**Understanding the differences in boys' and girls' involvement in Physical Education in French High school context: an ecological approach.**

**Abstract**

The World Health Organization advises that adolescents engage in at least 60 minutes of moderate to vigorous physical activity daily. However, a significant proportion of adolescents do not meet this recommendation, with a notable gender gap. Specifically, 92% of girls fall short of this target, compared to 82% of boys. Contributing to this gap, physical education programs often exacerbate these inequalities. This study aims to investigate, within the ecological framework, the conditions that exacerbate or mitigate gender differences in physical activity engagement during physical education classes. The study is based on a mixed methodology, combining quantitative measures (accelerometers, questionnaires) and qualitative measures (focus groups, ethnographic notebook). This study aims to collect data from a broad cohort in different French schools, ranging from more to less advantaged secondary schools, on four different types of physical activity. Accelerometers will measure moderate to vigorous physical activity in girls and boys during a two-hour mandatory physical education class. Concurrently, focus groups will provide insights into factors influencing girls’ participation in physical education. The target population for this study is French secondary school students aged 11 to 15.

*Keywords: Physical education, Engagement, Gender gap, Physical Activity*

**Understanding the differences in boys' and girls' involvement in PE in French High school context: a bio-ecological approach.**

The promotion of physical activity (PA) has emerged as a critical social and public health issue. The World Health Organization (WHO) characterizes PA as "any bodily movement produced by skeletal muscles that require energy expenditure" [1], encompassing activities undertaken during leisure, work, or travel. This is distinct from sedentary behavior (SB), described as "any wakeful state with an energy expenditure of ≤1.5 METs while in a sitting, reclining, or lying posture"[1]. The WHO advises adolescents to engage in at least 60 minutes of moderate to vigorous physical activity (MVPA) daily, yet adherence to this recommendation remains suboptimal. Insufficient PA is linked to substantial health and social concerns, including increased risks of non-communicable diseases such as cardiovascular disease, obesity, type 2 diabetes, and certain cancers [2]. Additionally, the rise of SB contributes to significant socioeconomic burdens. Globally, physical inactivity incurs an estimated $54 billion in direct healthcare costs [1], with France experiencing a parallel economic impact of approximately 17 billion euros annually, predominantly attributed to healthcare expenses.

Alarmingly, PA deficiency is a global phenomenon, affecting approximately 28% of adults, with a higher prevalence among women (32%) than men (23%). This trend is more pronounced among youth, with 81% of adolescents aged 11-17 not meeting WHO PA guidelines [1]. Research indicates that PA levels decline from childhood into adulthood, with this trend being more acute among females[3]. Studies reveal persistent gender disparities in PA engagement across various cultures and age groups, with girls consistently less active than boys [4–6]. In the context of physical education (PE), this discrepancy is evident in assessment outcomes, where girls obtain grades significantly lower than boys, a gap that has widened over time [7]. Factors contributing to this disparity include socialization patterns, gender stereotypes, and inherent biases in PE programs and assessment criteria [8–10]. For instance, certain PE program components are perceived as masculine or feminine, influencing participation and performance [11]

The ecological model by Bauman et al. (2012) offers a comprehensive framework for understanding the complexity of PA engagement, highlighting the interplay of individual, interpersonal, environmental, and policy factors in shaping PA behaviour [12]. Despite recognizing the gender imbalance in PE engagement, empirical quantification and analysis of its determinants have been limited.

This study aims to investigate the conditions that exacerbate or mitigate gender differences in PA engagement during PE classes, within the context of the ecological framework. Our hypotheses posit that: (1) Boys exhibit significantly higher motor engagement in PE than girls; (2) Individual relationships with PA and sport critically influence engagement levels; (3) The cultural gendering of activities mediates this engagement; (4) Socio-cultural and geographical school characteristics correlate with the gender gap, being less pronounced in advantaged urban settings and more so in disadvantaged urban and rural areas; (5) Teachers' ability to create an inclusive environment can diminish gender disparities in PE engagement.

**Methods**

The research methodology for this study received ethical approval from the university's ethics board in July 2023, under the reference number CER 2023-16. Using a mixed methods approach, the study combines quantitative tools, such as accelerometers and questionnaires, with qualitative techniques, including semi-structured interviews conducted in creative focus groups settings and ethnographic notebooks. As Creswell (2009) explains, this mixed methods approach is crucial for a comprehensive understanding of complex issues in human sciences, providing richer and more nuanced insights than single-method approaches [13].

This study aims to gather data from a wide-ranging cohort in various French schools, covering both more and less advantaged secondary schools, focusing on four different types of physical activity. Accelerometers will be used to measure MVPA in both girls and boys during a two-hour mandatory PE class. Simultaneously, focus groups will delve into the factors influencing girls' participation in PE.

Special attention has been paid to gender and socio-demographic parity to ensure an unbiased representation in PA distribution, in line with Slootmaker et al. (2009). The inclusion criteria include students from years 7 to 9 in lower-secondary schools in France, who consent to wear an accelerometer for an entire PE lesson. Along with PA data, sociodemographic information, such as age, sex, height, weight, email address, and phone number, will be collected, offering participants the option to withhold any of this information. Written consent will be obtained from all participants and their parents or caregivers prior to participation. Data collection is scheduled from April to June 2024 to minimize seasonal variations, adhering to the Declaration of Helsinki (2013) guidelines, with the study's ethical approval granted by the Ethics Committee of XXX University in July 2023.

**Participants**

The study focuses exclusively on students enrolled in junior high school (“collège” in France), covering grades 7 to 9. Formal authorization and a detailed explanation of the protocol will be obtained from inspectors, school principals, teachers, parents, and students.

A power analysis, conducted using G\*Power software, determined the required sample size for testing our hypotheses with an alpha level of 0.05 and a power level of 0.8. This analysis, set within a factorial design, considers three variables: gender (male/female), learning field (1, 2, 3, 4), and socio-economic background (deprived, average, affluent), creating a total of 24 groups. The results indicate that a sample of 1000 participants is needed to detect a small effect size (F=0.15), while 372 participants are sufficient for a medium effect size (F=0.25). Given that the average class size is about 30 students, our study's design efficiently includes one class per learning field for each socio-economic status category, adequately detecting medium-sized effects.

Site selection targets public secondary schools in the XXX and XXX regions of France to achieve a geographically and socio-economically diverse sample. Schools are classified based on the Indicator of Social Position (IPS), as defined by the French Ministry of Education, with an IPS below 80 indicating disadvantaged schools, between 80 and 119 as average, and above 120 as advantaged. This stratification enables a thorough analysis across different socio-economic educational environments.

The quantitative protocol includes all volunteer students from XXX’s secondary schools, aged 11 to 15, who have parental authorization. Exclusions apply to sports section classes and students from special needs classes. The qualitative protocol is restricted to volunteer girls from the classes selected for accelerometer testing. This approach ensures a focused examination of the factors influencing PA among junior high school students across varied socio-demographic backgrounds.

**Quantitative protocol**

***Description of the protocol***

The aim of this quantitative analysis is to measure the potential disparity in physical engagement levels between girls and boys during a two-hour PE class, and to evaluate the impact of various dependent variables, including the type of activity, socio-cultural level, and environment. PA levels are assessed using accelerometers to categorize the MVPA of students. This potential disparity in MVPA is analysed through the lens of the secondary school's socio-economic status (IPS) and the types of activities offered. The objective is to identify which variables exert the most significant influence on the observed gap.

***Data collection***

Before the study commences, we will collect personal data for each participant, including age, height, weight, and other socio-cultural information. This data collection serves two purposes: programming the accelerometer and defining the participant's characteristics. The study will be conducted during a regular 2-hour PE class. The research team will briefly introduce the study without disclosing its focus on gender differences in PA levels to prevent potential bias. Students will then be equipped with ActiGraph accelerometers, model GT3X+ (ActiGraph™, Pensacola, FL, USA), which will be set to a 30Hz sampling rate and worn on the preferred hip using an elastic belt for the duration of the PE lesson. Data will be processed in 10-second epochs, and Troiano’s (2007) wear-time validation algorithm will be applied to ensure accuracy. For children, intensity level cut-offs will be determined using Evenson’s (2008) ActiGraph output, while Freedson’s (1998) calibration will be used to establish cutpoints for young adults.

***Data analysis***

The statistical analysis of our study will employ a three-way ANOVA to assess the impact of gender (male, female), type of activity (with four levels: 1, 2, 3, 4), and the socio-cultural background of schools (categorized as deprived, average, affluent) on our dependent variable. We will use parametric or non-parametric statistics based on the data's normality and homogeneity of variances. The significance level is set at α < 0.05. To measure the effect size of each factor and their interactions, we will calculate partial eta-squared values, indicating the proportion of variance in the dependent variable each factor explains. Tukey's post-hoc analysis will then be conducted to pinpoint specific differences between factor levels and explore their interactions, enhancing the thoroughness and robustness of our findings.

**Qualitative protocol**

***Description of the protocol***

The protocol is divided into two specific phases. The first phase consists in an ethnographic observation, which aims at characterizing the interactions between boys, girls, and the teacher during the lesson. The second phase consists of a focus group of 6 to 8 girls (from highly engaged to almost disengaged in PE) which aims to gather more detailed data by listening to the girls' voice about their feelings in PE on the topic of engagement.

***Ethnographic observation***

The purpose of this non-participant observational phase is to analyse student engagement in PE on physical, psychological/emotional, social, and cognitive levels, and to determine how gender influences these observations. The ethnographic notebook is organized in four parts.

First, the observers have to briefly describe the context of the observation moment by filling in the following information: date, place of observation, description of the environment (the academic level, the specific class, the characteristics of the teacher), the participant, the course of the session (start and end time of the sessions, the proposed PA and the sequence of the session, the planned activities for the PE session) and the general observation (general aspects of the class, the ambience, the organisation and any notable elements (location of the session, spatial arrangement, lighting, noise, presence of other classes).

Secondly, throughout the PE lesson, the observer must pay attention to specific observations of the areas of engagement by trying to answer the following questions. Who participates most actively? How do boys and girls participate? Which types of activities are more interesting for boys and girls? Are there differences in enthusiasm? How do pupils interact with each other during the session? (avoidance, separate or mixed groups, differentiated spaces, contact, laughter) Are there specific group dynamics based on gender?

Thirdly, the observers conduct a short interview with the teacher, asking the following questions: In general, do boys and girls participate equally in PE? Was this the case in this lesson? Should different approaches be used to motivate boys and girls? If there is a difference, how do you deal with it? If there is a difference in engagement between boys and girls, what do you think is the reason? Does the school environment seem conducive to girls' participation?

Finally, the observers should write down their personal reflections (personal impressions, emerging questions, and any preliminary ideas about what they have observed, details or anecdotes related to the session or the behaviour of boys and girls) and preliminary conclusions about what factors seem to explain the differences in engagement between boys and girls.

***Creative focus group***

We are set to conduct a 30-minute creative focus group [14] with 6 to 8 female participants after the PE lesson (more than an hour, less than a week). The central aim is to explore their relationship with PA, specifically focusing on their reasons for either participating in or abstaining from certain PE lessons. This qualitative inquiry is designed to identify both motivational and inhibitory factors affecting their involvement in PA. An innovative aspect of our methodology involves a creative exercise where participants will express their thoughts artistically by drawing a flower, with each petal representing factors that either attract them to or deter them from physical activities. This exercise is intended to facilitate a deeper, more expressive understanding of the participants' perspectives. The focus group will be facilitated by a researcher responsible for leading the discussions, ensuring a productive and engaging conversation. Meanwhile, another researcher will be tasked with accurately recording the interview and managing the time effectively. This dual approach in managing the focus group is designed to ensure a comprehensive capture of insights while maintaining the flow and structure of the session. Through this creative and participatory approach, our study aims to add valuable insights to the literature on female engagement in PE and activities.

We decided to use focus groups to gather more specific data on individual, interpersonal and environmental systems. The aim is to collect information on the following topics: relationship to the body, engagement in PE, representation of PA, relationship to effort and PA, relationship to teachers, interaction between girls and boys, and the pedagogical content of the lesson.

***Data collection***

Each focus group lasts 30 minutes and involves 6-8 girls. After an introduction to the round table, the facilitator asks seven different questions, ranging from general to more specific topics.

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| **Table 1**  *List of the questions* | |
| Q1 | Firstly, can you take turns introducing yourselves: first name, age, physical activity, or hobby outside PE and say who you do it with (family, friend, alone)? |
| Q2 | What does commitment to PE mean to you in three words? |
| Q3 | Does your level of commitment vary depending on the activity? Can you see a PA example under the different levels of commitment? |
| Q4 | Had you already done activity X outside PE? If so, did it enable you to be more involved in PE? |
| Q5 | What exercises did you enjoy and what motivated you to take part in the "X" lesson? |
| Q6 | Do the relationships you have with each other in the class influence your level of commitment to this "X activity" course? |
| Q7 | Do other people's opinions affect your involvement in this activity, and in what way? |
| Q8 | Free questions, specific to the class, after the observation in relation to a theme that emerges in the ethnographic notebook. |

The focus group session will be comprehensively audio-recorded, while the second researcher diligently documents key aspects. This includes noting down the names of the participants as they speak, observing and recording their non-verbal interactions, and capturing the general ambiance of the group.

The verbatim of the focus group is done in two phases, a first transcription with a computer program and a second phase to complete and add details manually. The verbatim is a raw transcription of the girl's interaction, considering the silences, repetitions, or hesitations during the verbal exchange.

***Data analysis***

Subsequently, the findings from both the ethnographic observations and the focus group will be juxtaposed for a comparative analysis. This process aims to scrutinize and understand the correlation between the observer's interpretations and the perspectives shared by the pupils, thereby ensuring a holistic understanding of the dynamics at play.

The focus group analyses will be conducted using a semi-open coding method, drawing on the reflexive exploration of coding techniques outlined by Blair (2015) [12]. The data analysis will proceed in three steps: open coding, categorization, and the creation of an analysis grid.

In the open coding phase, we will employ the initial stage of the grounded theory methodology as described by Strauss and Corbin (1998, as cited by Blair), utilizing emergent codes from the verbatim [12]. Our approach is to code concepts rather than individual words or lines, allowing for a broader spectrum of interpretation. All elements of the verbatim will be coded, excluding interactions related to the organization of the creative activity. If it enhances our understanding of the participants' perspectives, a concept may be assigned to two different codes.

For categorization, we will use a template coding methodology, defining *a priori* eight categories: relationship with the body, engagement in PE, representation of sporting activities, relationship with effort, relationship with PA, relationship with the teacher, interactions between girls and boys, and teaching content. These categories aim to capture all necessary information to address our research question and hypotheses. They are informed by Bauman's ecological model, which serves as our theoretical framework [11]. The objective here is to assign each code to a specific category, with each code being assignable to only one category.

Finally, to develop our analysis grid, each category will be aligned with one of Bauman's five systems, offering a comprehensive view of the verbatim in the context of our theoretical framework. This step aims to provide a holistic understanding of the girls' perspectives. Information from the ethnographic notebook will also be incorporated into the final analysis grid. The grid is designed to identify which systems most significantly influence girls' engagement or disengagement in PE.

**Declaration of interest**

The authors report no conflict of interest.

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