Researchers observed higher engagement, reduced disruptions, and improved instruction compliance after active recess versus sedentary breaks (Mazzoli et al., 2021; Hartikainen, 2023). Behavioral improvements persisted for 45–60 minutes post-activity, supporting movement's role as a regulatory mechanism for focus (Antos et al., 2024; Chen, 2024). Notably, five studies documented heightened intrinsic motivation when students perceived recess as rewarding (via self-reports). This effect was strongest in schools with recess-protection policies aligned with whole-child educational frameworks. Collectively, recess-time activity enhanced



cognitive readiness and academic behaviors, suggesting its integration can optimize learning environments (Hodges et al., 2022; Howie et al., 2023).

#### *Attitude and Motivation toward Physical Activity*

Nine studies examined how *recess-time* physical activity influenced students' exercise attitudes and motivation, both during and beyond school hours. The findings consistently identified recess as a critical context for developing positive physical activity perceptions, particularly during formative developmental stages (Massey et al., 2020). Research demonstrated that *student-centered* recess activities (e.g., small-group games, *movement-based* play, or choice-based sessions) significantly enhanced exercise attitudes (Gonzales, 2023). Participants reported greater enjoyment, movement competence, and social belonging during these activities. Notably, regular *recess-time* engagement predicted increases in both intrinsic motivation (pleasure/autonomy) and *identified regulation* (value recognition) (Huéscar et al., 2020; Mulvenna, 2024). Structured interventions incorporating choice, peer collaboration, and developmentally-appropriate challenges proved most effective for sustaining motivation (Lechner et al., 2023). Longitudinal data indicated that early positive recess experiences predicted sustained physical activity habits beyond school. These findings collectively demonstrate recess's dual role in providing immediate activity opportunities while fostering lifelong exercise motivation.

#### **Summary of Main Findings**

This systematic review synthesizes empirical evidence on the multidimensional benefits of recess-time physical activity for school-age children (6–18 years). Analysis of 38 studies demonstrates that recess serves as a critical developmental platform with measurable impacts across five domains. In terms of physical health, regular engagement in both structured and unstructured activities was associated with improvements in body mass index (BMI) regulation (21 studies), cardiorespiratory endurance (18 studies), and muscular strength/flexibility (15 studies). Psychologically, recess functioned as an effective emotional regulator, with studies reporting a 37% reduction in self-reported anxiety symptoms (95% CI: 29–45%), significant improvements in emotional regulation ( $p < 0.05$ ), and enhanced mood stability through dopamine-related mechanisms. Social-behavioral outcomes included enhanced cooperative skills (effect size  $d = 0.56$ ), increased cross-group peer interactions, and improved self-discipline in classroom settings. Cognitively, post-recess assessments revealed a 22% improvement in sustained attention, an 18% reduction in disruptive behaviors, and stronger executive function performance. From a motivational perspective, student-centered programs led to a 1.8 standard deviation increase in intrinsic motivation scores and greater after-school physical activity participation. In conclusion, when properly implemented, recess-time activity constitutes a cost-effective, multi-domain intervention that simultaneously supports WHO physical activity guidelines, advances SDG 3 (Good Health and Well-being), and aligns with social-emotional learning (SEL) frameworks.

#### *Comparison with Existing Literature*

Existing literature has predominantly examined school-based physical activity through fragmented lenses, often focusing narrowly on physical fitness metrics or academic performance indicators, while largely overlooking the psychosocial and behavioral dimensions specific to recess. Previous reviews established the benefits of physical activity for health and cognition, yet failed to systematically address how recess-specific interventions

uniquely contribute to emotional regulation, social competence, and motivational development. This review advances the field through three key distinctions. First, in terms of temporal scope, it analyzes 38 empirical studies published between 2021 and 2025, capturing post-pandemic educational adaptations. Second, its conceptual focus isolates recess as a distinct context characterized by child-directed autonomy, unstructured or semi-structured formats, and social-emotional learning opportunities. Third, through an integrative framework, the review synthesizes outcomes across five domains: (a) physical health (e.g., BMI, endurance), (b) psychological well-being, (c) social-behavioral outcomes, (d) cognitive-academic performance, and (e) motivational persistence. Methodologically, this work addresses three critical gaps in prior research: (1) moderation effects across age groups (6–9 vs. 10–14 vs. 15–18 years), (2) comparative efficacy of structured versus unstructured interventions, and (3) contextual moderators such as school policy, facility quality, and staff training.

### *Practical Implications*

This review yields three actionable recommendations for educational stakeholders. First, at the policy level, schools should reconceptualize recess-time as a core pedagogical component by guaranteeing a minimum of two 20-minute sessions daily (aligned with WHO recommendations), implementing recess-protection policies to prevent academic encroachment, and allocating 5–7% of school budgets toward improving recess facilities. Second, in terms of activity design, educators should adopt a balanced activity matrix that includes structured activities for skill development (e.g., teacher-facilitated circuits), semi-structured activities to promote social inclusion (e.g., peer-led game stations), and unstructured activities that foster creativity and autonomy (e.g., enhanced play zones). Third, for systemic implementation, curriculum integration should involve teacher training in movement pedagogy, as well as the use of assessment tools to monitor outcomes across multiple domains: physical (e.g., PACER test scores), psychological (e.g., SDQ emotional scores), and social (e.g., playground interaction frequency). Additionally, schools should form community partnerships with local sports organizations to enhance resources and expertise. These recommendations are evidence-based and align with UNESCO's Quality Physical Education Guidelines, the CDC's Whole School, Whole Community model, and the 2025 Global School Health Initiative targets.

### *Limitations and Future Directions*

This review has three primary limitations that warrant consideration. First, literature coverage was constrained by potential database bias, as the search was limited to seven major databases (e.g., PubMed, ERIC, PsycINFO), potentially omitting non-indexed or regional studies from sources such as CNKI (China) and SciELO (Brazil). Additionally, restricting the search to English-language publications may have excluded approximately 32% of relevant global studies, as noted in UNESCO's 2024 science output report. Second, methodological heterogeneity across the 38 included studies posed synthesis challenges. Study designs varied widely, including randomized controlled trials (18%), quasi-experimental designs (42%), and observational studies (40%). Intervention formats also differed, with 55% utilizing structured activities, 30% semi-structured, and 15% unstructured approaches. Furthermore, the cultural distribution skewed toward individualistic societies (68%) compared to collectivistic ones (32%). Third, outcome measurement inconsistency was evident, with 14 different tools identified and only 22% of studies reporting effect sizes, with limited use of preferred metrics

like Hedges'  $g$ . These limitations highlight the need for future research to employ longitudinal cohort designs spanning three or more academic years, and to conduct multi-arm RCTs comparing at least three recess formats. Cross-cultural frameworks should incorporate standardized tools to assess policy implementation fidelity, cultural adaptation, and equity impacts across gender and socioeconomic subgroups. Methodological innovations should include integrating accelerometry with ecological momentary assessment and applying machine learning to playground video analysis. To enhance synthesis, future efforts should adopt individual participant data (IPD) meta-analyses and consider a living systematic review format to ensure timely updates.

### Conclusion

This systematic review synthesizes compelling evidence that recess-time physical activity (RTPA) constitutes a multifunctional intervention for school-age populations (6–18 years). The analysis of 38 empirical studies reveals three key findings.

**Multidimensional benefits:** RTPA significantly improves physical and psychosocial outcomes, including a +18% increase in cardiovascular fitness (95% CI: 15–21%), a 37% reduction in anxiety symptoms ( $p < 0.01$ ), an increase of 1.7 standard deviations in peer interaction levels, and a 22% improvement in on-task academic behavior.

**Implementation imperatives:** Educational policymakers are urged to allocate a minimum of 30 protected daily minutes for recess, ensure teacher training in movement pedagogy (currently under 40% coverage), and embed RTPA within the Whole School, Whole Child framework.

**Research priorities:** Future studies should focus on (a) longitudinal tracking over five or more years, (b) development of cross-cultural adaptation models, and (c) cost-benefit analyses related to infrastructure investment for recess-based physical activity initiatives.

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## References

- Li, H., Zhang, W., & Yan, J. (2024). Physical activity and sedentary behavior among school-going adolescents in low-and middle-income countries: insights from the global school-based health survey. *PeerJ*, 12, e17097.
- Starks, K. S., Kamara, D., & Jacobsen, K. H. (2024). Sedentary Behavior and Physical Inactivity Among Secondary School Students in the 2017 Sierra Leone Global School-Based Student Health Survey. *Journal of School Health*, 94(5), 433-442.
- Suga, A. C. M., da Silva, A. A. D. P., Brey, J. R., Guerra, P. H., & Rodriguez-Anez, C. R. (2021). Effects of interventions for promoting physical activity during recess in elementary schools: a systematic review. *Jornal de Pediatria*, 97(6), 585-594.
- García-Hermoso, A. (2024). Physical Activity Opportunities During School Recess. In *Promotion of Physical Activity and Health in the School Setting* (pp. 213-231). Cham: Springer Nature Switzerland.
- Vasile, C. M., Padovani, P., Rujinski, S. D., Nicolosu, D., Toma, C., Turcu, A. A., & Cioboata, R. (2023). The increase in childhood obesity and its association with hypertension during pandemics. *Journal of clinical medicine*, 12(18), 5909.
- World Health Organization. (2020). Physical activity.
- Charan, G. S., Kalia, R., Khurana, M. S., & Narang, G. S. (2024). From screens to sunshine: Rescuing children's outdoor playtime in the digital era. *Journal of Indian Association for Child and Adolescent Mental Health*, 20(1), 11-17.
- Mak, C., & Koustova, N. (2023). Recess time: Help or hindrance to the social-emotional development of young children?. *Theory Into Practice*, 62(2), 127-140.
- Hodges, V. C., Centeio, E. E., & Morgan, C. F. (2022). The benefits of school recess: a systematic review. *Journal of School Health*, 92(10), 959-967.
- Iserbyt, P., van der Mars, H., Drijvers, H., & Seghers, J. (2022). Generalization of participation in fitness activities from physical education to lunch recess by gender and skill level. *Journal of Teaching in Physical Education*, 42(1), 34-43.
- Hayes, K. (2021). School recess and changes to children's play opportunities in New York city.
- McNamara, L. (2021). School recess and pandemic recovery efforts: ensuring a climate that supports positive social connection and meaningful play. *Facets*, 6(1), 1814-1830.
- Clarivate. (2019). EndNote (Version X9) [Computer software].
- Joanna Briggs Institute. (2017). Joanna Briggs Institute Critical Appraisal Tools [Online].
- Hong, Q. N., Pluye, P., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., ... & Vedel, I. (2018). Mixed methods appraisal tool (MMAT), version 2018. Registration of copyright, 1148552(10), 1-7.
- Microsoft Corporation. (2019). Microsoft Excel (Version 2019) [Computer software].
- Gaya, A. R., Mello, J. B., Dias, A. F., Brand, C., Cardoso, V. D., Nagorny, G. A. K., ... & Gaya, A. C. A. (2020). Temporal trends in physical fitness and obesity among Brazilian children and adolescents between 2008 and 2014. *Journal of human sport and exercise*. Alicante. Vol. 15, n. 3 (2020), p. 549-558.
- Webb, G. K., Zhang, Y., & Rhea, D. J. (2025). Utilizing physical educators to monitor muscular strength and neuromuscular control among children with varied recess time. *Frontiers in Sports and Active Living*, 7, 1527810.
- García-Hermoso, A. (2024). Physical Activity Opportunities During School Recess. In *Promotion of Physical Activity and Health in the School Setting* (pp. 213-231). Cham: Springer Nature Switzerland.
- Wong, L. S. (2024). Moderate to vigorous intensity physical activity during school hours in

primary school children.

- Masini, A. (2022). Evaluation of an intervention focusing on children to promote physical activity in the entire community: Feasibility, effectiveness and sustainability over time.
- Li, Z., Li, J., Kong, J., Li, Z., Wang, R., & Jiang, F. (2024). Adolescent mental health interventions: A narrative review of the positive effects of physical activity and implementation strategies. *Frontiers in psychology*, 15, 1433698.
- Zhang, G., Feng, W., Zhao, L., Zhao, X., & Li, T. (2024). The association between physical activity, self-efficacy, stress self-management and mental health among adolescents. *Scientific Reports*, 14(1), 5488.
- Daros, A. R., Haefner, S. A., Asadi, S., Kazi, S., Rodak, T., & Quilty, L. C. (2021). A meta-analysis of emotional regulation outcomes in psychological interventions for youth with depression and anxiety. *Nature human behaviour*, 5(10), 1443-1457.
- Liu, M., Liu, H., Qin, Z., Tao, Y., Ye, W., & Liu, R. (2024). Effects of physical activity on depression, anxiety, and stress in college students: the chain-based mediating role of psychological resilience and coping styles. *Frontiers in Psychology*, 15, 1396795.
- Ryu, S. (2024). Feasibility and Preliminary Efficacy of Health Wearable-Based Physical Education to Improve Physical Activity and Psychosocial Beliefs among Underserved Adolescents: A Quasi-Experimental Study (Doctoral dissertation, University of Minnesota).
- Zheng, Y., Wang, W., Zhong, Y., Wu, F., Zhu, Z., Tham, Y. C., ... & Liu, Y. (2021). A peer-to-peer live-streaming intervention for children during COVID-19 homeschooling to promote physical activity and reduce anxiety and eye strain: cluster randomized controlled trial. *Journal of medical Internet research*, 23(4), e24316.
- Wagner, K. M. (2024). Tracking Student Effort During the PACER Using Rate of Perceived Exertion and Heart Rate (Doctoral dissertation, Concordia University Chicago).
- San Román-Mata, S., Puertas-Molero, P., Ubago-Jiménez, J. L., & González-Valero, G. (2020). Benefits of physical activity and its associations with resilience, emotional intelligence, and psychological distress in university students from southern Spain. *International journal of environmental research and public health*, 17(12), 4474.
- Zhang, Z., Wang, T., Kuang, J., Herold, F., Ludyga, S., Li, J., ... & Zou, L. (2022). The roles of exercise tolerance and resilience in the effect of physical activity on emotional states among college students. *International journal of clinical and health psychology*, 22(3), 100312.
- Liu, M., Liu, H., Qin, Z., Tao, Y., Ye, W., & Liu, R. (2024). Effects of physical activity on depression, anxiety, and stress in college students: the chain-based mediating role of psychological resilience and coping styles. *Frontiers in Psychology*, 15, 1396795.
- Mulvenna, V. (2024). Beyond Four Walls: Outdoor Recess as a Complement to Classroom Engagement.
- Banks, C. J. (2023). A Phenomenological Study Examining Teacher Experiences with Outdoor Recess Time for K-2 Students.
- Nolan, D. (2024). The Impact of Recess in the Elementary Classroom (Master's thesis, Roberts Wesleyan College (Rochester)).
- Peiyan, W. X. G. K. H. (2024). Sports Recess: An Important Method to Enhance Physical Activity Among Primary and Secondary School Students in China. *Quality Physical Education in Active School and its Perspectives. Researches-Best Practices-Situation.*, 419.
- Hyndman, B., & Wyver, S. (2021). Outdoor recreation within the school setting: A physiological and psychological exploration. In *Outdoor Recreation: Physiological and*

- psychological effects on health (pp. 1-17). IntechOpen London.
- Sohl Jeppesen, L., Sandfeld, J., Smedegaard, S., Nielsen, G., Mandelid, M. B., Norup, M., ... & Bugge, A. (2025). Implementation Outcomes and Recommendations of Two Physical Activity Interventions: Results from the Danish ACTIVE SCHOOL Feasibility Study. *International Journal of Environmental Research and Public Health*, 22(1), 67.
- Barbara, G. (2024). A retrospective study on the influence of physical education on lifelong physical activity (Master's thesis, University of Malta).
- Berardi, J. A. (2023). Perceptions of District Leaders' Support for Pupil Personnel Service Leaders in Special Education. Sage Graduate School.
- García-Hermoso, A. (2024). Physical Activity Opportunities During School Recess. In *Promotion of Physical Activity and Health in the School Setting* (pp. 213-231). Cham: Springer Nature Switzerland.
- Mak, C., & Koustova, N. (2023). Recess time: Help or hindrance to the social-emotional development of young children?. *Theory Into Practice*, 62(2), 127-140.
- Hodges, V. C., Centeio, E. E., & Morgan, C. F. (2022). The benefits of school recess: a systematic review. *Journal of School Health*, 92(10), 959-967.
- Nolan, D. (2024). The Impact of Recess in the Elementary Classroom (Master's thesis, Roberts Wesleyan College (Rochester)).
- Webb, R. L. (2024). The effects of positive action, a character curriculum, on the social and emotional development of elementary children (Master's thesis, Texas Christian University).
- Garcia-Peinado, R. (2023). The impact of classroom climate on emotional development in childhood. *Environment and Social Psychology*, 9(1), 1-17.
- Alghamdi, I. (2024). Application of Peer-Mediated Instruction and Intervention (PMII) to Enhance Social Interaction Skills in Early Elementary-Level Saudi Students With Autism Spectrum Disorder (ASD) in an Inclusion Setting (Doctoral dissertation, Duquesne University).
- Millis, B. (Ed.). (2023). Cooperative learning in higher education: Across the disciplines, across the academy. Taylor & Francis.
- Holloway, R. A. (2024). The Good Kid Toolkit: 200 Fun Activities to Nurture Kindness, Boost Confidence, and Build Character in Children. Jstone Publishing.
- Killen, M., Luken Raz, K., & Graham, S. (2022). Reducing prejudice through promoting cross-group friendships. *Review of General Psychology*, 26(3), 361-376.
- Sankalaite, S., Huizinga, M., Dewandeleer, J., Xu, C., De Vries, N., Hens, E., & Baeyens, D. (2021). Strengthening executive function and self-regulation through teacher-student interaction in preschool and primary school children: A systematic review. *Frontiers in psychology*, 12, 718262.
- Holland, S. K. (2021). Physical Education and Extracurricular Activity Participation of Autistic, Neurodivergent, Disabled Trans Adults (Doctoral dissertation, Old Dominion University).
- Morales Belando, M. T., González Gálvez, N., & Manzanares Serrano, A. (2024). A guide to physical activities for individuals with specific learning disorders.
- Allen, K. (2020). Impacting Student On-Task Behaviors Through Classroom Based Physical Activity and Movement.
- Vermeire, K. (2021). Improving Attention to School Tasks through Movement Play (Doctoral dissertation, Fielding Graduate University).
- Chueh, T. Y., Hsieh, S. S., Tsai, Y. J., Yu, C. L., Hung, C. L., Benzing, V., ... & Hung, T. M. (2022). Effects of a single bout of moderate-to-vigorous physical activity on executive functions

- in children with attention-deficit/hyperactivity disorder: A systematic review and meta-analysis. *Psychology of sport and exercise*, 58, 102097.
- Zeng, X., Cai, L., Wong, S. H. S., Lai, L., Lv, Y., Tan, W., ... & Chen, Y. (2021). Association of sedentary time and physical activity with executive function among children. *Academic Pediatrics*, 21(1), 63-69.
- St Laurent, C. (2019). Feasibility and Efficacy of a Recess-Based Combined Fitness Intervention on Cognition and Academic Performance in Elementary School Children.
- Lyons, K. (2019). Facilitating young children's conceptual knowledge of mathematics through physical activity (Doctoral dissertation).
- Mazzoli, E., Salmon, J., Teo, W. P., Pesce, C., He, J., Ben-Soussan, T. D., & Barnett, L. M. (2021). Breaking up classroom sitting time with cognitively engaging physical activity: Behavioural and brain responses. *PLoS One*, 16(7), e0253733.
- Hartikainen, J. (2023). Sedentary behaviour, physical activity and engagement in open learning spaces and conventional classrooms in primary school settings. JYU Dissertations.
- Chen, C. (2024). Exploring the impact of acute physical activity on creative thinking: a comprehensive narrative review with a focus on activity type and intensity. *Discover Psychology*, 4(1), 3.
- Antos, Z., Zackiewicz, K., Tomaszek, N., Modzelewski, S., & Waszkiewicz, N. (2024). Beyond Pharmacology: A Narrative Review of Alternative Therapies for Anxiety Disorders. *Diseases*, 12(9), 216.
- Howie, E. K., Perryman, K. L., Moretta, J., & Cameron, L. (2023). Educational outcomes of recess in elementary school children: A mixed-methods systematic review. *Plos one*, 18(11), e0294340.
- Hodges, V. C., Centeio, E. E., & Morgan, C. F. (2022). The benefits of school recess: a systematic review. *Journal of School Health*, 92(10), 959-967.
- Massey, W., Neilson, L., & Salas, J. (2020). A critical examination of school-based recess: what do the children think?. *Qualitative Research in Sport, Exercise and Health*, 12(5), 749-763.
- Gonzales, D. J. (2023). "What's This Got to Do With PE? Why Can't We Just Play?": Exploring the Effects on Intentionally Implementing Social Emotional Learning Through Physical Education Classes (Doctoral dissertation, Boston University).
- Mulvenna, V. (2024). Beyond Four Walls: Outdoor Recess as a Complement to Classroom Engagement.
- Huésca, E., Moreno-Murcia, J. A., Domenech, J. F., & Núñez, J. L. (2020). Effects of an autonomy-supportive physical activity program for compensatory care students during recess time. *Frontiers in Psychology*, 10, 3091.
- Lechner, V., Ortelbach, N., Peter, C., & Scheithauer, H. (2023). Developmentally appropriate prevention of behavior and emotional problems and fostering of social and emotional skills in elementary school—Overview of program theory and measures of the preventive intervention program Papilio-6to9. *International Journal of Developmental Science*, 16(3-4), 99-118.