Physical Activity in Children
ISSN: 2783-5391

Original Article

Impact of Cooperative Games on Intention to Physical Activity, Self-Esteem and Perceived Competence in Obese Adolescents

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Received: 06 February, 2025; **Revised:** 15 April, 2025; **Accepted:** 23 April, 2025; **Published**: 30 May, 2025.

Abstract

Introduction: The significant impact of play and physical activity (PA) on both physical and mental well-being underscores the importance of enhancing self-esteem and competence in obese adolescents.
Objective: The purpose of current study was to investigate and evaluate the effectiveness of cooperative games in fostering intention to PA, self-esteem and perceived competence among obese adolescents.
Methods: A quasi-experimental design utilizing a pretest-posttest approach was employed. The sample consisted of 86 obese adolescents, aged 13 to 16 years, who were divided into intervention and control groups. The intervention group engaged in the cooperative games in physical education (PE) over a period of 16 weeks. Standardized questionnaires were employed to assess the research variables, and the data were analyzed using ANCOVA.
Results: The findings revealed that individuals in the intervention group demonstrated a significant enhancement in intention to PA ($F = 9.847$, $P < 0.001$), self-esteem ($F = 12.859$, $P < 0.001$) and perceived competence ($F = 19.850$, $P < 0.001$) from the pretest to the posttest. In contrast, the control group did not show any significant changes.
Conclusion: The findings of this study can be implied as a foundation for developing educational interventions within school settings, particularly in PE.

Keywords: Cooperative Games, Intention, Physical Activity, Self-Esteem, Obesity, Perceived Competence

How to Cite: Fallah Z. Impact of Cooperative Games on Intention to Physical Activity, Self-Esteem and Perceived Competence in Obese Adolescents. Phys. Act. Child. 2025;2(1):7-12. doi: 10.22034/PACH.2025.504948.1044

1. Introduction

Obesity represents a significant public health issue in the current century and ranks as the fifth leading cause of mortality globally. It is characterized by an excessive buildup of adipose tissue, which arises from a disparity between caloric consumption and energy expenditure (1,2). Obesity is recognized as a chronic condition that serves as a precursor to numerous health issues, particularly cardiovascular diseases and diabetes (3). It significantly diminishes individuals' work capacity and overall functionality, rendering them more susceptible to a variety of illnesses. Medical literature emphasizes that the development of obesity and weight gain in adulthood poses a considerable health threat (4,5). Furthermore, obesity adversely affects the quality of life, elevating the prevalence of both psychiatric and physical disorders (6). In addition, the incidence of obesity has steadily risen since the early twentieth century. This trend can be attributed to the growth of industrialization, modernization, and economic advancements across numerous nations, which, while enhancing living standards and expanding services, have also led to negative outcomes such as alterations in dietary habits, reduced physical activity (PA), and an increase in obesity rates (7). In recent decades, the number of individuals classified as obese has consistently grown, with a notable surge in prevalence over the last ten years. In 2022, approximately 12.5% of the global population was affected by obesity (2). Since 1990, the global prevalence of obesity in adults has more than doubled, and the rate among adolescents has surged fourfold. In that year, approximately 2.5 billion adults aged 18 and older were identified as overweight, with 890 million of them qualifying as obese (7).

The rising rates of obesity and overweight conditions among both children and adults globally serve as a significant concern for health professionals. In numerous nations, the prevalence of obesity is attributed to decreased levels of PA and unhealthy lifestyle choices (8). High health indicators and robust physical capabilities are reflective of a society's overall health and empowerment (9). In recent years, physical inactivity has become increasingly common, emerging as the second leading cause of mortality worldwide, resulting in approximately 3.2 million deaths each year (10). Individuals engaging in vigorous PA tend to exhibit better health outcomes compared to those participating in light or moderate exercise. Conversely, those who are physically inactive are more likely to become overweight and may experience withdrawal, pessimism, and social isolation, ultimately leading to an imbalance in their psychological well-being (11).

Adolescence is recognized as a critical and vulnerable phase in human development. This period is characterized by a rapid increase in growth, necessitating heightened levels of mobility and PA (12). During adolescence, individuals typically achieve approximately 20% of their final adult height and 50% of their adult weight. Currently, the global adolescent demographic is estimated at around 1.3 billion, representing roughly 16% of the overall world population (13). Issues related to inactivity and excess weight are prevalent among adolescents, adversely impacting not only their growth trajectories but also their long-term health outcomes as adults (14). The levels of PA and mobility are intrinsically linked to both physical and mental well-being; maintaining a healthy BMI and engaging in regular daily activities are essential for promoting individual health and enhancing overall productivity (15). It is during adolescence that foundational health behaviors are established, and various risk factors, such as obesity, cardiovascular diseases, lipoprotein abnormalities, and hypertension—often precursors to chronic diseases in adulthood—begin to emerge (16). Despite ongoing global initiatives aimed at enhancing community health, the challenges of physical inactivity and overweight remain significant health concerns, particularly in developing nations (17).

Obesity significantly impacts the social, psychological, and cognitive development of youth, with these secondary issues frequently extending into adulthood (1,5,6). Key areas influenced by obesity include PA, self-esteem, and perceived competence (7,9). Research indicates that youth who are obese often feel inadequate in their ability to engage in daily activities, exhibit low PA, and possess diminished self-esteem and physical competence (14,15,17). Numerous studies have explored various interventions within school settings aimed at addressing obesity among this demographic (see 17 for a review). However, the diversity of these interventions and the variability in their quality have complicated efforts to establish definitive conclusions regarding the effectiveness of any single approach. Consequently, there is a pressing need for further investigation into the factors that influence the success of these interventions.

PA plays a crucial role in the educational experiences of school-aged children (18,19). Educators and facilitators in childhood settings utilize PA to enhance motivation and foster a joyful learning atmosphere. Various concepts, including second language acquisition, mathematics, and social skills development, are imparted to children through play, with movement being a fundamental component of all childhood games (20,21). Indeed, children engage in activities such as climbing, jumping, running, and throwing objects primarily for enjoyment and to explore their physical abilities (18-20). In the realm of education, both cooperative and competitive games can be employed as learning tools (22-24). The achievement of an individual within a group is intricately linked to the accomplishments of fellow members, as each participant contributes to the collective effort aimed at reaching a shared objective. Consequently, the success of one individual enhances the prospects of others within the group. Conversely, traditional educational practices have often emphasized competition among students, with many schools favoring competitive methods (22). Competitive learning, characterized by individual or group rivalry to attain specific goals, inherently means that the success of one group can hinder the progress of another. Furthermore, limited research has explored the contrasting outcomes of different types of activities; for instance, youth facing obesity may refrain from participating in group games due to inadequate athletic performance, which can further aggravate their condition. Thus, the implementation of cooperative and group games emerges as a valuable and effective training approach, particularly in enhancing physical coordination, and such cooperative activities can significantly aid in addressing developmental coordination disorders.

The significant impact of PA on both physical and mental well-being underscores the importance of enhancing self-esteem and competence in obese adolescents. Consequently, it is essential to undertake research that explores and contrasts various training methodologies tailored for this population. A review of existing literature revealed a lack of studies focusing on the influence of exercise and the comparative analysis of different training approaches on the PA, self-esteem and competence of children with obesity. Therefore, the current study aims to examine and evaluate the effectiveness of cooperative games in fostering intention to PA, self-esteem and perceived competence among obese adolescents.

2. Methods

2.1. Participants

A quasi-experimental design employing a pretest-posttest non-equivalent group framework was implemented to engage participants in this research. Class groups were preserved to facilitate a contextual and ecological examination of interventions centered on game-based approaches. The statistical population of this study included adolescents aged 13 to 16 years with a BMI at or above the 95th percentile who were enrolled in the 7th to 9th grades in public middle schools. The study sample involved 86 obese adolescents across four schools that shared a comparable socio-economic and cultural background. Participants were categorized into an intervention group (n = 44; comprising 23 males and 22 females) and a control group (n = 42; consisting of 21 males and 20 females). The study's inclusion criteria specified that participants must be between the ages of 13 and 16 years with a BMI of 30 or higher and should not exhibit any acute neurological or psychological disorders. Additionally, specific physical conditions that contribute to obesity, such as endocrine or hormonal disorders, were considered exclusionary factors. Participants were also required to refrain from using medications that could induce weight gain. Conversely, individuals were excluded from the study if they failed to cooperate during testing or did not attend educational sessions. This research was conducted based on the principles outlined in the Helsinki Declaration, ensuring that all ethical considerations regarding the participants were adhered to. Consent written forms were obtained from both the participants and their parents.

2.2. Measurements

2.2.1. Intention to Physical Activity

The assessment of the intention to PA was conducted through two questions, utilizing a Likert scale that spanned from strongly disagree (1) to strongly agree (7). In this research, the questionnaire's validity was affirmed by a panel of eight experts, yielding a Content Validity Index (CVI) of 1.00 and a Content Validity Ratio (CVR) of 1.00. Additionally, the reliability of the questionnaire was found to be excellent, as evidenced by a Cronbach's alpha coefficient of 0.98.

2.2.2. Self-Esteem

The Rosenberg Self-Esteem Scale (25) served as the tool for evaluating the self-esteem levels of the students. This scale comprises 10 items rated on a four-point Likert scale, ranging from strongly disagree (0) to strongly agree (3). In the context of this study, eight experts were consulted to evaluate the validity of the questionnaire, employing measures such as CVI and CVR. The experts affirmed the validity of the scale, yielding a CVI of 1.00 and a CVR of 1.00. Furthermore, the reliability of the questionnaire was examined, resulting in a Cronbach's alpha coefficient of 0.92.

2.2.3. Perceived Competence

Perceived competence in physical education (PE) was evaluated through the Scrabis-Fletcher and Silverman Questionnaire (26), which consists of 15 items rated on a 5-point Likert scale ranging from completely disagree (1) to completely agree (5). In the current study, the validity of the questionnaire was corroborated by a panel of eight experts, yielding a CVI of 0.92 and a CVR of 0.94, and its reliability was evaluated, yielding a Cronbach's alpha coefficient of 0.70.

2.3. Procedure

The research commenced with vital collaboration with the Education Department, which was subsequently followed by the acquisition of necessary permissions to proceed. Both students and parents were thoroughly briefed beforehand regarding the aims and methodology of the study. Approval for the distribution of the questionnaire to students was granted by the school principals, and written consent was collected through signatures from all participating students and their guardians. It was emphasized to both students and their parents that participation in the survey was entirely voluntary and anonymous. The questionnaires were conducted during standard class periods, requiring about 15 to 20 minutes for completion. In contrast, participation in the intervention program, which incorporated cooperative games into PE curriculum, was compulsory. The intervention group participated in PE that utilized the Cooperative Learning model, emphasizing positive interdependence among peers and the development of interpersonal skills through collaborative tasks over 16 weeks/lessons. Conversely, the control group engaged in standard PE characterized by individual drills and repetitive exercises aimed at skill enhancement and procedural mastery. The formulation of the intervention program was informed by prior studies on cooperative learning methodologies, the elements of established cooperative games, and principles derived from Self-Determination Theory. Cooperative games were designed to enhance key factors that contribute to the enjoyment of PE, particularly the sense of social connectedness and perceived competence within this context. To achieve these objectives, a structural approach to cooperative learning was adopted to select games that promote two fundamental aspects: positive interdependence among group members and individual accountability. Examples of such games include Blinded Soccer and Pyramid Construction, which emphasize essential skills such as communication, cooperative coordination, collective problem-solving, tolerance for mutual dependence, physical interaction, trust-building, and collaborative strategy development (23,24). Participants completed paper-based questionnaires on the first (i.e., pretest) and last days (i.e., posttest) of the intervention.

2.4. Data Analysis

In this research, the variables were defined through the computation of the mean and standard deviation (SD). The Kolmogorov-Smirnov test was employed to evaluate the normality of the data distribution, with all outcomes showing $P>0.05$. To compare the pretest scores across the different research groups, an independent t-test was utilized. Furthermore, analysis of covariance (ANCOVA) was performed to examine the impact of the intervention on the research variables. A significance threshold of 0.05 was set for all statistical evaluations, and data analysis was conducted using SPSS software version 27.

3. Results

The participants in the intervention and control groups had average ages of 14.85 ± 0.23 years and 14.80 ± 0.21 years, respectively, with no statistically significant differences observed ($P>0.05$). Additionally, BMI for the intervention group was 31.23 ± 1.41, while the control group had a mean BMI of 31.19 ± 1.39, again indicating no statistically significant differences ($P>0.05$).

Table 1 presents the mean and SD of the research variables in the pretest and posttest. As observed, there is no significant difference between the intervention and control groups regarding the intention to PA during the pre-test (2.22 ± 0.43 and 2.18 ± 0.34, respectively, $t = 0.632$, $P = 0.601$). Additionally, no significant difference was found in self-esteem scores between the intervention and control groups at the pre-test stage (11.49 ± 1.76 and 11.13 ± 1.42, respectively, $t = 0.820$, $P = 0.426$). Finally, the pre-test scores for the perceived competence indicated that there is no significant difference between the intervention and control groups (24.85 ± 3.63 and 23.93 ± 2.97, respectively, $t = -0.746$, $P = 0.537$). These results suggest that the research groups were in a similar condition concerning the study variables prior to the commencement of the intervention.

Table 1. Mean and Sd of Research Variables in the Pretest and Posttest Across Groups.

	Intervention		Control	
	Pre-test	Post-test	Pre-test	Post-test
Intention to Physical Activity	2.22 ± 0.43	3.47 ± 0.68	2.18 ± 0.34	2.20 ± 0.36
Self-Esteem	11.49 ± 1.76	15.82 ± 2.78	11.13 ± 1.42	11.29 ± 1.55
Perceived Competence	24.85 ± 3.63	32.58 ± 4.19	23.93 ± 2.97	24.08 ± 2.71

The findings regarding the influence of the intervention on the research variables are presented in Table 2. Regarding intention to PA, the results indicated that participants in the intervention group exhibited a 1.25 increase in their intention to PA from the pre-test to the post-test (2.22 ± 0.43 and 3.47 ± 0.68 in the pretest and posttest, respectively). In contrast, no significant change in scores was observed among the control group participants (2.18 ± 0.34 and 2.20 ± 0.36 in the pretest and posttest, respectively). Here, the ANCOVA results revealed a statistically significant effect for the group ($F = 9.847$, $P < 0.001$), suggesting a significant difference between the intervention group and the control group. These findings suggest that participation in a cooperative games' intervention has led to a heightened intention to PA among adolescents with obesity.

Furthermore, concerning self-esteem, the findings demonstrated that individuals in the intervention group experienced an increase of 4.69 in their self-esteem from the pre-test to the post-test (11.49 ± 1.76 for the pretest and 15.82 ± 2.78 for the posttest). Conversely, the control group showed no notable change in their scores (11.13 ± 1.42 for the pretest and 11.29 ± 1.55 for the posttest). The results of the ANCOVA indicated a statistically significant effect for the group ($F = 12.859$, $P < 0.001$), highlighting a significant difference between the intervention and control groups. These results imply that involvement in a cooperative games intervention has contributed to an enhancement of self-esteem among adolescents with obesity.

In addition, regarding perceived competence, the results indicated that participants in the intervention group experienced an increase of 7.73 in their perceived competence from the pre-test to the post-test (with scores of 24.85 ± 3.63 for the pretest and 32.58 ± 4.19 for the posttest). In contrast, the control group exhibited no significant change in their scores (23.93 ± 2.97 for the pretest and 24.08 ± 2.71 for the posttest). The ANCOVA results revealed a statistically significant effect for the group ($F = 19.850$, $P < 0.001$), underscoring a significant difference between the intervention and control groups. These findings suggest that participation in a cooperative games' intervention has positively influenced the perceived competence of adolescents with obesity.

Table 2. The Results of ANCOVA.

	Type III Sum of Squares	df	MS	F-Value	P-Value	η^2
Intention to Physical Activity	1536.745	1	576.428	9.847	<0.001	0.224
Self-Efficacy	2142.127	1	758.215	12.859	<0.001	0.361
Physical Self-Concept	3247.663	1	967.458	19.850	<0.001	0.638

4. Discussion

The current study examined the effectiveness of cooperative games in fostering intention to PA, self-esteem and perceived competence among obese adolescents. These findings of this study suggest that participation in a cooperative games' intervention in PE has led to a heightened intention to PA and enhancement of self-esteem and perceived competence among adolescents with obesity. These findings, which align with previous research regarding the positive impact of cooperative games on youth (23,24,27-33), clearly indicate that the incorporation of cooperative games in PE can yield beneficial effects on the physical and mental health of youth, particularly those facing obesity challenges.

The interpretation of these findings suggests that PA create avenues for youth with obesity to engage in realistic and affirmative self-assessment through social interactions (14). PA intervention programs have been shown to enhance physical self-efficacy, perceived physical competence, and enjoyment (15). The findings suggest that regular engagement in PA, particularly in young children, leads to improved motor skill proficiency, which in turn elevates their perceived motor competence (16). This enhancement subsequently fosters greater physical self-efficacy and enjoyment in participating in PA among the study participants. In contrast, no such increase was noted in the control group, which continued with their standard play and motor activities throughout the day.

In this study, the games were structured to promote encouragement among all group members, allowing students to experience moments of pride and joy multiple times. This experience was particularly beneficial for individuals grappling with low self-esteem and psychological challenges stemming from physical inactivity, as it enhanced their mental well-being and facilitated a more favorable evaluation of their abilities, thereby boosting intention to PA, self-esteem and self-confidence (23,24). It is noted that youth with obesity often face diminished self-esteem due to a history of failures and perceived incompetence. The results of this study further indicated that cooperative games significantly contributed to enhancing self-esteem and feelings of competence among obese adolescents. Such games lay the groundwork for increased success, which in turn fosters motivation, making PA more enjoyable. This enjoyment leads to heightened self-confidence and perceived competence, ultimately resulting in an increase in self-esteem (33).

Conversely, when children find themselves in circumstances where they might err or experience failure, they often exhibit heightened anxiety and stress, leading to diminished performance. Additionally, youth with obesity frequently perceive themselves as susceptible to unfavorable assessments from others, resulting in a tendency to fear and evade social interactions (28,29). In competitive activities typically employed in PE, the apprehension regarding judgment and negative evaluations of their performance, skills, and abilities by peers, friends, and

coaches generates significant worry and stress. This emotional burden can subsequently lead to a decline in motivation and a reduction in self-confidence (30,31). This reduced motivation and confidence are likely to impede enhancements in self-esteem relative to engagement in cooperative games. Therefore, it can be argued that students benefit directly from cooperative games, as they derive increased enjoyment and a stronger sense of skill and connection with their peers during PE. Additionally, these games contribute to overall enjoyment by fostering positive experiences linked to competence and social bonds (30,33).

4.1. Conclusion

This research demonstrated that an educational intervention utilizing cooperative games in PE markedly enhanced the intention to engage in physical activity, self-esteem, and perceived competence among obese adolescents. These positive outcomes are likely attributable to heightened enjoyment and self-confidence experienced by these individuals in PE. Such findings are significant for advancing both the physical and mental well-being of adolescents facing obesity challenges. Given the critical role of physical activity during adolescence and its long-term health implications, these results can serve as a foundation for developing educational interventions within school settings, particularly in PE. To effectively integrate the cooperative games model within educational environments, particularly in PE, it is advisable for schools to conduct regular workshops aimed at both students and physical educators. This approach will facilitate a comprehensive understanding of the model's principles. Furthermore, promoting involvement in group activities and team sports, particularly among students with obesity-related issues, can significantly enhance their enthusiasm for engaging in physical exercise. Additionally, ongoing assessment and monitoring of the outcomes associated with educational initiatives, such as cooperative games in PE, are crucial for their refinement and enhancement. Lastly, it is important to investigate the long-term impacts of educational strategies like cooperative games in PE settings across diverse populations.

Acknowledgments

The authors is grateful to all the participants who participated in this research.

Footnotes

Authors' Contribution: This study was carried out solely by the corresponding author.

Conflicts of Interest

Non to declare.

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

Ethical Approval: The author confirms that all steps and requirements of this study comply with ethical guidelines. Participants were informed about the characteristics of the study and gave written informed consent.

Funding Support

This study received no grant.

Informed Consent: Informed written consent was obtained from all participants

Supplementary information accompanies this paper at doi: 10.22034/PACH.2025.504948.1044

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References

1. Jebeile H, Kelly AS, O'Malley G, Baur LA. Obesity in children and adolescents: epidemiology, causes, assessment, and management. Lancet Diabetes Endocrinol. 2022;**10**(5):351-365. [PubMed ID: 35248172]. [PubMed Central ID: PMC9831747]. https://doi.org/10.1016/s2213-8587(22)00047-x
2. Kansra AR, Lakkunarajah S, Jay MS. Childhood and Adolescent Obesity: A Review. Front Pediatr. 2021;**8**:581461. [PubMed ID: 33511092]. [PubMed Central ID: PMC7835259]. https://doi.org/10.3389/fped.2020.581461
3. Lister NB, Baur LA, Felix JF, Hill AJ, Marcus C, Reinehr T, Summerbell C, Wabitsch M. Child and adolescent obesity. Nat Rev Dis Primers. 2023;**9**(1):24. [PubMed ID: 37202378]. https://doi.org/10.1038/s41572-023-00435-4
4. Cali AM, Caprio S. Obesity in children and adolescents. J Clin Endocrinol Metab. 2008;**93**(11 Suppl 1):S31-6. [PubMed ID: 18987268]. [PubMed Central ID: PMC2585761]. https://doi.org/10.1210/jc.2008-1363
5. Zhang X, Liu J, Ni Y, Yi C, Fang Y, Ning Q, Shen B, Zhang K, Liu Y, Yang L, Li K, Liu Y, Huang R, Li Z. Global Prevalence of Overweight and Obesity in Children and Adolescents: A Systematic Review and Meta-Analysis. JAMA Pediatr. 2024;**178**(8):800-813. [PubMed ID: 38856986]. [PubMed Central ID: PMC11165417]. https://doi.org/10.1001/jamapediatrics.2024.1576
6. Nogueira-de-Almeida CA, Weffort VRS, Ued FDV, Ferraz IS, Contini AA, Martinez EZ, Ciampo LAD. What causes obesity in children and adolescents? J Pediatr (Rio J). 2024;**100** Suppl 1(Suppl 1):S48-S56. [PubMed ID: 37918812]. [PubMed Central ID: PMC10960191]. https://doi.org/10.1016/j.jped.2023.09.011
7. Wong G, Srivastava G. Obesity Management in Children and Adolescents. Gastroenterol Clin North Am. 2023;**52**(2):443-455. [PubMed ID: 37197885]. https://doi.org/10.1016/j.gtc.2023.03.011
8. Bradwisch SA, Smith EM, Mooney C, Scaccia D. Obesity in children and adolescents: An overview. Nursing. 2020;**50**(11):60-66. [PubMed ID: 33105431]. https://doi.org/10.1097/01.nurse.0000718908.20119.01
9. Lee EY, Yoon KH. Epidemic obesity in children and adolescents: risk factors and prevention. Front Med. 2018;**12**(6):658-666. [PubMed ID: 30280308]. https://doi.org/10.1007/s11684-018-0640-1
10. Tung JYL, Poon GWK, Du J, Wong KKY. Obesity in children and adolescents: Overview of the diagnosis and management. Chronic Dis Transl Med. 2023;**9**(2):122-133. [PubMed ID: 37305109]. [PubMed Central ID: PMC10249183]. https://doi.org/10.1002/cdt3.58
11. Hu K, Staiano AE. Trends in Obesity Prevalence Among Children and Adolescents Aged 2 to 19 Years in the US From 2011 to 2020. JAMA Pediatr. 2022 Oct 1;**176**(10):1037-1039. [PubMed ID: 35877133]. [PubMed Central ID: PMC9315946]. https://doi.org/10.1001/jamapediatrics.2022.2052 Erratum in: JAMA Pediatr. 2023;177(12):1362. https://doi.org/10.1001/jamapediatrics.2023.4558.
12. Chung YL, Rhie YJ. Severe Obesity in Children and Adolescents: Metabolic Effects, Assessment, and Treatment. J Obes Metab Syndr. 2021;**30**(4):326-335. [PubMed ID: 34924365]. [PubMed Central ID: PMC8735819]. https://doi.org/10.7570/jomes21063
13. van Sluijs EMF, Ekelund U, Crochemore-Silva I, Guthold R, Ha A, Lubans D, Oyeyemi AL, Ding D, Katzmarzyk PT. Physical activity behaviours in adolescence: current evidence and opportunities for intervention. Lancet. 2021;**398**(10298):429-442. [PubMed ID: 34302767]. [PubMed Central ID: PMC7612669]. https://doi.org/10.1016/s0140-6736(21)01259-9
14. Ługowska K, Kolanowski W, Trafialek J. Increasing Physical Activity at School Improves Physical Fitness of Early Adolescents. Int J Environ Res Public Health. 2023;**20**(3):2348. [PubMed ID: 36767711]. [PubMed Central ID: PMC9915395]. https://doi.org/10.3390/ijerph20032348
15. Reilly JJ, Aubert S, Brazo-Sayavera J, Liu Y, Cagas JY, Tremblay MS. Surveillance to improve physical activity of children and adolescents. Bull World Health Organ. 2022;**100**(12):815-824. [PubMed ID: 36466205]. [PubMed Central ID: PMC9706360]. https://doi.org/10.2471/blt.22.288569
16. Marques A, Henriques-Neto D, Peralta M, Martins J, Demetriou Y, Schönbach DMI, Matos MG. Prevalence of Physical Activity among

Adolescents from 105 Low, Middle, and High-income Countries. Int J Environ Res Public Health. 2020;**17**(9):3145. [PubMed ID: 32365969]. [PubMed Central ID: PMC7246732]. https://doi.org/10.3390/ijerph17093145
17. Neil-Sztramko SE, Caldwell H, Dobbins M. School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6 to 18. Cochrane Database Syst Rev. 2021;**9**(9):CD007651. [PubMed ID: 34555181]. [PubMed Central ID: PMC8459921]. https://doi.org/10.1002/14651858.cd007651.pub3
18. James J, Pringle A, Mourton S, Roscoe CMP. The Effects of Physical Activity on Academic Performance in School-Aged Children: A Systematic Review. Children (Basel). 2023;**10**(6):1019. [PubMed ID: 37371251]. [PubMed Central ID: PMC10297707]. https://doi.org/10.3390/children10061019
19. Marrero-Rivera JP, Sobkowiak O, Jenkins AS, Bagnato SJ, Kline CE, Gordon BD, Taverno Ross SE. The Relationship between Physical Activity, Physical Fitness, Cognition, and Academic Outcomes in School-Aged Latino Children: A Scoping Review. Children (Basel). 2024;**11**(3):363. [PubMed ID: 38539398]. [PubMed Central ID: PMC10969699]. https://doi.org/10.3390/children11030363
20. Sutapa P, Pratama KW, Rosly MM, Ali SKS, Karakauki M. Improving Motor Skills in Early Childhood through Goal-Oriented Play Activity. Children (Basel). 2021;**8**(11):994. [PubMed ID: 34828707]. [PubMed Central ID: PMC8625902]. https://doi.org/10.3390/children8110994
21. Cámara-Martínez A, Ruiz-Ariza A, Suárez-Manzano S, Cruz-Cantero RM, Martínez-López EJ. Effect of an Integrated Active Lessons Programme through Playful Maths Games on Self-Concept, Self-Esteem and Social Skills in Preschool Children. Behav Sci (Basel). 2023;**13**(3):260. [PubMed ID: 36975285]. [PubMed Central ID: PMC10044771]. https://doi.org/10.3390/bs13030260
22. Alotaibi MS. Game-based learning in early childhood education: a systematic review and meta-analysis. Front Psychol. 2024;**15**:1307881. [PubMed ID: 38629045]. [PubMed Central ID: PMC11018941]. https://doi.org/10.3389/fpsyg.2024.1307881
23. Engels ES, Freund PA. Effects of cooperative games on enjoyment in physical education-How to increase positive experiences in students? PLoS One. 2020;**15**(12):e0243608. [PubMed ID: 33284852]. [PubMed Central ID: PMC7721155]. https://doi.org/10.1371/journal.pone.0243608
24. Bores-García D, Hortigüela-Alcalá D, Fernandez-Rio FJ, González-Calvo G, Barba-Martín R. Research on Cooperative Learning in Physical Education: Systematic Review of the Last Five Years. Res Q Exerc Sport. 2021;**92**(1):146-155. [PubMed ID: 32023176]. https://doi.org/10.1080/02701367.2020.1719276
25. Davis C, Kellett S, Beail N. Utility of the Rosenberg self-esteem scale. Am J Intellect Dev Disabil. 2009;**114**(3):172-8. [PubMed ID: 19374464]. https://doi.org/10.1352/1944-7558-114.3.172
26. Scrabis-Fletcher K, Silverman S. Perception of competence in middle school physical education: instrument development and validation. Res Q Exerc Sport. 2010;**81**(1):52-61. [PubMed ID: 20387398]. https://doi.org/10.1080/02701367.2010.10599627
27. Staiano AE, Abraham AA, Calvert SL. Motivating effects of cooperative exergame play for overweight and obese adolescents. J Diabetes Sci Technol. 2012;**6**(4):812-9. [PubMed ID: 22920807]. [PubMed Central ID: PMC3440152]. https://doi.org/10.1177/193229681200600412
28. Zhou T, Wang H, Li D. Focusing on the value of cooperative learning in physical education: a bibliometric analysis. Front Psychol. 2023;**14**:1300986. [PubMed ID: 38090169]. [PubMed Central ID: PMC10713848]. https://doi.org/10.3389/fpsyg.2023.1300986
29. Mo W, Saibon JB, Li Y, Li J, He Y. Effects of game-based physical education program on enjoyment in children and adolescents: a systematic review and meta-analysis. BMC Public Health. 2024;**24**(1):517. [PubMed ID: 38373997]. [PubMed Central ID: PMC10875794]. https://doi.org/10.1186/s12889-024-18043-6
30. Neira-Navarrete D, Páez-Herrera J, Reyes-Amigo T, Yáñez-Sepúlveda R, Cortés-Roco G, Oñate-Navarrete C, Olivares-Arancibia J, Hurtado-Almonacid J. Effects of Modified Invasion Games on Motor Competence and Self-Assessed Physical Condition in Elementary School Students in the Physical Education Classroom. Children (Basel). 2024;**11**(3):337. [PubMed ID: 38539372]. [PubMed Central ID: PMC10969664]. https://doi.org/10.3390/children11030337
31. Yang C, Chen R, Chen X, Lu KH. The Efficiency of Cooperative Learning in Physical Education on the Learning of Action Skills and Learning Motivation. Front Psychol. 2021;**12**:717528. [PubMed ID: 34744877]. [PubMed Central ID: PMC8564497]. https://doi.org/10.3389/fpsyg.2021.717528
32. Fernández-Espínola C, Abad Robles MT, Collado-Mateo D, Almagro BJ, Castillo Viera E, Giménez Fuentes-Guerra FJ. Effects of Cooperative-Learning Interventions on Physical Education Students' Intrinsic Motivation: A Systematic Review and Meta-Analysis. Int J Environ Res Public Health. 2020;**17**(12):4451. [PubMed ID: 32575836]. [PubMed Central ID: PMC7345659]. https://doi.org/10.3390/ijerph17124451
33. Rivera-Pérez S, Fernandez-Rio J, Iglesias Gallego D. Effects of an 8-Week Cooperative Learning Intervention on Physical Education Students' Task and Self-Approach Goals, and Emotional Intelligence. Int J Environ Res Public Health. 2020;**18**(1):61. [PubMed ID: 33374777]. [PubMed Central ID: PMC7795078]. https://doi.org/10.3390/ijerph18010061