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Research article

Exploring the relationship between physical activity behavior, sport modality, and higher-order psychosocial skills in children

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ABSTRACT

This study investigated the association among physical activity and sport modality on fair play, moral decision-making, physical self-efficacy, and self-esteem in young children. The sample consisted of 129 primary school children (59 females). The findings revealed that both physical activity and sex variables had a general impact on fair play, whereas sport modality did not display any significant association with the studied constructs. In terms of moral decision-making, sex emerged as a significant predictor, while physical activity and sport modality did not show any noticeable effect. Regarding self-esteem, no notable distinctions were found among the independent variables. However, sex, physical activity level, and sport modality were identified as significant predictors of physical self-efficacy. This study emphasizes the intricate nature of these constructs and underscores the significance of considering multiple factors when examining their interrelationships.

1. Introduction

1.1. Background and rationale

Physical activity and sports play a fundamental role in children's cognitive, emotional, and social development. Engaging in structured and unstructured physical activities fosters not only physical health but also essential psychosocial skills such as fair play, moral reasoning, self-esteem, and self-efficacy [1–4].

Several theoretical models suggest that participation in sports facilitates the development of social behaviors, enhances self-regulation, and promotes ethical decision-making in competitive and cooperative settings [5–7].

Sport and physical activity can be categorized based on various factors, including metabolic demands (e.g., aerobic *vs.* anaerobic), technical complexity [8], and environmental interaction [9–11]. Within the environmental dimension, sociomotor classification distinguishes between open- and closed-skill sports, a continuum described in Parlebas' [9] model. Open-skill sports occur in dynamic, unpredictable environments where athletes must continuously adapt their actions based on external stimuli [12–14]. Examples include

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football, basketball, and tennis, which require higher situational awareness, decision-making skills, and real-time motor adjustments. In contrast, closed-skill sports take place in stable, controlled environments, where movements follow predefined, repetitive patterns with minimal external variability. Sports such as swimming, track and field, and cycling emphasize consistency and precision, allowing athletes to focus on refining their technique rather than reacting to changing conditions. However, even within these broad categories, sports vary in their degree of environmental stability [15]. For example, in open-skill sports, team-based activities (e.g., volleyball, basketball) typically require athletes to process a greater volume of information simultaneously compared to individual open-skill sports like tennis, where interaction with opponents is more structured. Conversely, in closed-skill sports, events like sprinting are largely unaffected by environmental factors, while disciplines such as gymnastics may involve minor variations due to performance surfaces or apparatus settings.

A similar classification exists between individual and team sports, which also overlaps with sociomotor theory. Team sports inherently involve direct interaction, cooperation, and coordination among players, fostering social and communication skills. In contrast, individual sports emphasize self-regulation, goal-setting, and personal accountability, as athletes rely primarily on their own strategies and abilities to achieve success [16]. Given these distinctions, it is reasonable to hypothesize that participation in different sport modalities may shape psychosocial skills in distinct ways, particularly during childhood and adolescence.

1.2. Theoretical framework

1.2.1. Self-efficacy theory, psychosocial development, and sport

Self-efficacy theory [17,18] provides a relevant framework for understanding how sport participation influences psychosocial outcomes. According to Bandura, self-efficacy, one's belief in their ability to perform specific tasks, affects motivation, persistence, and emotional resilience. In the context of sports, engaging in physical activities allows children to experience mastery, receive social encouragement, and observe peer performance, all of which contribute to self-efficacy development [19,20].

Empirical evidence supports the role of physical activity in enhancing self-efficacy and self-esteem in children, but findings vary by sport type and structure. Research suggests that physically active children tend to have higher self-efficacy and self-esteem compared to their less active peers [7,21,22]. However, the mechanisms underlying this relationship remain unclear. Some studies indicate that self-efficacy gains are more pronounced in team sports due to social reinforcement and collective efficacy—where teammates provide encouragement and support, fostering a sense of competence [2,16]. Conversely, individual sports may enhance self-efficacy through self-regulation, personal goal-setting, and independent mastery experiences [1,16,2].

Recent findings suggest that excessive specialization or high-intensity sport participation can have adverse effects. For instance, Evans and colleagues [16] reported that youth who engage in more than 17 hours of sport per week may experience psychological distress rather than enhanced self-efficacy. Additionally, early sport specialization has been linked to decreased enjoyment and motivation, particularly in competitive settings where performance pressure is high [23,16]. Understanding how different sport modalities influence self-efficacy is crucial for designing interventions that promote psychological well-being in children. While team sports may offer stronger social benefits, individual sports may foster greater self-reliance and personal resilience.

1.2.2. Moral decision-making and fair play in sport

Moral decision-making in sports refers to the ethical judgments individuals make in competitive settings, including adherence to rules, respect for opponents, and attitudes toward cheating [6]. Lee et al.'s [6] model conceptualizes moral decision-making as a multidimensional construct influenced by individual experiences, social norms, and contextual factors. This framework has been widely applied to investigate how sports participation shapes children's ethical reasoning and fair play behaviors.

Fair play, defined as respect for teammates, opponents, and the rules of the game, is often promoted in physical education and youth sports programs [24]. However, competitive pressure and performance-oriented environments can sometimes lead to an increased acceptance of gamesmanship and cheating [25,26]. The systematic review by Evans et al. [16] highlights that moral decision-making and fair play behaviors differ across sport types. Specifically, team sports, due to their social nature, can enhance cooperation and ethical reasoning but also expose young athletes to peer pressure that may encourage unethical behavior, such as strategic fouling or deception. In contrast, individual sports may foster self-regulation and self-discipline, but they provide fewer social interactions where moral reasoning is developed [1].

Additionally, the relationship between the moral climate in sports and athletes' moral behavior has been widely examined. A meta-analysis by Spruit et al. [4] found that a prosocial moral climate, characterized by respect for fair play and ethical conduct, was associated with greater adherence to fair play and fewer instances of cheating. Conversely, an antisocial moral climate, often fostered by hyper-competitive environments, significantly increased cheating, aggression, and moral disengagement. This effect was particularly stronger in team sports, where peer influences were more prominent than coach-driven moral norms.

Differences in moral reasoning have also been observed between open- and closed-skill sports, as well as between individual and team sports [16]. Open-skill sports, which require rapid decision-making in unpredictable environments, may promote strategic reasoning but can also create situations where bending the rules is perceived as advantageous. For instance, in sports like football or basketball, athletes may engage in tactical fouling to gain a competitive edge. Conversely, closed-skill sports, such as swimming and track and field, emphasize personal discipline and structured routines, which may lead to a lower prevalence of gamesmanship [14,12].

Behavior in sports is not only shaped by immediate social and environmental factors but also by broader ethical values reinforced by sport organizations, schools, and society at large [4,27]. Efforts to improve the moral climate in youth sports should focus on promoting positive peer interactions, ethical coaching practices, and intrinsic motivation for fair competition [2]. Programs that integrate character education and ethical training into youth sports have been shown to reduce unsportsmanlike behavior and enhance

prosocial values. These findings also highlight the importance of sport context in shaping moral values and ethical behavior in young athletes.

1.3. Research gaps and objectives

Despite extensive research on the benefits of physical activity, there is still a need to clarify how sport modality influences children's psychosocial development. Previous studies have reported conflicting findings regarding the role of team sports in fostering fair play and moral reasoning [6,16]. For instance, some evidence suggests that team sports enhance social integration and cooperation skills due to their inherently interactive nature [2,16], while others indicate that individual sports provide greater opportunities for self-discipline and personal growth [6,16]. Additionally, within team sports, heterogeneity in motor demands and the degree of cooperation among players may influence moral decision-making and fair play behaviors [16]. Furthermore, while self-efficacy theory suggests that physical activity positively impacts confidence and motivation, the differential effects of individual versus team sports on self-efficacy remain underexplored [1,20]. However, it is important to note that the majority of studies in this area have focused on adolescents and older youth athletes, leaving a significant gap in understanding how these relationships manifest in pre-adolescent children [4].

Early childhood and pre-adolescence are critical periods for developing moral reasoning, self-perception, and social behaviors, yet research investigating sport modality effects within this specific age group is scarce and inconclusive. Given that primary school children experience rapid psychosocial development, their responses to different sport settings may differ substantially from those of older individuals. Thus, further research is needed to examine how different sport modalities influence moral decision-making, self-efficacy, and social development in primary school children, as well as to determine whether findings from adolescent studies can be meaningfully applied to this younger population.

The present study aims to address these gaps by investigating the relationship between physical activity, sport modality, and psychosocial skills in primary school children. Specifically, it seeks to determine:

- The extent to which physical activity level influences fair play, moral decision-making, self-esteem, and self-efficacy.
- Whether sport modality (team vs. individual; open- vs. closed-skill) is associated with differences in psychosocial skills.

1.4. Research hypotheses

Based on the existing literature and theoretical models, the study formulates the following hypotheses:

- **H1**: Children with higher levels of physical activity will exhibit greater fair play, moral decision-making, self-esteem, and self-efficacy compared to their less active peers [7,22,4].
- **H2**: Participation in team sports will be associated with higher fair play and moral decision-making scores compared to individual sports, as team environments foster cooperative play, communication, and social responsibility [2,16,4]. However, the competitive nature of some team sports may also moderate this effect [26].
- **H3**: Children engaged in open-skill sports will exhibit higher moral decision-making scores compared to those in closed-skill sports, as open-skill sports demand greater adaptability, real-time decision-making, and social interaction with teammates and opponents [6,14].
- **H4**: Self-efficacy will be positively influenced by both physical activity level and sport modality, with team sports providing stronger reinforcement of confidence and skill development through collective achievement and social reinforcement [1,20].

Biological sex will be included as a confounding factor in statistical analyses to control for potential differences in moral decision-making, self-efficacy, and fair play behaviors [16,28].

1.5. Significance of the study

This study aims to provide a deeper understanding of how physical activity levels and different sport modalities influence children's psychosocial development. By examining the interplay between physical activity, sport type (team vs. individual, open vs. closed skills), and psychosocial constructs such as fair play, moral decision-making, self-efficacy, and self-esteem, the findings will offer valuable insights into how sports participation fosters ethical behavior, social responsibility, and psychological well-being in young athletes. Findings will provide insights for educators, coaches, and policy makers on designing sports programs that promote ethical behavior, confidence, and well-being in young athletes. Specifically, the study's findings can contribute to evidence-based recommendations for promoting inclusive, ethical, and skill-building sports environments that enhance children's confidence, resilience, and social competence.

2. Method

2.1. Transparency and openness

The data and script analysis for this study are stored on the OSF (Open Science Framework) repository. They can be accessed and viewed at the following link https://osf.io/vdk26/?view_only=727a56df4b604786854919eb27f9463e. All parents or legal guardians

were thoroughly briefed about the study's objectives and provided written informed consent, along with signing the privacy form. Additionally, children aged 8 years old received age-appropriate explanations about the study's purpose and procedures. In particular, researchers provided verbal explanations and were available to address any questions or concerns the children might have had. The study adhered to the guidelines outlined in the Declaration of Helsinki and received the approval from the Bioethics Committee of University of Bologna (Protocol No. 0245687 - 13/07/2022).

2.2. Participants

Predicated on a power analysis ($\eta_p^2 = .0289$, $f = .17$, $1 - \beta\ f = .9$, $\alpha = .01$), 104 individuals were required to take part in the study. This effect size was the lowest effect size extracted from two studies with a similar research question and experimental design [21,29]. The effect size η_p^2 of .143 ($f = .4$) was identified by Yaffe et al. [29] for the dependent variable "gamesmanship" comparing two sport modalities (i.e., team vs. individual). In addition, the effect size r of .17 ($f = .1725$) was identified by Vitali et al. [21] in 2019 for a correlation between physical activity levels and physical self-efficacy in children. The more conservative approach adopted in our study is justified primarily by the differences in the experimental protocol. An additional 25% of the total sample was recruited to compensate for the possibility of attrition. One hundred twenty-nine children (59 females) took part in the present study, all of whom were enrolled in the third grade of two primary schools ($M_{age} = 8.13$, $SD = 0.81$ y.o.). All of them completed all questionnaires; however, 17 individuals (7 females) were excluded from the analysis of physical activity level due to reporting illness during the previous week (check Table S1 in Supplemental Material for the number of participants according to independent variables).

2.3. Surveys and procedures

The following questionnaires were administered: the 15-item Fair Play in Physical Education Questionnaire (FPPEQ; [24]), the 20-item Attitudes Moral Decision-Making in Youth Sport Questionnaire (AMDM-Q; [6]); the 10-item Rosenberg Self-Esteem Questionnaire (RSEQ; [30]), the 6-item Physical Self-Efficacy questionnaire, and the 9-item Physical Activity Questionnaire (PAQ-C; [31]).

The FPPEQ assesses fair play levels using four sub-scales: Gamesmanship, Respect Towards Teammates, Respect Towards Opponents, and Cheating, and participants responded on a 5-point Likert scale. Gamesmanship involves skillful tactics within the game's rules. Respect towards teammates involves cooperation, support, and treating them with dignity. Respect towards opponents means fair treatment and avoiding unsportsmanlike behavior. Cheating involves using unethical methods to gain advantages.

The AMDM-Q measures Moral decision-making in three aspects: Acceptance of Gamesmanship, Keeping winning in proportion, and Acceptance of cheating, using a 5-point Likert scale. Acceptance of Gamesmanship involves unethical tactics. Keeping winning in proportion means balancing importance with other factors. Acceptance of cheating refers to accepting unfair behavior.

RSEQ and physical self-efficacy questionnaires measured self-esteem and physical self-efficacy. The PAQ-C assessed the previous week's physical activity. All questionnaires were validated by their authors, but we have to point out that some questionnaires (e.g., AMDM-Q and FPPEQ) were validated for pre-adolescent and adolescent children, not our specific age range. Nonetheless, both the FPPEQ and AMDM-Q questionnaires have been previously administered to primary school children, as noted in [32,33], highlighting their clarity and accessibility. Such questionnaires are generally designed to be easily comprehensible, ensuring their effectiveness at various ages.

Participants' weekly sports activity frequency, years of engagement in each sport, and after-school sport were collected. Thus, participants were categorized into open-skill (e.g., basketball and football) and closed-skill sports (e.g., dancing and swimming). Additionally, individual *vs.* team sports were distinguished (refer to Table S1 in SI file for group sizes). In addition, 23 participants reported not engaging in any regular sport activities.[1]

2.4. Data analysis

The data analysis was conducted using the R Software package [35] with the RStudio framework [36]. Data normality was checked with the Shapiro-Wilk and Levene's tests on raw data or residuals ($p > .05$). BestNormalize package [37,38] or a rank or log transformation to find the best normalizing transformation was used. However, if the transformation failed to normalize the data, non-parametric analysis was used through the *ARTool* package [39]. Thus, linear regressions for parametric and non parametric data were computed to analyze the scores of each questionnaire subscale. Parametric analyses were performed with *lm* function, while the non-normal distribution of dependent variables was addressed by transforming the data. The independent variables were categorized as "sex" (females *vs.* males), "physical activity level" (PAL, high *vs.* low, "sport modality 1" (open- *vs.* closed-skills sports *vs.* no-activity group), and "sport modality 2" (individual *vs.* team sports *vs.* no-activity group). Post-hoc pairwise comparisons were performed using the *Emmeans* package [40] as a means by which to locate significant differences. A Bonferroni correction was applied to adjust for multiple comparisons.

[1] Participants filled out the questionnaire during school time in the fourth quarter of the school year, in the informatics room of the respective schools, under the supervision of a researcher/teacher. Although the researcher/teacher did not interfere with the completion process, they provided assistance when requested, ensuring that children understood the items and could complete the questionnaire accurately [34].

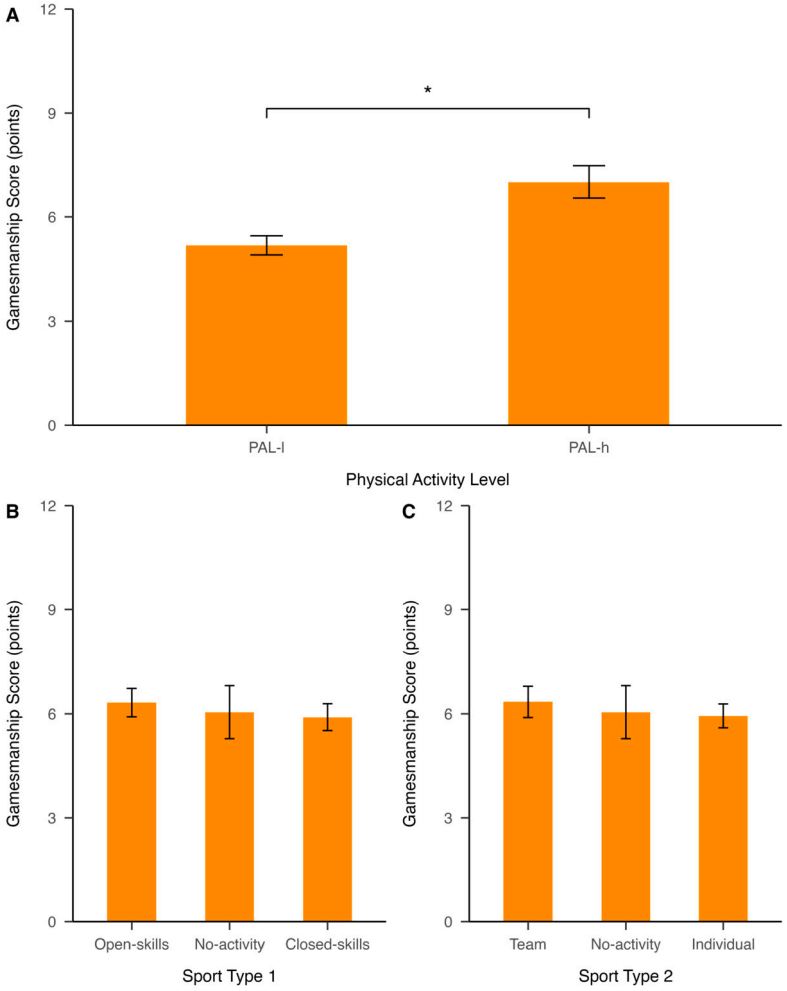

Fig. 1. Gamesmanship score according to PAL (Fig. A) and the two Sport type variables (Fig. B and C). $*= p < .05$.

3. Results

3.1. FPPEQ

3.1.1. Gamesmanship

The Artool analysis indicated that the "PAL" factor had a significant impact on gamesmanship ($F(1, 108) = 6.42$, $p = .013$, $\eta_p^2 = 0.06$, CI[−1.47, 10.89]). Specifically, participants in the PAL-h group exhibited higher scores compared to participants in the PAL-l group (see Fig. 1A). Moreover, the "sex" factor was found to be significant ($F(1, 108) = 9.96$, $p = .002$, $\eta_p^2 = 0.09$, CI[1.44, 10.91]) with males scoring higher ($M = 6.60$, $SE = 0.41$) than females $M = 5.52$, $SE = 0.40$). However, the interaction "PAL" × "sex" was nonsignificant ($F(1, 108) = 0.16$, $p = .70$, $\eta_p^2 = 0.002$, CI[−4.90, 7.45]; Males: $M_{PAL-h} = 7.11$, $SE = 0.56$ *vs.* $M_{PAL-l} = 5.78$, $SE = 0.53$; Females: $M_{PAL-h} = 6.84$, $SE = 0.91$ *vs.* $M_{PAL-l} = 4.76$, $SE = 0.27$). Furthermore, no significant differences were observed for the "sport modality 1" factor ($F(2, 123) = 0.31$, $p = .74$, $\eta_p^2 = 0.005$, see Fig. 1B). Similarly, the "sex" factor and the interaction "sport modality 1" × "sex" were nonsignificant ($F(1, 123) = 1.79$, $p = .18$, $\eta_p^2 = 0.01$, CI[−7.65, 7.15]; "sport modality 1" × "sex" $F(2, 123) = 0.79$, $p = .79$, $\eta_p^2 = 0.004$, see Table S2 in SI file, respectively).

Analysis of "sport modality 2" factor revealed nonsignificant differences among the three groups ($F(2, 123) = 0.47$, $p = .62$, $\eta_p^2 = 0.01$, see Fig. 1C). The "sex" factor also did not yield significant results ($F(1, 123) = 1.79$, $p = .18$, $\eta_p^2 = 0.01$, CI [7.46, 6.84]) with males scoring $M = 6.47$ ($SE = 0.35$), and females scoring $M = 5.74$ ($SE = 0.42$). Moreover, the interaction "sport modality 2" × "sex" was nonsignificant ($F(2, 123) = 0.26$, $p = .77$, $\eta_p^2 = 0.004$, see Table S2 in SI File).

3.1.2. Respect convention

The respect convention scale was *OrderNorm* transformed, and the analysis indicated that the "PAL" factor was significant ($F(1, 108) = 9.06$, $p = .003$, $\eta_p^2 = 0.07$, CI[−0.46, 0.56]). PAL-h group had a higher score compared to those in the PAL-l group (see

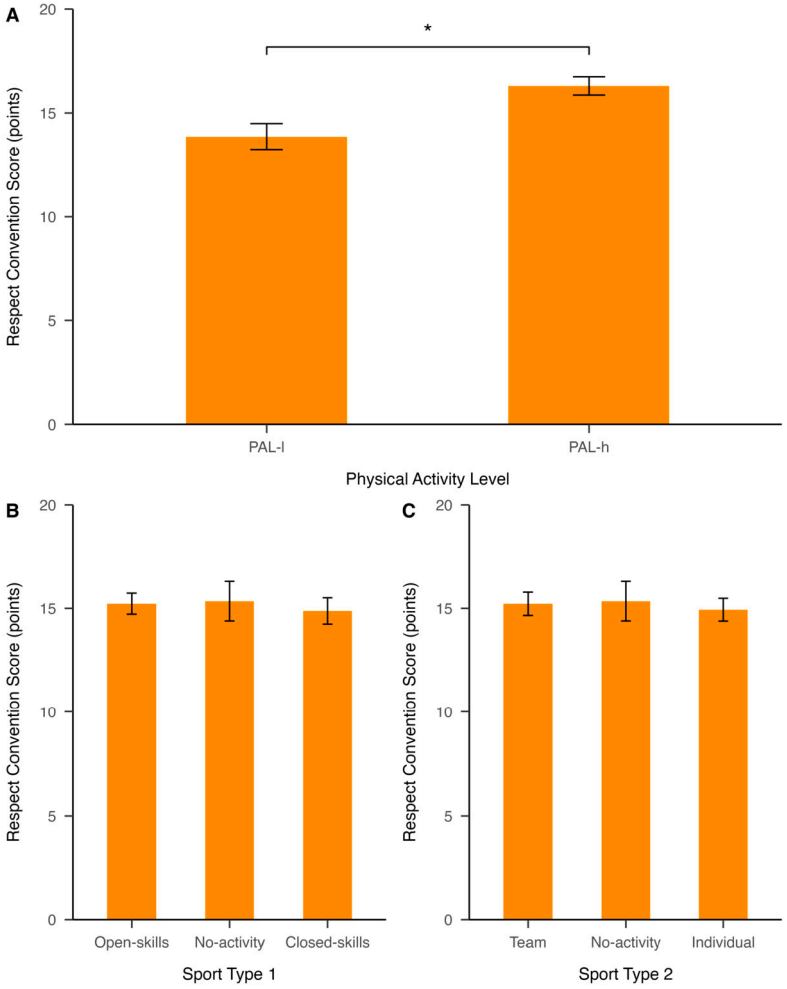

Fig. 2. Respect convention score according to PAL (Fig. A) and the two Sport type variables (Fig. B and C). $*= p < .05$.

Fig. 2A), Similarly, the "sex" factor showed a significance ($F(1, 108) = 4.19$, $p = .04$, $\eta_p^2 = 0.03$, $CI[-0.45, 0.51]$) with males scoring higher ($M = 16.20$, $SE = 0.51$) than females ($M = 13.79$, $SE = 0.59$). Additionally, the interaction "PAL" × "sex" was found to be significant ($F(1, 108) = 3.84$, $p = .05$, $\eta_p^2 = 0.03$, $CI[0.01, 1.37]$). The post-hoc analysis revealed that PAL-h males had a higher score compared to PAL-l males ($M_{PAL-h} = 17.43$, $SE = 0.42$ *vs.* $M_{PAL-l} = 14.22$, $SE = 1.03$; $t(108) = 3.09$, $p = .01$, $d = 0.82$). Moreover, PAL-h males had a higher score compared to PAL-h females ($M_{PAL-h\ females} = 14.11$, $SE = 0.81$; $t(108) = 2.83$, $p = 0.2$, $d = 0.80$). No significant differences were observed between PAL-l males and PAL-l females ($M_{PAL-l\ males} = 14.21$, $SE = 1.03$ *vs.* $M_{PAL-l\ females} = 13.61$, $SE = 0.81$; $t(108) = 0.12$, $p = 1.00$, $d = 0.06$) as well as between PAL-l females and PAL-h females ($t(108) = 0.19$, $p = 1.00$, $d = 0.05$). Furthermore, the analysis for the single factor "sport modality 1" did not yield significant results ($F(2, 123) = 0.17$, $p.85$, $\eta_p^2 = 0.003$, see Fig. 2B). The "sex" remained significant ($F(1, 123) = 7.07$, $p = .009$, $\eta_p^2 = 0.05$, $CI[-0.41, 0.71]$). However, the interaction "sport modality 1" × "sex" was not significant ($F(1, 123) = 2.33$, $p = .10$, $\eta_p^2 = 0.03$, see Table S2 in SI file). Moreover, the analysis as a function of "sport modality 2" revealed no significant differences among the three groups ($F(2, 123) = 0.18$, $p = .84$, $\eta_p^2 = 0.003$, see Fig. 2C). The "sex" factor was significant ($F(1, 123) = 6.71$, $p = .011$, $\eta_p^2 = 0.05$, CI [−0.54, 0.75]; with males scoring higher ($M = 16.09$, $SE = 0.47$ than females ($M = 14.02$, $SE = 0.54$). The interactions "sport modality 2" × "sex" was not significant ($F(2, 123) = 2.38$, $p = .09$, $\eta_p^2 = 0.04$, see Table S2 in SI file).

3.1.3. Respect towards teammates

The Artool regression model on respect towards teammates variable indicated that the "PAL" factor was nonsignificant ($F(1, 108) = 80, 80$, $p = .37$, $\eta_p^2 = 0.007$, CI[−4.43, 8.21] see Fig. 3A). Conversely, the "sex" factor demonstrated significance ($F(1, 108) = 5.26$, $p = .02$, $\eta_p^2 = 0.05$, CI[−6.25, 6.39]), with males having a higher score ($M = 17.13$, $SE = 0.37$) compared to females $M = 15.71$, $SE = 0.48$). The interaction "PAL" × "sex" was found to be nonsignificant ($F(1, 108) = 1.96$, $p > .05$, $\eta_p^2 = 0.02$, CI[−1.85, 10.8]). Specifically, for males the scores were $M_{PAL-h} = 17.57$, $SE = 0.44$ and $M_{PAL-l} = 16.44$, $SE = 0.63$, while for females, the scores were: $M_{PAL-h} = 15.15$, $SE = 0.84$ and $M_{PAL-l} = 16.03$, $SE = 0.59$). Similarly, the single factor "sport modality 1" yielded nonsignificant results

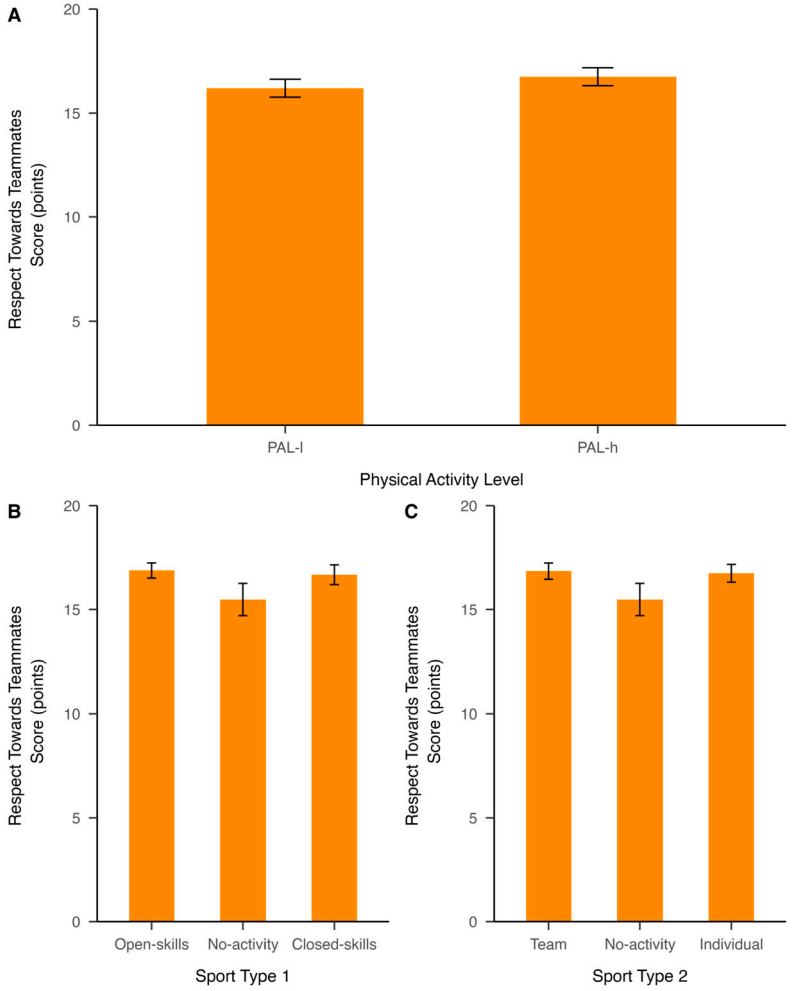

Fig. 3. Respect towards teammates score according to PAL (Fig. A) and the two Sport type variables (Fig. B and C). $*= p < .05$.

($F(2, 123) = 1.01$, $p = .37$, $\eta_p^2 = 0.02$, see Fig. 3B). The "sex" factor remained significant ($F(1, 123) = 4.21$, $p = .04$, $\eta_p^2 = 0.03$). However, the interaction "sport modality 1" × "sex" was not significant ($F(2, 123) = 0.50$, $p = .61$, $\eta_p^2 = 0.01$, see Table S2 in SI file). Furthermore, the Artool regression revealed that "sport modality 2" was nonsignificant ($F(2, 123) = 1.08$, $p = .34$, $\eta_p^2 = 0.02$, see Fig. 3C). The sex factor was significant ($F(1, 123) = 3.94$, $p = .05$, $\eta_p^2 = 0.03$), indicating that the males had a higher score ($M_{males} = 17.11$, $SE = 0.34$) compared to females ($M_{females} = 15.92$, $SE = 0.44$). The interactions "sport modality 2" × "sex" was found to be nonsignificant ($F(2, 123) = 0.25$, $p = .78$, $\eta_p^2 = 0.004$, see Table S2 in SI file).

3.1.4. Cheating

The Artool analysis on cheating scores indicated that both single factors "PAL" and "sex" were nonsignificant ($F(1, 108) = 0.11$, $p = .11$, $\eta_p^2 = 0.02$, CI[−4.42, 8.21], see Fig. 4A; $F(1, 94) = 0.20$, $p = .30$, $\eta_p^2 = 0.009$, CI[−6.24, 6.39]; $M_{males} = 5.28$, $SE = 0.36$ *vs.* $M_{females} = 4.62$, $SE = 0.29$, respectively). Additionally, the interaction "PAL" × "sex" was also not significant ($F(1, 94) = 0.02$, $p = .70$, $\eta_p^2 = 0.001$, CI[1.85, 10.78]). Specifically, for males the scores were $M_{PAL-h} = 5.41$, $SE = 0.47$ and $M_{PAL-l} = 4.09$, $SE = 0.55$, while for females, the scores were $M_{PAL-h} = 4.68$, $SE = 0.49$ and $M_{PAL-l} = 4.58$, $SE = 0.36$. Similarly, the single factor "sport modality 1" yielded nonsignificant results ($F(2, 123) = 0.12$, $p = .89$, $\eta_p^2 = 0.004$, see Fig. 4B). The "sex" factor was also nonsignificant ($F(1, 123) = 0.45$, $p = .50$, $\eta_p^2 = 0.004$), and the interaction "sport modality 1" × "sex" was found to be nonsignificant ($F(2, 123) = 0.58$, $p = .56$, $\eta_p^2 = 0.01$, see Table S2 in SI file). Furthermore, the Artool analysis revealed nonsignificant results for the single factor "sport modality 2" ($F(2, 123) = 0.19$, $p = .83$, $\eta_p^2 = 0.003$, see Fig. 4C). The "sex" factor was also nonsignificant ($F(2, 123) = 0.16$, $p = .69$, $\eta_p^2 = 0.001$; $M_{males} = 5.27$, $SE = 0.32$ *vs.* $M_{females} = 4.90$, $SE = 0.30$). Similarly, the interaction "sport modality 2" × "sex" was nonsignificant ($F(2, 123) = 0.55$, $p = .58$, $\eta_p^2 = 0.01$, see Table S2 in SI file).

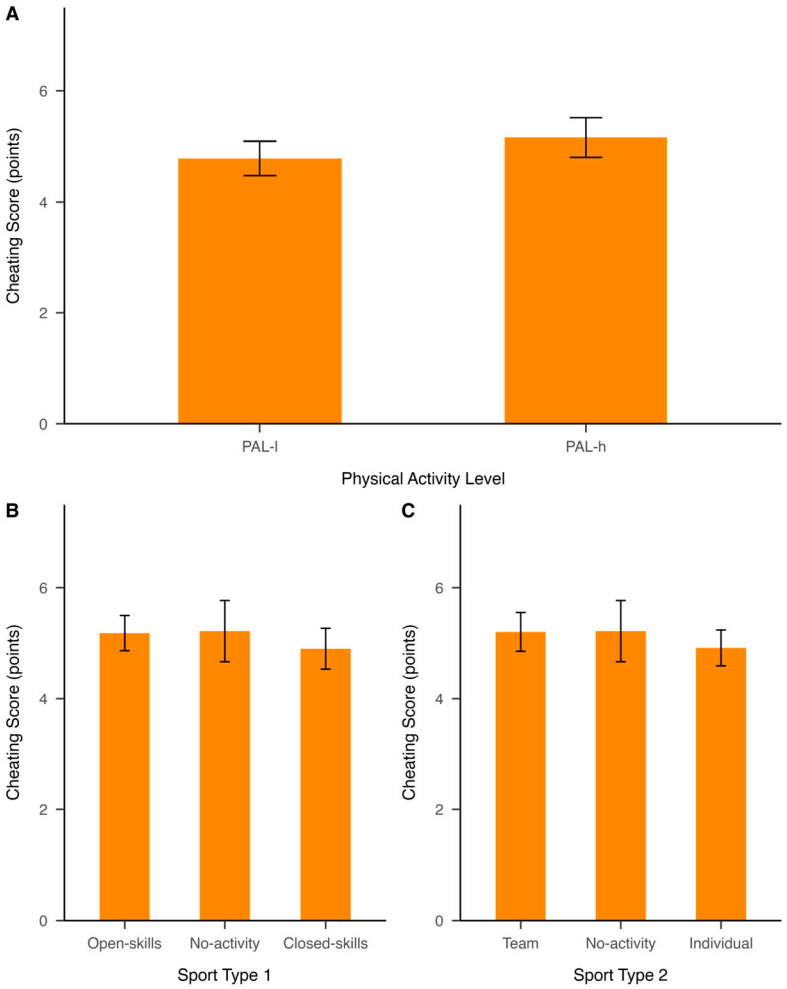

Fig. 4. Cheating score according to PAL (Fig. A) and the two Sport type variables (Fig. B and C). $*= p < .05$.

3.2. AMDM-Q

3.2.1. Acceptance of gamesmanship

A linear regression analysis on acceptance of gamesmanship indicated that the "PAL" factor was nonsignificant ($F(1,108) = 3.34$, $p = .07$, $\eta_p^2 = 0.03$, $CI[-20.32, 13.77]$, see Fig. 5A). However, the "sex" factor yielded significant results ($F(1,108) = 17.12$, $p < .0001$, $\eta_p^2 = 0.13$, $CI[1.39, 33.54]$), with males scoring higher than females ($M_{males} = 15.25$, $SE = 0.57$ *vs.* $M_{females} = 12.29$, $SE = 0.44$). The interaction "PAL" × "sex" was found to be nonsignificant ($F(1,108) = 1.43$, $p = 0.24$, $\eta_p^2 = 0.01$, $CI[-9.22, 37.15]$). Specifically, for males, the scores were $M_{PAL-h} = 15.81$, $SE = 0.75$ and $M_{PAL-l} = 14.35$, $SE = 0.78$, while for females, the scores were $M_{PAL-h} = 12.05$, $SE = 0.78$ *vs.* $M_{PAL-l} = 12.42$, $SE = 0.54$). Furthermore, the single factor "sport modality 1" was significant ($F(1,123) = 4.20$, $p = .017$, $\eta_p^2 = 0.06$). However, post-hoc analysis did not reveal significant differences across the groups $t(123) < 1.55$, $p > .05$; see Fig. 5B). The "sex" factor was significant ($F(1,123) = 11.75$, $p = .001$, $\eta_p^2 = 0.09$, $CI[-12.9, 35.85]$ with males scoring higher than females ($M_{males} = 15.16$, $SE = 0.51$ points *vs.* $M_{females} = 12.56$, $SE = 0.42$ points)

The interaction "sport modality 1" × "sex" was nonsignificant ($F(2,123) = 1.54$, $p = .22$, $\eta_p^2 = 0.02$, see Table S3 in SI file). Moreover, the linear regression analysis on ranked data indicated that the "sport modality 2" factor was significant ($F(2,123) = 3.61$, $p = .030$, $\eta_p^2 = 0.05$). However, multiple comparisons tests did not reveal any significant differences across the groups ($t(123) < 1.62$, $p > .05$, $d < 0.41$, see Fig. 5C). The "sex" factor demonstrated significance ($F(1,123) = 12.71$, $p = .001$, $\eta_p^2 = 0.1$, CI$[-2.33, 40.19]$), with males scoring higher than females ($M_{males} = 15.16$, $SE = 0.51$ points *vs.* $M_{females} = 12.56$, $SE = 0.42$ points). However, the interaction "sport modality 2" × "sex" was nonsignificant ($F(2,123) = 1.29$ $p = .28$, $\eta_p^2 = 0.02$, see Table S3 in SI file).

3.2.2. Keeping winning in proportion

The Artool analysis on keeping winning in proportion variable revealed that single factors "PAL" and "sex" were nonsignificant ($F(1,108) = 0.62$, $p = .43$, $\eta_p^2 = 0.01$, CI$[-7.23, 5.34]$; see Fig. 6A; $F(1,108) = 0.62$, $p = .43$, $\eta_p^2 = 0.01$, CI$[-5.94, 6.63]$; $M_{males} = 24.70$,

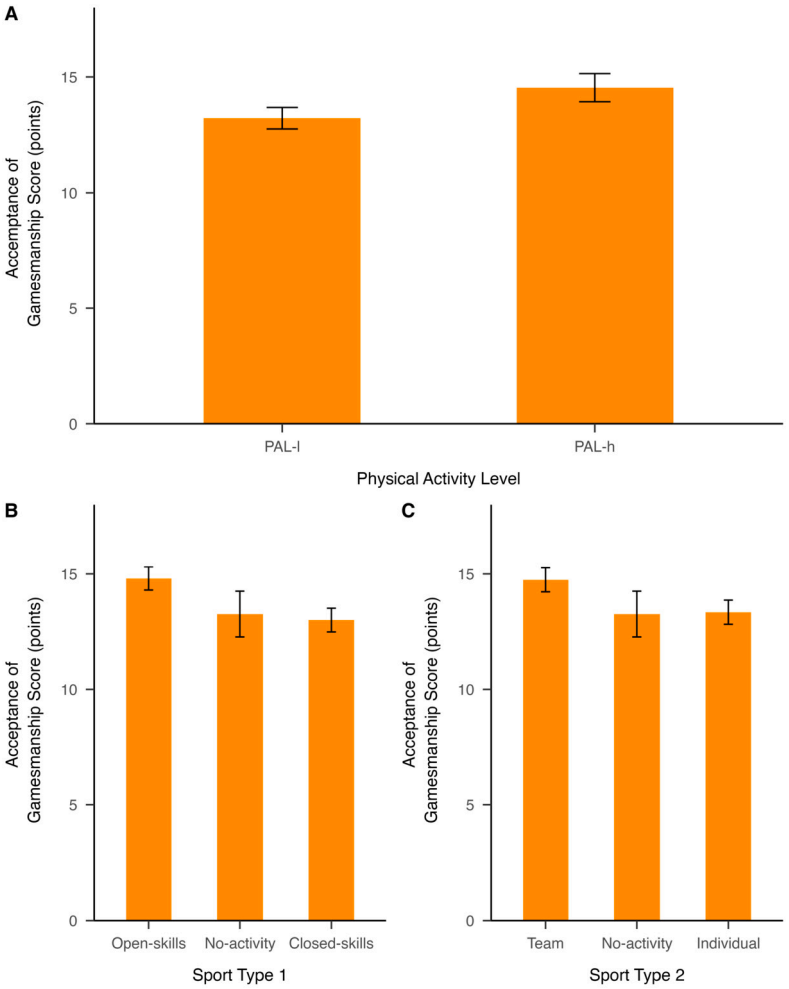

Fig. 5. Acceptance of gamesmanship score according to PAL (Fig. A) and the two Sport type variables (Fig. B and C). $*= p < .05$.

$SE = 0.54$ *vs.* $M_{females} = 25.21$, $SE = 0.67$, respectively). Furthermore, the interaction "PAL" × "sex" was found to be nonsignificant ($F(1, 108) = 3.33$, $p = .07$, $\eta_p^2 = 0.03$, CI[−0.50, 12.07]. Specifically, for males, the scores were $M_{PAL-h} = 25.00$, $SE = 0.66$ and $M_{PAL-l} = 24.22$, $SE = 0.91$, while for females, the scores were $M_{PAL-h} = 23.74$, $SE = 1.21$ and $M_{PAL-l} = 26.06$, $SE = 0.78$).

Regarding the "sport modality 1" factor, a significant effect was observed ($F(1, 123) = 3.66$, $p = .029$, $\eta_p^2 = 0.06$). Post-hoc analysis revealed differences between closed-skills group and no-activity group ($t(123) = 2.49$, $p = .043$, $d = 0.68$, CI[0.14, 1.22], see Fig. 6B). No significant differences were identified between the closed-skills and open-skills groups ($t(123) = 1.17$ $p = .73$, $d = 0.26$, CI[−0.18, 0.71], see Fig. 6B) or between the open-skill group and no-activity group ($t(123) = 1.67$, $p = .29$, $d = 0.42$, CI[−0.97, 0.18], see Fig. 6B). The "sex" factor and its interaction with "sport modality 1" were nonsignificant ($F(1, 123) = 0.17$, $p = .68$, $\eta_p^2 = 0.001$); $F(2, 123) = 0.30$, $p = .73$, $\eta_p^2 = 0.005$ [see Table S3 in SI file], respectively). Furthermore, a linear regression on *OrderNorm* transformed data revealed that "sport modality 2" factor was significant ($F(2, 123) = 3.92$, $p = .022$, $\eta_p^2 = 0.06$). Post-hoc comparison indicated a higher score for the individual sports group compared to the no-activity group ($t(123) = 2.74$, $p = .021$, $d = 0.71$, CI[0.08, 1.28], see Fig. 6C), while no significant differences were observed between the individual sports group and the team sports group ($M_{team} = 24.66$, $SE = 0.57$; $t(123) = 1.42$, $p = 68$, $d = 0.30$, CI[−0.12, 0.72], see Fig. 6C). Additionally, no significant difference emerged between the team sports group and the no-activity group ($t(123) = 1.61$, $p = .33$, $d = 0.41$, CI[−0.92, 0.10], see Fig. 6C). The "sex" factor was nonsignificant ($F(1, 123) = 0.23$, $p = .68$, $\eta_p^2 = 0.002$, $CI[-0.58, 0.58]$; $M_{males} = 25.51$, $SE = 0.51$ *vs.* $M_{females} = 25.03$, $SE = 0.61$) as well as the interaction "sport modality 2" × "sex" ($F(2, 123) = 0.40$, $p = .81$, $\eta_p^2 = 0.006$, Table S3 in SI file).

3.2.3. Acceptance of cheating

The results from the Artool analysis on acceptance of cheating revealed that the "sex" factor was significant ($F(1, 108) = 4.80$, $p = .03$, $\eta_p^2 = 0.04$, CI[−3.96, 8.52]). Specifically, males had a higher means score ($M_{males} = 11.00$, $SE = 0.56$) compared to females $M_{females} = 9.15$, $SE = 0.36$). However, the "PAL" factor and its interaction with "sex" were found to be nonsignificant ($F(1, 108) =$

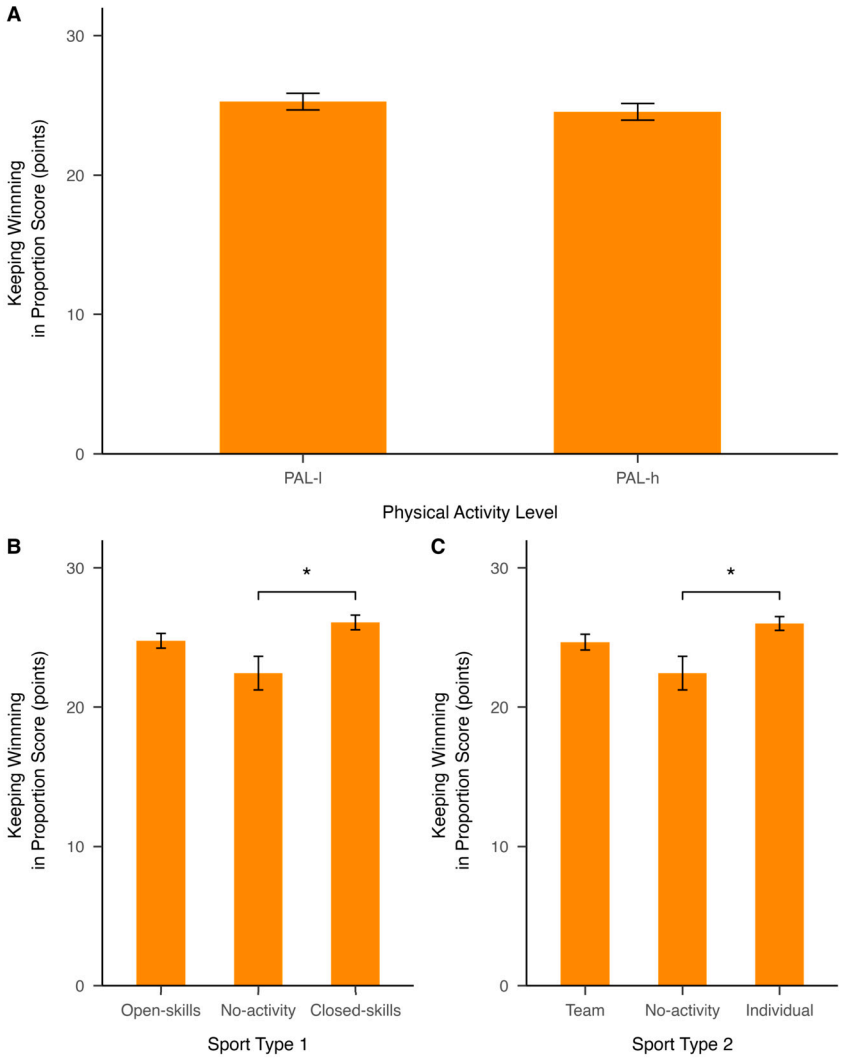

Fig. 6. Keeping winning in proportion score according to PAL (Fig. A) and the two Sport type variables (Fig. B and C). $*= p < .05$.

1.02, $p = .32$, $\eta_p^2 = 0.01$, CI[2.14, 10.34] see 7A); $F(1, 108) = 2.39$, $p = .13$, CI[−1.39, 11.08]; Males: $M_{PAL-h} = 11.46$, $SE = 0.79$ *vs.* $M_{PAL-l} = 10.26$, $SE = 0.71$, Females: $M_{PAL-h} = 8.74.20$, $SE = 0.62$ *vs.* $M_{PAL-l} = 9.39$, $SE = 0.45$, respectively).

Regarding the "sport modality 1" factor, it was found to be nonsignificant ($F(2, 123) = 0.20$, $p = .83$, $\eta_p^2 = 0.003$, see 7B). Similarly, the "sex" factor ($F(1, 123) = 3.00$, $p = .68$, $\eta_p^2 = 0.02$) and the interaction "sport modality 1" × "sex" were nonsignificant ($F(2, 123) = 0.69$, $p = .58$, $\eta_p^2 = 0.01$, see Table S3 in SI file). Furthermore, the Artool analysis revealed that "sport modality 2" factor was nonsignificant ($F(2, 123) = 0.37$, $p = .69$, $\eta_p^2 = 0.006$, see 7C). Similarly, the "sex" factor ($F(1, 123) = 3.07$, $p = .08$, $\eta_p^2 = 0.02$; $M_{males} = 10.84$, $SE = 0.51$ *vs.* $M_{females} = 9.31$, $SE = 0.37$) and the interaction "sport modality 2" × "sex" were nonsignificant ($F(2, 123) = 0.87$, $p = .42$, $\eta_p^2 = 0.01$, see Table S3 in SI file).

3.3. RSEQ

The results from a linear regression analysis on self-esteem indicated that single factors "PAL" and "sex" were nonsignificant ($F(1, 108) = 0.63$, $p = .43$, $\eta_p^2 = 0.006$, $CI[-6.62, -0.89]$, see Fig. 8A; $F(1, 108) = 0.03$, $p = .86$, $\eta_p^2 = 0.00$, $CI[-5.60, -0.19]$; $M_{males} = 15.25$, $SE = 0.56$ *vs.* $M_{females} = 12.29$, $SE = 0.44$, respectively). However, interaction "PAL" × "sex" was found to be significant ($F(1, 108) = 8.25$, $p = .005$, $CI[1.75, 9.54]$). Post-hoc pairwise comparisons revealed a significant difference between females in PAL-h group and females in PAL-l group ($t(108) = 2.60$, $p = .04$, $d = 0.75$, CI[0.17, 1.33]; $M_{PAL-h\,females} = 26.79$, $SE = 1.04$ *vs.* $M_{PAL-l\,females} = 30.55$, $SE = 0.73$). No significant differences were found between males in the PAL-h group and males in the PAL-l group ($t(108) = 1.41$, $p = .63$, $d = 0.37$, $M_{PAL-h}\ males = 29.54$, $SE = 0.92$ *vs.* $M_{PAL-l}\ males = 27.65$, $SE = 1.14$). In addition, there were no significant differences between males and females within both PAL groups (PAL-h: $t(108) = 1.94$, $p = .22$, $d = 0.55$; PAL-l: $t(108) = 2.12$, $p = .14$, $d = 0.58$, see Table S4 in SI file).

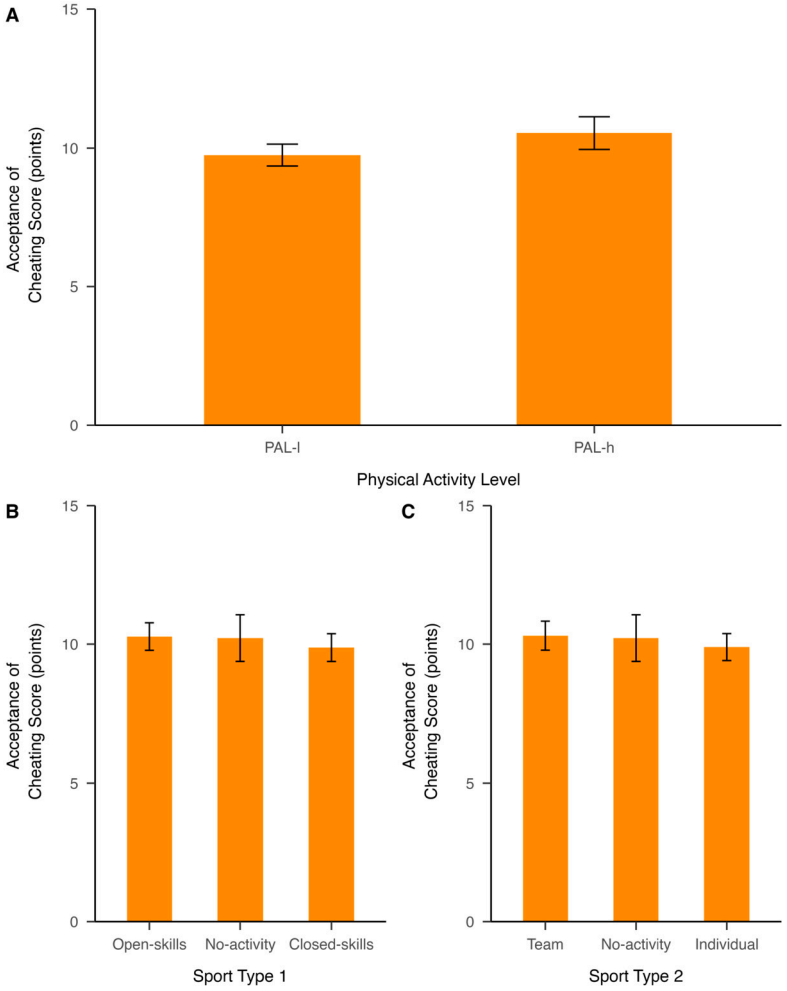

Fig. 7. Acceptance of cheating score according to PAL (Fig. A) and the two Sport type variables (Fig. B and C). $*= p < .05$.

This analysis also revealed that "sport modality 1" and "sex" factors were nonsignificant ($F(2, 123) = 1.35$, $p = .26$, $\eta_p^2 = 0.02$, see Fig. 8B; $F(2, 123) = 0.11$, $p = .74$, $\eta_p^2 = 0.001$). The interaction "sport modality 1" × "sex" was also nonsignificant ($F(2, 123) = 0.12$, $p = .89$, $\eta_p^2 = 0.002$, see Table S4 in SI file). Similarly, a linear regression analysis revealed that "sport modality 2" and "sex" factors were nonsignificant ($F(2, 123) = 0.85$, $p = .43$, $\eta_p^2 = 0.014$ see Fig. 8C; $F(1, 123) = 0.009$, $p = .92$, $\eta_p^2 = 0.000$, CI[−3.96, 2.53]; $M_{males} = 29.17$, $SE = 0.66$ *vs.* $M_{females} = 28.88$, $SE = 0.65$, respectively). The interaction "sport modality 2" × "sex" was also nonsignificant ($F(2, 123) = 0.31$, $p = .73$, $\eta_p^2 = 0.005$, see Table S4).

3.4. Physical self-efficacy

Linear regression analysis on the physical self-efficacy variable revealed that both "PAL" and "sex" factors were significant ($F(1, 108) = 10.45$, $p = .0016$, $\eta_p^2 = 0.09$, $CI[-0.93, 1.54]$; $F(1, 108) = 9.56$, $p = .0026$, $\eta_p^2 = 0.08$, $CI[-0.47, 1.86]$, respectively). Specifically, individuals in the PAL-h group exhibited higher self-efficacy levels than those in the PAL-l group (see Fig. 9A). Similarly, males demonstrated higher self-efficacy ($M_{males} = 19.37$, $SE = 0.31$) when compared to females ($M = 17.81$, $SE = 0.28$). Interestingly, the interaction "PAL" × "sex" was found to be nonsignificant ($F(1, 108) = 2.28$, $p = .13$, $\eta_p^2 = 0.02$, $CI[-0.40, 2.96]$; Males: $M_{PAL-h} = 19.97$, $SE = 0.37$ *vs.* $M_{PAL-h} = 18.39$, $SE = 0.49$; Females: $M_{PAL-h} = 18.00$, $SE = 0.43$ *vs.* $M_{PAL-l} = 17.70$, $SE = 0.36$).

The linear regression analysis also indicated that the "sport modality 1" was significant ($F(2, 123) = 11.84$, $p < .0001$, $\eta_p^2 = 0.16$). Post-hoc analysis revealed differences between the open-skills group and the no-activity group ($t(123) = 3.91$, $p = .0005$, $d = 0.98$, CI[−1.49, −0.47, Fig. 9B) as well as between the closed-skills group and no-activity group ($t(123) = 2.93$, $p = .012$, $d = 80$, CI[0.25, 1.35], Fig. 9B). However, no significant differences were observed between closed- and open-skills groups ($t(123) = 0.77$, $p = 1.00$, $d = 0.17$, Fig. 9B). It is important to emphasise that the "sex" factor also remained significant ($F(1, 123) = 6.06$, $p = .015$, $\eta_p^2 = 0.05$, CI[−1.00, 2.08]). However, the interaction "sport modality 1" × "sex" was nonsignificant ($F(2, 123) = 1.89$, $p = .16$, $\eta_p^2 = 0.01$, see Table S4 in SI file). Furthermore, the results from the linear regression analysis revealed that "sport modality 2" factor

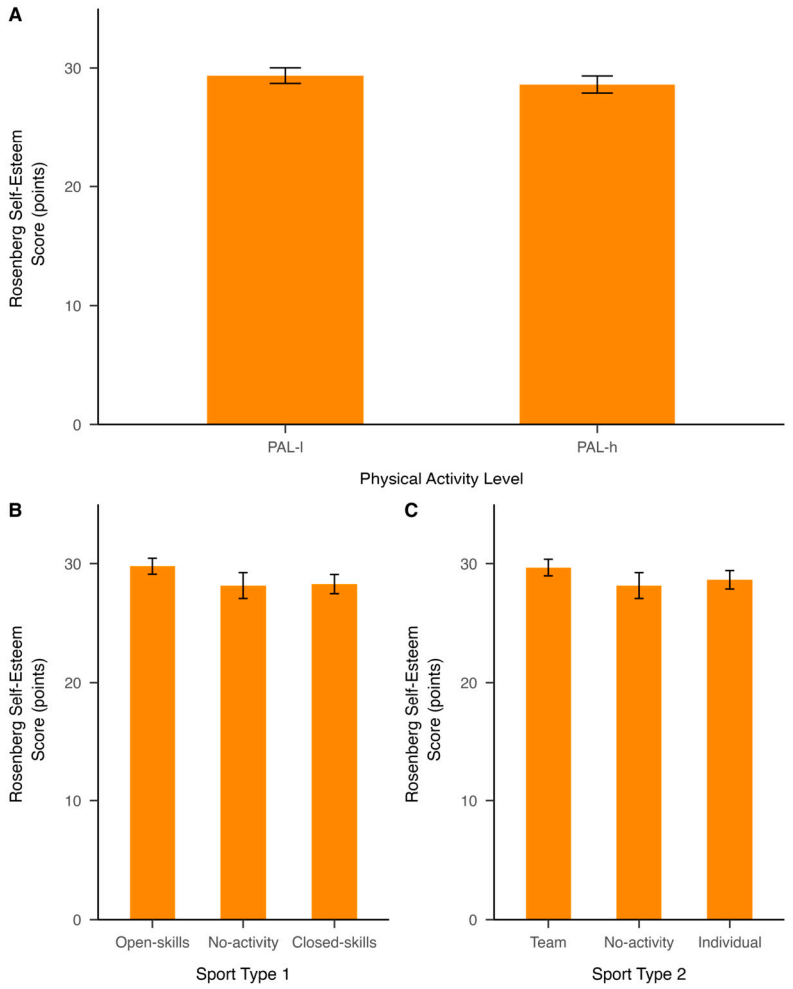

Fig. 8. Rosenberg self-esteem score according to PAL (Fig. A) and the two Sport type variables (Fig. B and C). $*= p < .05$.

had a significant influence on self-efficacy ($F(2, 123) = 11.13$, $p < .0001$, $\eta_p^2 = 0.15$). Post-hoc analysis indicated significant differences between the individual sport group and no-activity group ($t(123) = 3.40$, $p = .003$, $d = 0.89$, CI[0.36, 1.41], Fig. 9C), as well as between the team sports group and the no-activity group ($t(123) = 3.80$, $p = .0007$, $d = 0.97$, CI[−1.49, −0.45], Fig. 9C). However, no significant differences were found between the team sport and individual sports groups ($t(123) = 0.42$, $p = 1.00$, $d = 0.09$, CI[−0.51, 0.33], Fig. 9C). The "sex" remained significant ($F(1, 123) = 6.90$, $p = .01$, $\eta_p^2 = 0.53$; $M_{males} = 19.20$, $SE = 0.31$ *vs.* $M_{females} = 17.90$, $SE = 0.26$). The interaction "sport modality 2" × "sex" was also found to be nonsignificant ($F(2, 123) = 1.54$, $p = .22$, $\eta_p^2 = 0.02$; see Table S4in SI file).

4. Discussion

This study explored the relationship between physical activity, sport modality, and psychosocial skills in children. The findings indicate that while physical activity and sex influence fair play, sport modality does not. Moral decision-making is primarily affected by sex, while self-esteem remains unaffected by any variable. However, physical self-efficacy is influenced by sex, physical activity, and sport modality. In general, these results partially align with prior studies highlighting the role of physical activity in fair play and moral decision-making (e.g., [6,29]). However, the absence of a clear effect of sport modality and the lack of differences in self-esteem contrast with previous research (e.g., [1]). These discrepancies may stem from variations in coaching styles, age-related factors, or socio-cultural influences.

4.1. FPPEQ

Our results partially support H1, as physical activity level and sex were associated with some fair play dimensions (e.g., gamesmanship and respect), while sport modality showed no effect. Specifically, the findings indicate that physically active individuals are more likely to engage in gamesmanship behavior, pushing the boundaries of regulation, with males showing a higher inclination than

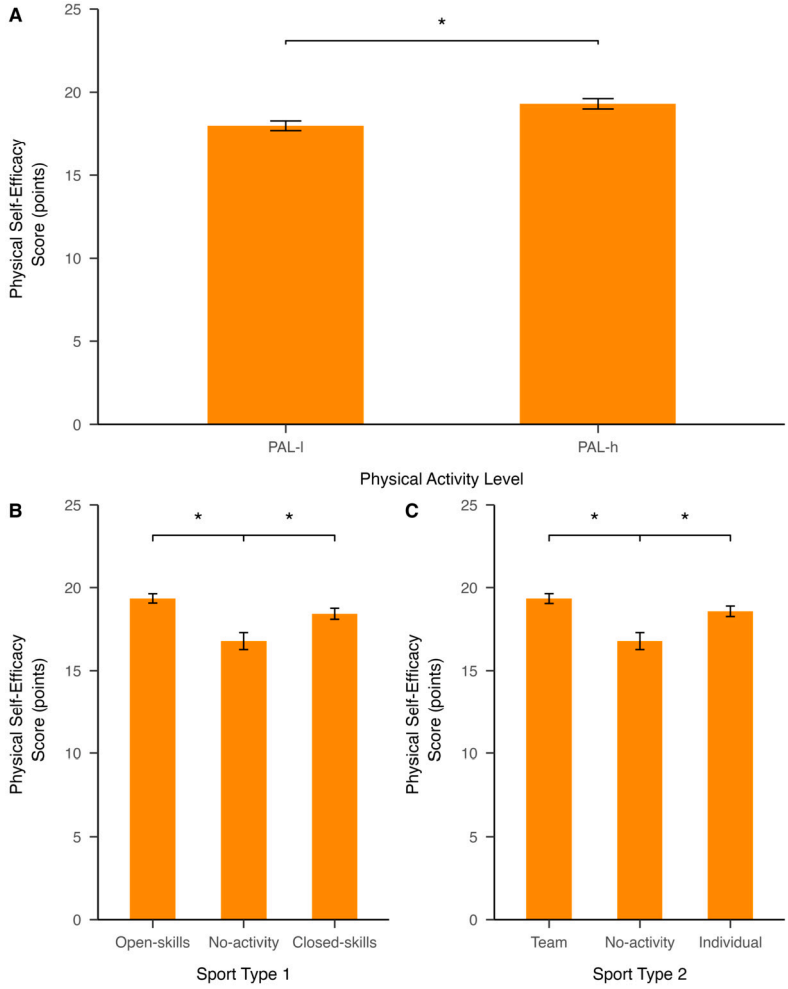

Fig. 9. Physical self-efficacy score according to PAL (Fig. A) and the two Sport type variables (Fig. B and C). $*= p < .05$.

females. In addition, physically active participants demonstrate greater respect for the convention (i.e., the ability to play within the boundaries of the rule), particularly males towards peers than females. However, only males show greater respect towards teammates. Surprisingly, no significant differences in cheating behavior were identified between physically active/non-physically active children or between males and females.

Neither team versus individual sports nor open versus closed-skill sports significantly influenced fair play behaviors. These results partially contrast with those of previous research [16]), highlighting the complex and multifaceted nature of sportsmanship behaviors and the potential for confounding factors such as coaching style, sport culture, and competitive pressure [16,2,4] in these types of studies.

Interestingly, while physically active participants exhibited greater gamesmanship, they did not report a higher tendency toward cheating, reinforcing the notion that competitive engagement does not necessarily lead to unethical behavior. This finding aligns with the idea that strategic rule utilization differs from outright violation of the rules. However, our findings partially contrast with previous research, such as the Turkish fair play in Physical Education validation study [28], which favored females regarding fair play and pro-social behavior. Various explanations could account for these discrepancies. Discrepancies may be due to participant age; our data were from a third-grade class (average age 8 years), while [28] studied children aged 11 to 18. This explanation is supported by Nevzat [28]'s findings, which indicate that age groups differed significantly in terms of fair play and pro-social behavior. It is, therefore, possible that older children are more likely to answer the questionnaire in a socially desirable manner, whereas younger children tend to be more honest about their behaviors [34]. Alternatively, socio-cultural factors may explain the differences between both studies. Put another way, psychosocial characteristics, including fair play and pro-social behavior, may be influenced by social background. Accordingly, comparing societies within and beyond the same country could help understand the differences between males and females. Sex differences in gamesmanship may be related to overall physical activity levels rather than specific sports. Females' participation in individual activities such as gymnastics and dancing may also serve to explain the differences observed in the present study. Understanding these nuances is critical for tailoring interventions that promote ethical conduct and fair play among young athletes.

4.2. AMDM-Q

The findings partially support Hypotheses 2 and 3. While sex influenced acceptance of gamesmanship and cheating, sport modality had limited or no effects, and physical activity level was mostly unrelated. In particular, AMDM-Q results indicate that males exhibited a greater tendency to accept gamesmanship and cheating compared to females. However, no significant sex differences were observed in the propensity to keep winning in proportion. These findings align with previous research suggesting that boys are generally more likely to accept strategic rule manipulation, a tendency that may stem from increased exposure to competitive environments, social reinforcement of risk-taking behavior, or differing moral development trajectories in sports contexts [16,4]. Physical activity had no significant effect on any sub-scale score, except for keeping winning in proportion. The modality of sport seems to influence this sub-scale, with differences observed between children practicing individual and closed-skill sports and those in the no-activity group. This suggests that engagement in structured physical activity, especially in sports emphasizing personal discipline, repetition, and self-regulation, may foster a more balanced perspective on competition and success [6,26]. The role of self-regulation and personal accountability in individual and closed-skill sports could contribute to these effects, as athletes/children in these settings may be more accustomed to internalized goal-setting rather than external validation from social competition [1].

Our results on the keeping winning subscale are partially consistent with previous research [6,29]. Specifically, we did not observe sex differences, but we found an effect of individual and closed-skill sports compared to the no-activity group. However, no significant differences were found between individual and team sports or between open- and closed-skill sports, which were instead reported by Lee et al. [6], Yaffe et al. [29].

One possible explanation for this discrepancy could be due to the relatively small sample size of our study and/or the age of our sample. For instance, Yaffe et al. [29] recruited adolescent children aged 11 to 18, a period in which competitive experience, peer influence, and social identity in sports play a stronger role in shaping moral reasoning [16,4]. In contrast, younger children, such as those in our study, may exhibit less defined attitudes toward competition and moral dilemmas in sport due to their more limited exposure to structured competitive environments. A complementary explanation for the difference between our study and previous research may be the variation in the populations studied. The unique characteristics of our participants, including their social, educational, and cultural backgrounds, may have influenced their responses to the AMDM-Q. Cultural and societal factors play a critical role in shaping attitudes toward gamesmanship and cheating, leading to inconsistencies between studies conducted in different contexts [41,42]. For example, children from environments where competition is strongly emphasized, such as highly structured sports academies, may be more accepting of strategic rule manipulation as part of their training philosophy. In contrast, those in cooperative or education-focused sports settings may place a stronger emphasis on fairness and sportsmanship, reducing their tendency to accept gamesmanship behaviors [4,43].

Finally, our results underscore the need to consider the moral climate within sports environments as a key factor influencing ethical decision-making. The findings from Spruit et al. [4] suggest that a prosocial moral climate, one that emphasizes respect, integrity, and fair play, can significantly reduce acceptance of unethical behavior in sports. Conversely, an antisocial moral climate, often found in hyper-competitive settings, is associated with increased cheating, aggression, and moral disengagement. Given that our study did not identify strong differences between sport modalities in moral decision-making, it is possible that the broader ethical framework within which children engage in sports is a stronger determinant than the specific type of sport. This interpretation is supported by recent intervention-based evidence showing that when moral values are explicitly embedded in physical education programs, such as through guided discussions and cooperative activities, significant improvements in prosocial behavior and classroom climate can be achieved [33]. Future interventions aimed at fostering fair play and ethical reasoning should, therefore, focus not only on sport type but also on the values reinforced by coaches, parents, and peers.

4.3. RSEQ

Results on RSEQ do not support H1, as no significant differences were found for self-esteem across physical activity level, sex, or sport modality. These findings align with previous research [1], which suggests that while physical activity is associated with various psychosocial benefits, its direct influence on self-esteem remains inconclusive, particularly in younger children. However, our results are in contrast to the results of Slutzky and Simpkins [44]. Specifically, they found that team sports can increase self-esteem of primary school children when compared to the ones who used to perform individual sports.

Several underlying factors may explain the lack of significant effects observed in our sample. One possible explanation is that self-esteem may be especially responsive to physical activity during adolescence and early adulthood, when individuals become more self-aware and develop a stronger sense of identity [45,22]. Research indicates that these life stages are critical for self-concept development, making self-esteem more prone to fluctuation [45,22]. Accordingly, it appears reasonable to hypothesize that, in early childhood, self-esteem is predominantly shaped by parental support, early social interactions, and foundational cognitive and emotional development, with sports and physical activity playing a less significant role. At this stage, a child's self-concept is still forming and is primarily influenced by close relationships and environmental factors rather than external achievements or physical engagement. This perspective aligns with sociocognitive theories of self-perception, which propose that young children's self-esteem is more dependent on immediate social reinforcement from parents and teachers rather than on personal accomplishments in structured activities [5,7]. Given that sports participation in early childhood is often recreational rather than performance-oriented, its impact on self-esteem may be less pronounced compared to later developmental stages when children begin to evaluate their skills in relation to peers and external benchmarks.

Although our study did not find significant effects, sport modality may influence self-esteem development. Team sports can foster social connection and belonging, while individual sports emphasize autonomy and self-discipline [2,16,44]. However, young children may not yet internalize social hierarchies and performance evaluations, which could explain the lack of differences in our findings.

Future research should explore the longitudinal effects of physical activity on self-esteem across different developmental stages, considering the role of social comparison, peer feedback, and self-perceived competence. Additionally, incorporating qualitative approaches, such as interviews with children, parents, and coaches, could provide deeper insights into how young athletes experience and interpret their self-worth in different sport settings.

4.4. Physical self-efficacy

The findings on physical self-efficacy support H4, revealing a clear and practically meaningful association between physical activity, sport modality, and self-efficacy. Specifically, physical activity and sex significantly impacted self-efficacy, with physically active participants reporting higher self-efficacy levels than their less physically active counterparts and males demonstrating higher self-efficacy levels than females. Notably, the effect of sport modality 1 and 2 was moderate ($\eta_p^2 > 0.15$), indicating a meaningful and practically relevant association between sport engagement and self-efficacy. In particular, children engaged in sports reported higher self-efficacy compared to those not involved in any activity. Thus, engaging in physical activity often provides repeated mastery experiences, where individuals develop and refine motor skills, leading to a sense of competence and control. However, no significant effect of sports practice on self-efficacy was observed. Our findings are consistent with prior research (e.g., [20,21]), which has also reported associations between physical activity, gender, and self-efficacy. The observed sex differences in self-efficacy may be attributed to several factors, including variations in socialization patterns, cultural expectations, and opportunities for physical activity participation [46,47]. It is possible that boys are more likely to engage in competitive, high-intensity sports, which may provide stronger reinforcement for self-efficacy development [46]. Moreover, societal norms often encourage boys to take risks and persevere in physical challenges, reinforcing their confidence in their athletic abilities [48,46]. In contrast, girls may experience more social constraints, lower encouragement for physical competence, or reduced exposure to competitive sports environments, potentially leading to lower self-efficacy scores [48,46].

Nevertheless, it is important to note that the underlying factors contributing to sex differences in self-efficacy are multifaceted and not readily discernible [17,49].

Future research should explore the long-term development of self-efficacy in different sport settings and investigate whether the effects of sport modality become more pronounced with age. Additionally, interventions aimed at fostering self-efficacy in girls through increased participation in diverse sports and skill-based reinforcement strategies may help address the observed gender gap.

5. Limitations

This study has several limitations that are worth mentioning. First, its cross-sectional design may limit understanding of the relationships between physical activity, sport modality, and psychosocial skills. Future research should attempt to use longitudinal or interventional designs to better understand the role of diverse physical activities in social skills. Additionally, future studies should also aim to consider potential moderators such as parents' education, teaching and coaching styles, which may influence psychosocial skill development.

Second, our study focused only on a specific group of children from two small cities, which may limit the generalizability of the findings. The socioeconomic, cultural, and educational contexts of these cities could play a role in shaping the relationship between physical activity and psychosocial factors, and future studies should aim to include larger, more diverse populations to enhance external validity. However, this limitation is common in several studies (e.g., [44,2]), as recruitment constraints often result in relatively homogeneous samples. Moreover, it is important to acknowledge that our study did not account for potential variations in access to sports facilities, quality of coaching, or differences in extracurricular opportunities between participants. These factors may have played a role in shaping children's experiences with physical activity and, consequently, their self-perception and moral reasoning. Expanding the scope of research to include children from urban, suburban, and rural areas, as well as from different socioeconomic backgrounds, would offer a more comprehensive understanding of how external influences interact with sport engagement.

Third, our study relied on self-reported questionnaires, which may introduce response bias due to social desirability or misinterpretation of questions. While we utilized validated instruments, it is important to acknowledge that some of these questionnaires were not originally developed for children but have been applied in studies with similar age groups to ours [32]. Future research should consider using mixed-method approaches, including structured interviews or behavioral observations, to strengthen the robustness of the findings.

It is important to acknowledge that the chosen approach of administering questionnaires, whether in a single session or divided into two sessions, may have influenced our ability to explore the relationship between sport modality, physical activity, and higher-order psychosocial skills. It is important to emphasize, however, that longer sessions could have contributed to increased mental fatigue, potentially affecting participants' ability to respond accurately and adequately to the questionnaire items [50].

Fourth, our study did not use objective measures of physical activity, relying instead on self-reported physical activity levels. While the PAQ-C is a validated measure, it may not fully capture variations in intensity, duration, or types of physical activity. Future studies should incorporate objective measures such as accelerometers, pedometers, or heart rate monitors to provide a more accurate assessment of physical activity patterns [51,52].

Finally, the size of the no-activity group was relatively small (only 24 participants). While global trends indicate a decline in physical activity levels among children and adolescents [53], it remains challenging to recruit a substantial number of children who engage in no sport or structured physical activity at all. Many children participate in at least some form of organized or informal physical activity, even if irregularly. This may limit direct comparisons between active and inactive groups, as even minimal engagement in physical activity can have an impact on psychosocial outcomes. Future research should consider refining inclusion criteria or employing more detailed tracking methods to better differentiate between levels of activity.

6. Conclusion

This study highlights a positive association between physical activity and psychosocial skills, particularly fair play, moral decision-making, and self-efficacy, while showing limited effects of sport modality (individual vs. team; open- vs. closed-skill). These findings suggest that general participation in physical activity may be more influential than the type of sport. Sex differences, especially in self-efficacy and moral reasoning, point to the importance of considering gender-specific socialization. In addition, the findings support the value of youth sport programs that incorporate character education and structured ethical reflection. Coaches and parents may play a key role in promoting fair play and prosocial behavior by emphasizing intrinsic motivation, cooperation, and respect.

CRediT authorship contribution statement

Gabriele Russo: Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Francesco De Matteis:** Writing – original draft, Methodology, Investigation. **Ekaterina Oparina:** Writing – review & editing, Writing – original draft, Methodology. **Andrea Ceciliani:** Writing – review & editing, Writing – original draft, Supervision, Methodology. **Marcelo Bigliassi:** Writing – review & editing, Writing – original draft, Supervision, Methodology.

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Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Dr. Marcelo Bigliassi and Dr. Gabriele Russo report a relationship with Cell Press Inc that includes: board membership. In particular, Dr. Marcelo Bigliassi served as an Academic Editor for Heliyon from January to December 2023, while Dr. Gabriele Russo is a current member of the Advisory Board of Heliyon. In accordance with the journal's editorial policies, both individuals had no involvement in the peer review of this article and no access to information regarding its review process. Full editorial responsibility for this manuscript was delegated to a different editor to ensure transparency and objectivity. The other authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary material

The supplementary material includes detailed tables reporting participant distribution by independent variables, descriptive statistics, and full post-hoc test results. These materials support the results reported in the main text and are available as a separate file accompanying this article.

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.heliyon.2025.e43739.

Data and code availability

The data and analysis scripts used in this study are available in the Open Science Framework repository at the following link: https://osf.io/vdk26/?view_only=727a56df4b604786854919eb27f9463e.

References

[1] S.J.H. Biddle, S. Ciaccioni, G. Thomas, I. Vergeer, Physical activity and mental health in children and adolescents: an updated review of reviews and an analysis of causality, Psychol. Sport Exerc. 42 (2019) 146–155, https://doi.org/10.1016/j.psychsport.2018.08.011.

[2] R.M. Eime, J.A. Young, J.T. Harvey, M.J. Charity, W.R. Payne, A systematic review of the psychological and social benefits of participation in sport for children and adolescents: informing development of a conceptual model of health through sport, Int. J. Behav. Nutr. Phys. Act. 10 (2013) 98, https://doi.org/10.1186/1479-5868-10-98.

[3] J. Serrano-Durá, P. Molina, A. Martínez-Baena, Systematic review of research on fair play and sporting competition, Sport Educ. Soc. 26 (2021) 648–662, https://doi.org/10.1080/13573322.2020.1786364.

[4] A. Spruit, M. Kavussanu, T. Smit, M. IJntema, The relationship between moral climate of sports and the moral behavior of young athletes: a multilevel meta-analysis, J. Youth Adolesc. 48 (2019) 228–242, https://doi.org/10.1007/s10964-018-0968-5.

[5] R. Bailey, Physical education and sport in schools: a review of benefits and outcomes, J. Sch. Health 76 (2006) 397–401, https://doi.org/10.1111/j.1746-1561.2006.00132.x.

[6] M. Lee, J. Whitehead, N. Ntoumanis, Development of the attitudes to moral decision-making in youth sport questionnaire (amdysq), Psychol. Sport Exerc. 8 (2007) 369–392, https://doi.org/10.1016/j.psychsport.2006.12.002.
[7] D.L. Shields, B.L. Bredemeier, Advances in Sport Morality Research, John Wiley & Sons, Ltd, 2007.
[8] D. Harre, Principles of sports training, ultimate athlete concepts, ultimate athlete concepts, https://books.google.it/books?id=KAj5nQEACAAJ, 2012.
[9] P. Parlebas, Contribution à un lexique commenté de l'action motrice, Insep, Paris, 1981.
[10] P. Parlebas, Jeux, sports et sociétés, in: INSEP-Éditions, 2018, pp. 317–410.
[11] B. Knapp, Skill in Sport: the Attainment of Proficiency, Taylor & Francis, 2024.
[12] Q. Gu, L. Zou, P.D. Loprinzi, M. Quan, T. Huang, Effects of open versus closed skill exercise on cognitive function: a systematic review, Front. Psychol. 10 (2019) 1707, https://doi.org/10.3389/fpsyg.2019.01707.
[13] J. Lai, Z. Zhang, G. Ni, Y. Luo, The influence of open-skill and closed-skill sports on executive functions: a systematic review, Br. J. Hosp. Med. 85 (2024) 1–16, https://doi.org/10.12968/hmed.2024.0168.
[14] G. Russo, M. Bigliassi, A. Ceciliani, A. Tessari, Exploring the interplay between sport modality and cognitive function in open- and closed-skill athletes, Psychol. Sport Exerc. 61 (2022) 102186, https://doi.org/10.1016/j.psychsport.2022.102186.
[15] R.N. Singer, Performance and human factors: considerations about cognition and attention for self-paced and externally-paced events, Ergonomics 43 (2000) 1661–1680, https://doi.org/10.1080/001401300750004078.
[16] M.B. Evans, V. Allan, K. Erickson, L.J. Martin, R. Budziszewski, J. Côté, Are all sport activities equal? A systematic review of how youth psychosocial experiences vary across differing sport activities, Br. J. Sports Med. 51 (2017) 169–176, https://doi.org/10.1136/bjsports-2016-096725.
[17] A. Bandura, Self-Efficacy: The Exercise of Control, Self-Efficacy: The Exercise of Control, W H Freeman/Times Books/ Henry Holt & Co, New York, NY, US, 1997.
[18] A. Bandura, Social cognitive theory, Handb. Soc. Psychol. Theories 2012 (2011) 349–373.
[19] D. Feltz, Understanding motivation in sport: a self-efficacy perspective, Motiv. Sport and Exerc. 6 (1992) 43.
[20] D. Colella, M. Morano, L. Bortoli, C. Robazza, A physical self-efficacy scale for children, Soc. Behav. Pers. Int. J. 36 (2008) 841–848, https://doi.org/10.2224/sbp.2008.36.6.841.
[21] F. Vitali, C. Robazza, L. Bortoli, L. Bertinato, F. Schena, M. Lanza, Enhancing fitness, enjoyment, and physical self-efficacy in primary school children: a dedipac naturalistic study, PeerJ 7 (2019) e6436, https://doi.org/10.7717/peerj.6436.
[22] G. Russo, F. Nigro, G. Raiola, A. Ceciliani, Self-esteem in physically active middle school students, J. Phys. Educ. Sport 19 (2019) 1984–1988.
[23] J. Fraser-Thomas, J. Côté, J. Deakin, Understanding dropout and prolonged engagement in adolescent competitive sport, Psychol. Sport Exerc. 9 (2008) 645–662, https://doi.org/10.1016/j.psychsport.2007.08.003, https://linkinghub.elsevier.com/retrieve/pii/S146902920700088X.
[24] M. Hassandra, M. Goudas, A. Hatzigeorgiadis, Y. Theodorakis, Development of a questionnaire assessing fair play in elementary school physical education, Athlitiki Psychol. 13 (2002) 105–126.
[25] S.C. Duncan, T.E. Duncan, L.A. Strycker, N.R. Chaumeton, Relations between youth antisocial and prosocial activities, J. Behav. Med. 25 (2002) 425–438, https://doi.org/10.1023/A:1020466906928.
[26] E.A. Rutten, G.J.J.M. Stams, G.J.J. Biesta, C. Schuengel, E. Dirks, J.B. Hoeksma, The contribution of organized youth sport to antisocial and prosocial behavior in adolescent athletes, J. Youth Adolesc. 36 (2007) 255–264, https://doi.org/10.1007/s10964-006-9085-y.
[27] A. Spruit, M. Assink, E. Van Vugt, C. Van Der Put, G.J. Stams, The effects of physical activity interventions on psychosocial outcomes in adolescents: a meta-analytic review, Clin. Psychol. Rev. 45 (2016) 56–71, https://doi.org/10.1016/j.cpr.2016.03.006.
[28] M. Nevzat, The validity and reliability of Turkish version of fair play questionnaire in physical education (fpq-pe) and an implementation, Educ. Res. Rev. 10 (2015) 2469–2480, https://doi.org/10.5897/ERR2015.2402.
[29] Y. Yaffe, O. Levental, D.L. Arey, A. Lev, Morality and values in sports among young athletes: the role of sport type and parenting styles – a pilot study, Front. Psychol. 12 (2021), https://www.frontiersin.org/articles/10.3389/fpsyg.2021.618507.
[30] M. Rosenberg, Rosenberg self-esteem scale, https://doi.org/10.1037/t01038-000, 2011.
[31] K.C. Kowalski, P. D, P.R.E. Crocker, P. D, R.M. Donen, B. Honours, Validation of the Physical Activity Questionnaire for Older Children, 1997.
[32] M. Hassandra, M. Goudas, A. Hatzigeorgiadis, Y. Theodorakis, A fair play intervention program in school Olympic education, Eur. J. Psychol. Educ. 22 (2007) 99–114, https://doi.org/10.1007/BF03173516.
[33] G. Russo, V. Paganelli, A. Ceciliani, Building respect, fairness, and collaboration through physical education: a primary school intervention, Acta Psychol. 258 (2025) 105187, https://doi.org/10.1016/j.actpsy.2025.105187.
[34] A. Bell, Designing and testing questionnaires for children, J. Res. Nurs. 12 (2007) 461–469, https://doi.org/10.1177/1744987107079616.
[35] R Core Team R, A Language and Environment for Statistical Computing, R Foundation for Statistical Computing, Vienna, Austria, 2021, https://www.R-project.org/.
[36] RStudio Team, RStudio: Integrated Development Environment for R, RStudio, Inc., Boston, MA, 2015, http://www.rstudio.com/.
[37] R.A. Peterson, J.E. Cavanaugh, Ordered quantile normalization: a semiparametric transformation built for the cross-validation era, J. Appl. Stat. 47 (2020) 2312–2327, https://doi.org/10.1080/02664763.2019.1630372.
[38] R.A. Peterson, Finding optimal normalizing transformations via bestNormalize, R J. 13 (2021) 310–329, https://doi.org/10.32614/RJ-2021-041.
[39] M. Kay, L.A. Elkin, J.J. Higgins, J.O. Wobbrock, ARTool: Aligned Rank Transform for Nonparametric Factorial ANOVAs, 2021, https://github.com/mjskay/ARTool, r package version 0.11.1.
[40] R.V. Lenth, Emmeans: estimated marginal means, aka least-squares means, https://CRAN.R-project.org/package=emmeans, 2023, r package version 1.8.4-1.
[41] N.L. Holt, K.C. Neely, L.G. Slater, M. Camiré, J. Côté, J. Fraser-Thomas, D. MacDonald, L. Strachan, K.A. Tamminen, A grounded theory of positive youth development through sport based on results from a qualitative meta-study, Int. Rev. Sport Exerc. Psychol. 10 (2017) 1–49, https://doi.org/10.1080/1750984X.2016.1180704.
[42] C.G. Pennington, Moral development and sportsmanship in physical education and sport, J. Phys. Educ. Recreat. Dance 88 (2017) 36–42, https://doi.org/10.1080/07303084.2017.1367745.
[43] K. Opstoel, L. Chapelle, F.J. Prins, A.D. Meester, L. Haerens, J. van Tartwijk, K.D. Martelaer, Personal and social development in physical education and sports: a review study, Eur. Phys. Educ. Rev. 26 (2020) 797–813, https://doi.org/10.1177/1356336X19882054.
[44] C.B. Slutzky, S.D. Simpkins, The link between children's sport participation and self-esteem: exploring the mediating role of sport self-concept, Psychol. Sport Exerc. 10 (2009) 381–389, https://doi.org/10.1016/j.psychsport.2008.09.006.
[45] S. Harter, The construction of the self: developmental and sociocultural foundations, 2nd ed., in: The Construction of the Self: Developmental and Sociocultural Foundations, The Guilford Press, New York, NY, US, 2012.
[46] R.M. Telford, R.D. Telford, L.S. Olive, T. Cochrane, R. Davey, Why are girls less physically active than boys? Findings from the look longitudinal study, PLoS ONE 11 (2016) e0150041, https://doi.org/10.1371/journal.pone.0150041.
[47] A. Williams, Who Cares About Girls? Equality, Physical Education and the Primary School Child, Routledge, 2017, pp. 125–138.
[48] L. Kretschmer, G.D. Salali, L.B. Andersen, P.C. Hallal, K. Northstone, L.B. Sardinha, M. Dyble, D. Bann, I.C.A.D.I. Collaborators, L.B. Andersen, S. Anderssen, G. Cardon, R. Davey, R. Jago, K.F. Janz, S. Kriemler, N. Møller, K. Northstone, R. Pate, J.J. Puder, J. Reilly, J. Salmon, L.B. Sardinha, E.M.F. Van Sluijs, Gender differences in the distribution of children's physical activity: evidence from nine countries, Int. J. Behav. Nutr. Phys. Act. 20 (2023) 103, https://doi.org/10.1186/s12966-023-01496-0.
[49] E. McAuley, B. Blissmer, Self-efficacy determinants and consequences of physical activity, Exerc. Sport Sci. Rev. 28 (2000) 85.

[50] P.M. Podsakoff, S.B. MacKenzie, N.P. Podsakoff, Sources of method bias in social science research and recommendations on how to control it, Annu. Rev. Psychol. 63 (2012) 539–569, https://doi.org/10.1146/annurev-psych-120710-100452.
[51] S. Skender, J. Ose, J. Chang-Claude, M. Paskow, B. Brühmann, E.M. Siegel, K. Steindorf, C.M. Ulrich, Accelerometry and physical activity questionnaires - a systematic review, BMC Public Health 16 (2016) 515, https://doi.org/10.1186/s12889-016-3172-0.
[52] D. Marasso, C. Lupo, S. Collura, A. Rainoldi, P.R. Brustio, Subjective versus objective measure of physical activity: a systematic review and meta-analysis of the convergent validity of the physical activity questionnaire for children (paq-c), Int. J. Environ. Res. Public Health 18 (2021) 3413, https://doi.org/10.3390/ijerph18073413.
[53] World Health Organization, Global action plan on physical activity 2018–2030: more active people for a healthier world, https://www.who.int/publications/i/item/9789241514187, 2018.