

The impact of gender on socio-motor creativity during adolescence: An underestimated variable in physical education?

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Abstract

Problem statement : There is a global consensus admitting that creativity is an important asset for performance in sports and physical education (PE). It is also acknowledged by multivariate framework studies that intrapersonal characteristics such as motivation or empathy strongly impact motor behavior and creativity at school. However, gender, especially during adolescence, is a variable that has scarcely been discussed in relation to motor creativity performance in social settings. If work surrounding gender and creativity are often inconclusive, this work aims to provide some data on how gender constructs may impact motor performance.

Approach: Our experimental population was composed of three groups of 20 adolescents (60 students in total; 31 girls and 29 boys), aged 12 years old. In alignment with the multivariate framework, socio-motor creativity was measured using praxical communication tools and protocols to establish fluency and flexibility levels. Then, a multifactor correspondence analysis (MCA) was conducted for data analysis by using the Trideux.cloud calculator. **Purpose:** Our study wishes to show how motor behavior can be influenced by gender in socio-motor settings in PE during adolescence. We also wish to underline the importance of socio-motor settings in the aim to encompass motor creativity in a more global way. Hence, this work aims to catalyze a change of perspective in assessing socio-motor creativity in PE, in hopes for a more efficient and inclusive motor development for adolescence. **Results :** MCA results indicate a strong relationship between gender and socio-motor performance in PE. A Pearson correlation calculation also showed a strong relationship with $r=0.852$. Moreover, it appears that girls, in particular, show weaker socio-motor creativity scores while boys tend to achieve the best socio-motor performance results. This underlines that being creative in socio-motor contexts tends to be strongly gender-dependent. **Discussion and conclusion :** This study provides one of the first direct insights into the relationship between gender and socio-motor creativity in socio-motor settings. Although many studies report inconclusive results regarding gender and its link to creativity, our findings using the socio-motor framework support the idea that gender is a variable that influences motor creativity. Therefore, the implications of our study advocates that in order to fully assess motor creativity, socio-motor settings must be encompassed. Moreover, our results suggest that gender, especially at adolescence, is a variable that may explain motor disparities between adolescents in socio-motor settings. Our data on gender also enriches findings regarding the multivariate framework and suggests that more in-depth research on socio-motor creativity and gender are needed to benefit motor development and well-being for adolescents in PE.

Keywords: Socio-motor creativity; Adolescent behavior; Gender; Physical Education; Motor creativity ; Praxical communications

Introduction

Nowadays, creativity is considered to be a desirable asset in sports and physical education (PE) to improve performance (Buning et al., 2020; Oboeuf et al., 2024). Creativity is often described as the skill to perform new, original work in a meaningful environment (Runco & Jaeger, 2012). Moreover, it represents the ability to express numerous and different answers (divergence) while being capable of selecting the optimal one (convergence) to solve a problem (Hatchuel & Weil, 2009; Zhang et al., 2020). In line with these definitions, creative motor performance refers to the capacity of one or several individuals to produce a solution that is both novel and appropriate in a motor situation (Oboeuf et al., 2020).

In PE, motor “productions” are carried out in real-life situations, requiring in situ interaction with the physical and social environment (Besançon & Lubart, 2011). Consequently, creative performance in PE is strongly linked to the task and domain of activity in which the individual is immersed (M Emmert, 2015). For instance, performing creatively in team sports such as football requires different motor abilities than in boxing or track and field (Lubart & Besançon, 2015). Therefore, it has been underlined that socio-motor environments—unstable, complex, and changing settings with social, physical, and technical constraints—are optimal for developing motor creativity (Bonnardel et al., 2023; Emmert, 2015).

Nonetheless, not all students engage equally in PE, especially in ecological settings where decision-making and motor skills are continuously disrupted by social interference from teammates or opponents.

Findings have shown that intrapersonal characteristics such as motivation, empathy, ego, or risk-taking also influence motor creativity (Kokkonen, 2018; Versace et al., 2018). However, if these singularities can impact motor behavior, the importance of gender on creative motor performance in socio-motor domains has been largely overlooked.

Gender is understood as “a social construct referring to a system of norms and stereotypes related to sex, that produces hierarchies between men and women and between the values and representations associated with them” (Verscheure et al., 2014, p. 133). Therefore, if both gender and physical activities are social and cultural products infused by certain norms and values, these social constructs could be prone to influence one’s behavior (Baer & Kaufman, 2011).

Authors have shown that in non-motor domains, creativity is not significantly impacted by gender, as studies remain inconsistent and heterogeneous (Abraham, 2016; Prado et al., 2016; Taylor & Barbot, 2021). Similarly, at an early age, before adolescence, no difference in creative motor abilities between genders is reported (Khorkhova et al., 2024). However, for adolescent or adult populations, it appears that gender could strongly influence motor behavior (Vigneron, 2004). Despite existing studies, results remain inconclusive, and almost no research has examined the relationship between gender and socio-motor creativity.

In light of this, we believe it is relevant to question gender and its influence on socio-motor creativity, as this area demands more in-depth study and could have a major influence on motor behavior and adolescent well-being. Consequently, supported by the multivariate framework (Palmiero et al., 2019), we assessed socio-motor creativity performance using praxical communication indicators. By establishing socio-motor creativity levels for all participants, we sought to observe whether a link exists between creativity levels and gender, through a multiple correspondence analysis (MCA).

Adolescence and Gender: A Critical Crossroads for Socio-Motor Creativity Development?

Adolescence, marked by pubertal changes, is a pivotal period when creative skills begin to take shape and crystallize across various domains (Lubart & Besançon, 2015). Likewise, gender is strongly influenced by adolescence, as it is a salient period in which socio-cultural factors, norms, stereotypes, and barriers are built (Morais & Almeida, 2019). Gender identity is therefore a learning process during which ideas, habits, rules, and representations are internalized by the individual (Steensma et al., 2013).

The transformations occurring during adolescence can act as a catalyst for developing creativity through the individuals’ desire to break certain rules, challenge adults, and assert themselves among peers. However, “peer pressure and identity development” (Lubart, 2015, p. 97) can also hinder creativity, as ego and the search for identity sometimes take the form of narcissism, where the gaze of others becomes unbearable (Scharmann, 2011). Adolescence is thus a pivotal age for the development of both creativity and the development of gender identity. The peer group serves as both a vital resource for self-assertion and a constant source of social threat.

Adolescence is also characterized by the emergence of asymmetrical positions, interdependent personality traits, and behaviors that may or may not be endorsed by individuals (Collet, 2011). For instance, in France, girls are often perceived as more “fragile” than boys, a cultural representation that may encourage certain personality traits, habits, and attitudes. Similarly, girls in school are typically described as calm, dedicated, and discreet, whereas boys tend to be represented as more disruptive and dynamic (Vigneron, 2004). These social representations are mirrored and embodied by adolescents as a means of gaining acceptance within their social environment. Gender construction during adolescence is therefore highly likely to influence one individuals’ actions and interactions with the world. Hence, it is relevant to examine gender in relation to socio-motor behavior and creativity expression.

Physical Education and Socio-Motor Activity: A Cultural Masculine Domination

When it comes to physical activity and sports, boys and girls are not subject to the same behavioral norms. During adolescence, girls are generally less likely to be enrolled or involved in sports, and those who are tend to participate in activities labeled as “feminine,” such as gymnastics or dance (Vigneron, 2004). Physical activities are thus gendered—boys are stereotypically considered “feminine” when dancing, while girls are seen as “masculine” when playing soccer. Girls are steered toward activities emphasizing expression and emotion (e.g., dance, gymnastics, figure skating), while boys are encouraged to engage in more instrumental and technical activities, such as collective sports (Lentillon, 2009).

These gendered representations of physical practices are often reflected in teachers’ expectations during PE. Girls are frequently perceived as having limited technical and physical abilities, which are used to explain their “failures,” when boys’ failures are attributed to a lack of seriousness or effort, as they are presumed to possess greater physical potential (Vigneron, 2004). Consequently, the existence of a differentiated relationship to the body and knowledge—a “hidden curriculum” that, either explicitly or implicitly, leads to the internalization of gendered norms and values strongly influences motor behavior.

Such cultural representations often result in the disengagement of students who are perceived as less legitimate or weak in a given physical activity, reinforcing the self-fulfilling prophecy created by the social expectations. As a result, the male cultural sphere tends to dominate and shape the culture of physical education, particularly in socio-motor activities such as football, boxing, or rugby.

Therefore, our hypothesis is that socio-motor environments tend to favor motor creativity development and motor expression of boys while penalizing girls. To verify this thesis, it is crucial to implement a socio-motor assessment method with precise indicators of creativity.

Praxical Communications: A Relevant Lens for Creative Socio-Motor Performance?

Previous research has shown that PE teaching in France remains heavily sport-centered, and that teachers often assess performance primarily based on physical, technical, and tactical criteria (Clemente et al., 2016; Coutts, 2014). While these traditional indicators are necessary conditions for performance, they are not sufficient to fully account for it (Furley & Memmert, 2018). Moreover, as we have shown, due to the cultural representations, the traditional sport indicators would favor boys, as they are more prone to engage in technical motor training.

To address this issue, recent researcher has used praxical communications as a means of assessing creative motor performance in socio-motor settings (Oboeuf & Frachey, 2025). Praxical communications refer to the interactions and exchanges expressed by players during ecological tasks, such as team games or collective sports (Parlebas, 1999). These communications can be divided into different categories such as direct communications, which are essential motor actions without which the game cannot be played (e.g., shooting, passing), and praxemes, which are indirect communicative behaviors that accompany and enhance direct actions such as a call for the ball or a fake pass (Bordes, 2020; Oboeuf, 2024).

The normative frame in which the player operates—shaped by the rules, objectives, and social or physical constraints of the game—catalyzes different behaviors and communication channels during play. Therefore, assessing a player's creative motor performance within a specific ecological setting requires identifying the full spectrum of motor possibilities and praxical communications available. In other words, a roster of game-specific communications must be established to meaningfully assess creative motor performance. For instance, in football, a call for the ball represents a praxeme. When a player suddenly runs into an opponent-free space, the action (running) serves as the signal conveying the message (calling for the ball) to a teammate. In handball, 75–85% of overall praxical communications occur through indirect channels such as praxemes. This highlights the importance of accurately coding and identifying the various communication types specific to each ecological activity. As an example in table 1, here are the listed direct communications and praxemes in football.

Table 1 Direct Communications and Praxemes in Football

Direct communications

Type	Description
Interception	When an opponent stops the ball from reaching its destination by cutting the pass line or shot.
Tackle	Defensive physical act that aims to recover the ball when the opposing player is in possession.
Contact	Shoulder-to-shoulder contact between two players who wish to take the ball.
Pass	Technical action that aims to transmit the ball to a teammate.
Shot	Direct ball attempt aimed at the opponent's goal.

Praxemes

Praxeme	Motor Action Description
Body feint	A motor action that makes opponents believe the player will move in one direction while moving in another.
Passing feint	A motor action that makes opponents believe a pass will be made, while another action (dodge, fixate, shot) is performed.
Shooting feint	A motor action that suggests a shot but leads to a different action.
Returning run	The run of a player who just lost the ball and returns quickly to a defensive position.
Tracking run	A player follows a direct opponent to reduce maneuvering space.
Holding run	The player behind the bearer runs to offer a pass solution.
Supporting run	The player in front of the bearer runs to offer a pass solution.
Focusing run	A run toward the rival bearer to limit their maneuvering margin.
Cross run	A player crosses in front of a teammate to destabilize the opposing defense.
Recolocation	Movements to occupy a suitable position relative to teammates, opponents, and the ball.
Ball call	A player accelerates toward the goal to anticipate a pass.
Ball counter-call	A player accelerates in another direction to create free space.
Fixation	A run into an area defended by two opponents to create a numerical advantage.
Slip	A movement in which a player from behind or the side of the bearer creates space for the next action.

Across studies, evaluating creative motor performance in socio-motor settings relies on identifying divergence, defined as the number of praxical motor communications (fluency), and flexibility, defined as the diversity of those communications (Mermert, 2015; Orth et al., 2024; Roca et al., 2021).

Therefore, while valid methods and indicators exist for assessing motor creativity performance, they are not designed to explain or interpret disparities in creative motor performance among students. By adopting the multivariate theoretical framework, this study aims to understand the dynamics between gender and creative socio-motor performance as an essential step toward a more comprehensive understanding of motor well-being and development in PE.

Method

Rooted in the multivariate framework, this study sought to establish relationships between gender and creative motor performance in ecological settings. The following section describes the experiment's participants, materials, and procedures, which allowed us to obtain quantitative results. Ethical considerations are also detailed below.

Recruitment and Context

The main author, who is also a PE teacher, conducted the experiment in a French middle school in collaboration with the PE teachers regularly assigned to each participating class. The first phase of the experiment began on the first day of school, when students and parents were informed of the upcoming study. Parental authorizations were distributed via email, completed by legal guardians, and collected by the main author for safekeeping. The email described the objectives of the study, duration, and withdrawal rights (the possibility of withdrawing at any time). It also outlined the terms regarding video consent and data confidentiality (anonymization, right to access results, etc.).

Only students who provided informed consent and parental authorization were included in the study.

Participants

The data collected involved 60 adolescents aged 12 years (31 girls and 29 boys), all from the same school. Participants gave information regarding their gender and the data was collected by the first author. The age group was chosen specifically, as many authors have identified this period as a critical moment for the development of creativity (Lubart, 2015; Kim, 2011). In addition, this age groups is also regarded as an important period for gender differentiation where cultural representations and habits become more salient than before (Khorkhova et al., 2024). Out of the 64 students initially enrolled, 4 were excluded: 2 due to lack of parental authorization and 2 due to temporary injury.

Table 2: Inclusion and exclusion criteria for participants.

Criteria	Inclusion	Exclusion
Participation and authorization	Participation document signed by parents.	Authorization documents unreturned or refusal of participation.
Image rights	Image authorization signed by parents.	Children without returned image authorization.
Attendance	Child present for the entire study.	Absence during any part of the assessments.
Physical condition	Physically fit to practice at the time of the experiment.	Unfit to practice physical activity at the time of the experiment.

Prior to data collection, the research protocol was approved by the Comité d'Éthique de la Recherche (CER), authorizing the experiment under French institutional and legal regulations. All data were anonymized and securely stored in accordance with Règlement Général sur la Protection des Données (RGPD; EU Regulation 2016/679).

Procedures for Assessing Creative Motor Performance

Socio-motor Creativity Assessment

The socio-motor creativity assessment was then conducted with each class group to measure ecological motor creativity. For this, the game "sitting ball" was used, as several studies have identified a wide variety of praxical indicators that facilitate the construction of coding and analysis grids for observers (Oboeuf et al., 2010; Bordes, 2020).

The aim of the sitting ball game is to eliminate other participants by throwing a ball at them within a defined area. When a player is hit, they must sit down and wait for an opportunity to catch the ball. If successful, they re-enter the game. The game ends when only one player remains or when time runs out.

For our assessment, each class group was divided in half and team composition was randomized at the beginning of the study with the constraint that teams were gender-balanced. Participants remained in the same teams and class group throughout the study. This design choice was intended to gather stable motor activity reports. Thus, each of the three class groups produced two subgroups of 10 players each, resulting in six total groups. Each subgroup played for 20 minutes within a 20-meter square area.

The objective was to assess students' creative motor performance and divergent abilities by evaluating the fluency (number) and flexibility (diversity) of their praxical communications (direct communications and praxemes) expressed during gameplay (Oboeuf et al., 2024). In the table below are presented the direct communications and praxemes identified for the game "sitting ball" in our study.

Table 3
Direct Communications for the Game of Sitting Ball

Type	Description
Shot	Offensive action aiming at scoring or hitting a target.
Pass	Transmission of the ball to a teammate.
Interception	Stopping the ball from reaching its intended destination.
Ball recovery	Regaining possession of the ball after loss.

Table 4
Praxemes for the Game of Sitting Ball

Praxeme	Motor Action Description
Call for the ball	A player signals for the ball with a hand gesture and body positioning toward the bearer.
Dodge run	Sudden change of rhythm or direction to become harder to target.
Replacement run	Slow repositioning steps to find a favorable location.
Supporting run	Running toward the ball bearer to offer a pass option.
Positioning step	Steps or jumps allowing the bearer to adjust before shooting.
Body feint	Misleading movement suggesting false intentions (e.g., faking right, moving left).
Pass feint	Pretending to pass while executing a different action.
Shooting feint	Pretending to shoot to gain advantage or switch action.
Dodge	Quick body movement to avoid a shot.
Elusive run	Fast run indicating clear space for receiving a pass.

Observer Training and Reliability

To ensure objectivity and consistency in the assessment of motor behaviors, trained observers were used to score the praxical communications. Based on existing protocols (Oboeuf et al., 2024; Oboeuf & Frachey, 2025), observers were selected among sports education students and PE teachers with at least five years of training in collective games or sports and five years of experience in sports faculties.

Additionally, all observers completed a six-hour theoretical training on praxical communications to ensure accurate identification of direct communications and praxemes. In table 5, the training content for observer preparation is available.

Table 5 : Theoretical Course Content

Format and Course Title	Objectives
Lecture 1 – Theoretical Foundations of Motor Communication	i) Contextualize motor communication within the theoretical framework of interactional analysis in sport; ii) Distinction between motor communication and motor counter-communication; iii) Introduce conceptual distinctions between motor signs (praxemes and gestemes).
Lecture 2 – Praxemes, Gestemes, and Indices: A Semiotic Approach	i) Define and differentiate expressive mediations; ii) Illustrate their use in various team sports contexts; iii) Explore tactical scope and ambiguity of motor messages.
Lecture 3 – Observing, Coding, and Interpreting Motor Behaviours	i) Provide tools for rigorous and reliable observation; ii) Present the Lince software and coding grids; iii) Address interpretative biases and challenges in observational analysis.

Assessments were conducted through the analysis of recorded game footage. Each player's performance was independently evaluated by two expert observers, each scoring the different praxical communications expressed by a given player. This dual evaluation process aimed to enhance inter-rater reliability by balancing situational expertise with methodological neutrality.

Inter-rater reliability and validity tests were conducted using Pearson and Spearman correlation coefficients (Marqu  z Jim  nez & Mart  nez de Santos, 2014). All coefficients exceeded $r = 0.96$, indicating strong agreement and confirming the robustness of this method.

After analyzing the footage, each participant received a fluency score (total number of praxical communications) and a flexibility score (diversity of praxical communications) assigned by the observers.

Multiple Correspondence Analysis

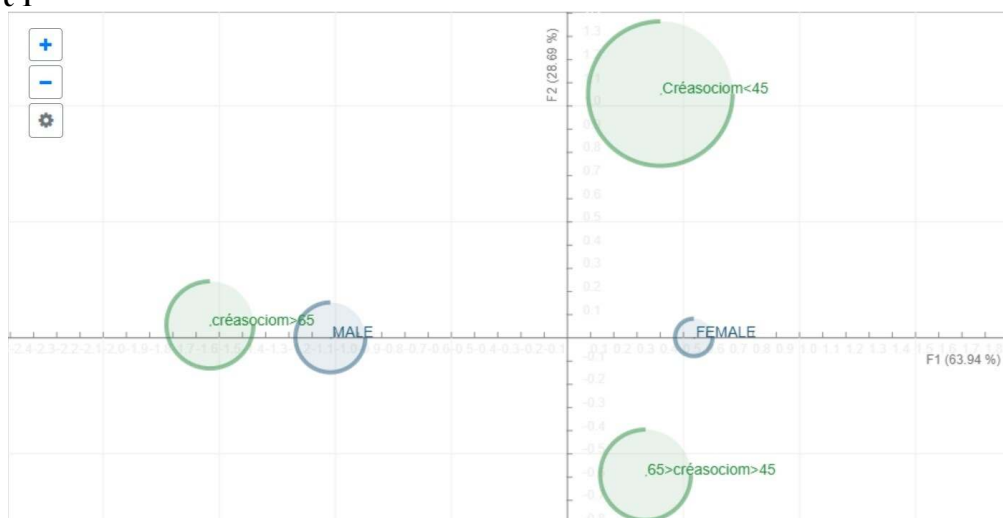
For each participant, creative motor performance was quantified using praxical communications (direct communications and praxemes) and divergent indicators (fluency and flexibility). Data were encoded by the observers after quantifying the praxical communications expressed during the game using an Excel grid. To interpret socio-motor creativity performance, it was necessary to categorize individual fluency and flexibility scores into different creativity brackets. Because creativity performance is context-dependent, classification was relative to the observed sample. Indeed, a player may be considered creative in this sample but not in another context. This categorization allowed the subsequent Multiple Correspondence Analysis (MCA) linking gender to creative motor performance within ecological contexts. The decision to create brands is grounded in MCA literature as a way to clearly identify groups allowing a clearer analytical strategy (Cibois, 2018; Coulangeon, & Duval, 2013).

To clarify the coding system:

1. cr  asociom < 45: lowest creative motor performance (below 45 points)
2. 45 < cr  asociom < 65: average creative motor performance (between 45 and 65 points)
3. cr  asociom > 65: highest creative motor performance (above 65 points)

These three performance brackets each represented one-third of the data distribution which allowed optimal interpretation. The TriDeux.cloud MCA tool was used to compute correspondences and correlations between the collected and encoded data. Our MCA aimed to determine whether gender can impact creativity and results will be interpreted through a graphical representation. MCA visualises the relationship between individuals and variables in terms of distance, producing clouds of points (Cibois, 2018). The distance between each point is based on how similar they are in their distribution. The proximity between encoded vectors indicate the strength of their correlation, while the size of an encoded vector represents its relative importance or influence on the overall results. Moreover, the cosine of the angle between vectors shows the correlation between the two corresponding variables (Clarke et al., 2021). Thus, a small angle between two vectors indicates that the two variables are highly correlated. If two vectors form an angle of 90° or greater than 90° then corresponding variables are uncorrelated or negatively correlated.

Figure 1



Results Interpretation

The MCA graphic presented above (figure 1) reveals two interpretable dimensions that together account for 92.63% of the total variance. The eigenvalue of F1 is 0.557, explaining 63.94% of total variance while the eigenvalue of F2 is 0.250 accounting for 28.69% of the variance. These values provide a reliable representation of the data structure. The horizontal dimension (F1), here designated as the “gender performative axis” captures a clear contrast between girls and boys, where high socio-motor levels ($\text{créasociom} > 65$) are clearly clustered near the masculine (MALE) code. The second axis (F2) that we will refer to as the “creativity differentiation axis” puts an emphasis on the mid-range group ($45 < \text{créasociom} < 65$) and the lowest creative categories ($\text{créasociom} < 45$) that are associated with girls (FEMALE). Therefore, the distribution of categories across the figural map suggests a coherent distribution between gender and socio-motor creativity performance. Gender categories show differentiation across the space, with MALE positioned closer to high socio-motor creativity clusters and FEMALE closer to weaker or more mid-range socio-motor creativity clusters. Thus, these results suggest that gender is correlated with socio-motor performance. To reinforce this relationship, a Pearson correlation was applied between gender and socio-motor scores, yielding a coefficient of $r = 0.852$, confirming a strong positive relationship between gender and socio-motor performance.

Discussion and Limitations

This study provides one of the first direct insights into the relationship between gender and socio-motor creativity in socio-motor settings. Although many studies report inconclusive results regarding gender differences in creativity, our findings support the idea that gender influences creativity in a domain-specific manner (Bonnardel et al., 2023; Memmert, 2015). By using the MCA analysis, the F1 and F2 dimensions allow us to clearly underline the fact that gender is a variable that influences socio-motor performance. Despite our results, it is also essential to recognize that this study was conducted within a French and European school context, where PE and sports carry specific cultural histories and gendered traditions. Therefore, we acknowledge the fact that even if we chose the sitting ball game in our study as an intent to establish a “gender neutral” assessment (Bordes, 2020; Ferretti & Bortolotti, 2024), other socio-motor settings could be used as a way to establish socio-motor creativity. Indeed, to limit the impairment of socio-motor creativity assessment, our aim is to use games such as “the three camps”, which have no artifact such as a ball, to limit a maximum of socio-cultural bias or inductor effects in future studies. To us, this perspective is crucial to study socio-motor behavior and creativity in a thorough manner. In convergence with this idea, it is worth highlighting that these

results are specific to this group sample and can't be generalized. Creativity levels encoded here are indeed specific within this group, and a participant labeled creative in our study may not have the same status in a different social group or context. Moreover, confounds such as prior familiarity between participants coming from the same class group could also impact some behaviors and results. Even if the study was lead early in the school year, familiarity between participants could generate some behavioral bias. In consequence, future research taking interest in gender and socio-motor creativity could use different cultural contexts or samples that have more limited familiarity to better understand how gender may influence socio-motor creativity. Also, a longitudinal approach could enrich this study, by investigating how gender impacts socio-motor creativity development over time, particularly into later stages of adolescence and adulthood. Finally, as the multivariate framework suggests, if gender can be one parameter that predicts socio-motor creativity, other intrapersonal singularities such as self-esteem, motivation or empathy could influence motor behavior (Memmert, 2015). Hence, a more global spectrum of variables would need to be encompassed to fully understand creative disparities in socio-motor settings.

Conclusion

This study provides one of the first direct insights into the relationship between gender and socio-motor creativity in socio-motor settings, paving a way for a more thorough understanding of socio-motor creativity. By using the MCA, the results gathered from the F1 and F2 dimensions allow us to clearly underline the fact that socio-motor performances tend to be influenced by gender. This was confirmed by a Pearson correlation calculation with $r = 0.852$. Furthermore, the MCA map produced a distinguish contrast between genders. High socio-motor levels ($créasociom > 65$) were related to male participants while lower creativity levels were associated with female participants. Although many studies report inconclusive results regarding gender differences in creative abilities, our findings support the idea that gender influences creativity in socio-motor contexts. As a result, this study has implications in showing the importance of a more in-depth study of socio-motor contexts for motor creativity assessments.

Indeed, authors have shown that a scarce focus on socio-motor settings in creativity research (Lee et al., 2023), has lead to a research gap in understanding motor creativity. This lack could be one of the reasons no relationship was previously found between motor creativity and gender. In addition to this, many authors tend to focus on younger populations (Khorkova et al., 2024) when studying the relationship between gender and motor creativity. Therefore, our study also has implications in supporting the fact that adolescence is a relevant age period for studying creativity and it's relationship with gender. Our socio-motor study aligns with similar conclusions established by previous studies that focused on non-motor creativity domains (Lubart, 2015), thus complementing knowledge surrounding creativity as a whole. Moreover, if many intrapersonal variables such as empathy or motivation have been studied, only few empirical data was available surrounding gender and socio-motor creativity at adolescence (Nakano et al., 2021). Therefore, rooted in the multivariate perspective (Memmert, 2015), our study contributes to enrich this framework by shedding light on the fact that motor creativity depends on multiple parameters, including gender.

This implies that in order to fully understand or interpret motor creativity, gender is a variable that must be encompassed and examined. Indeed, authors agree that social interactions and peer perception in socio-motor contexts, where girls are often labeled as less competent, can lead to a decrease of motor activity in PE (Taylor, 2025). Consequently, our findings raise awareness regarding the importance of pedagogical choices, representations and learning settings made by PE teachers as gender bias may hinder motor development for students, especially girls. Our findings tend to provide evidence that motor habits, norms, and socio-cultural environments may play significant roles in facilitating or constraining creative expression in socio-motor activities. Acknowledging that masculinity is culturally dominant in socio-motor activities is important for the well-being of participants, especially girls, as their motor behavior tends to be inhibited in these dynamic social environments. Our study therefore embraces the idea that pedagogical changes and thoughts are needed in PE to improve motor development and health for all students.

Declaration of generative AI and AI-assisted technologies in the writing process

The authors declare that no artificial intelligence (AI) tools were used in the collection, analysis, or interpretation of the study data. AI-assisted tools were used solely for language editing and grammatical refinement during manuscript preparation. All scientific content, study design, statistical analysis, and interpretation of results were performed solely by the authors.

Declaration of conflicting interests

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