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Influence of School Environment on Children's Motivation and Physical Activity Behaviour: A Structural Equation Modeling Approach

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ABSTRACT

This study examines how the school environment, encompassing both physical and social dimensions, affects children's motivation and physical activity (PA) behaviour. Using a cross-sectional design, data were collected from 347 inactive children aged 9–12 years enrolled in public and private schools in South Punjab, Pakistan. Structural Equation Modeling (PLS-SEM) was employed to test the hypothesized relationships among the school environment, motivation, and PA behaviour. Findings revealed that a supportive school environment significantly enhances both motivation and physical activity levels. Motivation was also found to mediate the relationship between the school environment and PA, although an unexpected negative association between motivation and PA suggests the influence of controlled rather than autonomous motives among inactive children. The results underscore the importance of integrating physical infrastructure improvements with socially supportive, autonomy-enhancing teaching practices. Comprehensive, needs-supportive environments can foster intrinsic motivation and promote sustainable participation in physical activity. The study contributes to the growing evidence that school environments play a critical role in shaping children's health-related behaviours and offers practical implications for educators and policymakers.

Highlights

1.The study examines how school environments influence children's motivation and physical activity.
2. Supportive school settings improved both motivation and activity levels.
3. Motivation mediated this link but showed a negative, controlled influence.
4. Enhancing physical and social support can build intrinsic motivation and lasting activity habits.

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1. Introduction

Schools are central environments for shaping children's physical activity (PA) behaviour and motivation. Contemporary research has moved beyond individual-level determinants, emphasizing how contextual and environmental factors within schools foster or constrain children's engagement in movement. The school environment encompasses both physical and social dimensions that jointly influence behaviour, motivation, and well-being (Shamsuddin, & Raza, 2025). Recent studies have shown that supportive, well-designed physical settings and positive social climates are powerful levers for promoting active lifestyles among children (Terrón-Pérez et al., 2021; Leung, 2025; Izadi & Hart, 2024).

In the last five years, investigations into the physical environment have advanced considerably. Early studies largely quantified the number of facilities or size of playgrounds, whereas current work emphasizes quality, accessibility, and aesthetic diversity. Terrón-Pérez et al. (2021) demonstrated that the diversity of playground design and maintenance quality, rather than mere facility availability, predicted higher PA levels among preschoolers. Leung (2025) developed a validated instrument measuring school PA environments, confirming that accessibility and spatial

usability strongly influence engagement. Similarly, Sánchez García et al. (2025) reported that designated activity zones and portable equipment substantially increase children's active play. Together, these findings indicate that the physical environment acts as a structural enabler of activity by providing varied, stimulating, and safe spaces that invite participation (Shakarami et al., 2024).

Concurrently, research on the social environment highlights the importance of psychological and relational factors within schools. Teacher behaviours, peer relationships, and institutional norms have been identified as pivotal influences on children's motivation to engage in PA (Moon & Lee, 2025; Rafiq et al., 2022). Grounded in Self-Determination Theory (Ryan & Deci, 2024; Godspower, 2024), recent studies show that when teachers support students' needs for autonomy, competence, and relatedness—by offering meaningful choices, positive feedback, and inclusive peer interactions—children develop stronger intrinsic motivation to be active (Yu et al., 2022; Andrews et al., 2021; Leuzzi et al., 2025). The school's social climate thus functions as a motivational ecosystem: one that can either reinforce active engagement or foster disengagement, particularly among inactive or low-confidence students (Deng et al., 2025; Kahil, 2025; Jam et al., 2025).

Importantly, evidence now converges on the interaction between physical and social components. Research indicates that environmental interventions are most effective when combined with motivational or pedagogical strategies (Henning et al., 2022; Liu et al., 2023; Ahmed, & Nihei, 2024). For example, improving facilities without teacher facilitation yields limited behavioural change, whereas integrating teacher-led support and peer collaboration amplifies the effects of physical upgrades (Nascimento et al., 2022; Essabir, & Ait Nasser, 2024). This multidimensional perspective positions the school environment as a composite construct—one in which material conditions and social dynamics operate synergistically to shape motivation and behaviour (Baafi, 2020; Imran, 2024; Tago et al, 2024).

Despite this progress, knowledge gaps remain regarding how these environmental dimensions interact to influence motivation and, in turn, physical activity behaviour in inactive children—a population particularly resistant to conventional interventions. Much of the existing evidence is drawn from Western or high-resource contexts, with limited application to developing regions such as South Asia, where disparities in infrastructure, policy, and pedagogy are pronounced. Moreover, few studies have empirically tested the mediating role of motivation in the relationship between school environment and PA behaviour using robust statistical modelling.

This study addresses these gaps by employing Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine how the physical and social features of school environments influence children's motivation and physical activity behaviour in South Punjab, Pakistan. Specifically, it aims to determine whether motivation mediates the relationship between the school environment and PA, providing an integrated, context-sensitive understanding of how school-based factors can activate and sustain physical engagement among inactive children.

2. Research Methodology

This study had a cross-sectional strategy and quantitative orientation to examine the links between different variables and physical outcomes. The study's population included 347 inactive school children aged 9-12 years old selected from the School Education Department of South Punjab, Pakistan, and the population were selected using a stratified random sampling method to adequately represent the differing sizes/source populations of schools in the province. This procedure allowed for the population to be separated into different strata (e.g., district, type of school, rural vs. urban, public vs. private) in which participants could then be randomly sampled. It was believed that a stratified sample is a necessary method for enhancing the representativeness of and generalizability of the results of the study's findings.

2.1 Conceptual Framework

The conceptual framework consists of three main variables: the independent variable (school environment), the mediating variable (motivation) (Liu et al., 2023), and the dependent variable (physical activity behavior). The school environment is treated as a higher-order construct comprising two sub-components: physical and social environments. Conceptual framework of the study is presented in Fig. 1.

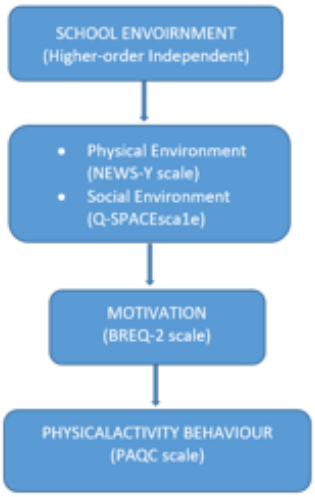

Fig 1 Conceptual Framework

2.2 Data Collection

The following criteria were used to select the participants: At least eighteen years old; currently participating in any organised sport; and being consistent with a specific geographical area were the first three criteria. To determine the

minimum sample size, an online power analysis tool was used to calculate a minimum of 110 to ensure enough statistical power of partial least squares structural equation modelling (PLS-SEM) analysis as proposed by Hair et al. (2024). Specifically, the study selects a sample of 347 inactive school children aged 9-12 years of the School Education Department, South Punjab, Pakistan. This research utilized Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze the data, for a number of important reasons that directly relate to the design of the study and the data characteristics. First, PLS-SEM is a predictive, variance-based approach to data modelling that is well-suited to exploratory research and theory development, which is consistent with the purpose of this research of exploring a complex, under-researched relationship contextualized to Pakistan.

2.3 Variables and Measurement Tools

This study examined three main constructs: the school environment, motivation for physical activity, and physical activity behaviour. Each construct was measured using established, validated instruments to ensure reliability and comparability.

2.3.1 School environment

The school environment served as the independent variable and was conceptualized as a higher-order construct comprising physical and social dimensions. The physical environment captured tangible features such as facilities, equipment, and play spaces, and was assessed using the Adapted Neighborhood Environment Walkability Scale for Youth (NEWS-Y). The social environment, reflecting teacher support, peer interaction, and overall school climate, was measured with the Questionnaire on School Physical Activity Climate and Environment (Q-SPACE). These two dimensions together represent how material and interpersonal factors shape opportunities for student engagement in physical activity.

2.3.2 Mediating variable

The mediating variable, motivation for physical activity, was measured through the Behavioral Regulation in Exercise Questionnaire–2 (BREQ-2), adapted for school-aged children. Grounded in Self-Determination Theory, this instrument distinguishes between intrinsic and extrinsic forms of motivation, allowing for a nuanced understanding of why children choose to be active.

2.3.3 Dependent variable

The dependent variable, physical activity behaviour, was assessed using the Physical Activity Questionnaire for Children (PAQ-C), which captures general activity levels across the previous week. Together, these tools provided a comprehensive basis for testing the hypothesized relationships among environmental, motivational, and behavioural factors.

2.3 Data analysis

This study employed the SmartPLS tool for SEM, since it allows scholars to view relationships between variables simultaneously. In terms of the PLS-SEM method, PLS-SEM was selected because (i) it allows for unlimited use of individual items and (ii) it is meant to estimate an empirical framework from a test standpoint about measurement by modeling about the main endogenous factor (Hair et al., 2024). The framework was empirically tested following a two-step procedure. First, confirmatory factor analysis (CFA) was used to evaluate the measurement model. Next, after identifying a suitable measurement model, the structural model was assessed. To understand the regression results appropriately, multi-collinearity with variance inflation factor (VIF) estimates was examined clearly before testing the structural model (Hair et al., 2024). However, when using PLS-SEM, great care before/after the study when using and reporting on the model fit because the base threshold values are not completely known since the suggested thresholds are still initial (Hair et al., 2024).

3. Results and Discussion

3.1 Assessment of measurement model

The validity and reliability of the data are evaluated using the measurement model to see if the research instruments satisfy the requirements for high-quality data (Hair et al., 2024). It is clear from the examination of the outer model coefficients that the concepts and research model must pass the measurement model's purification step in order to be tested in a predictive relational and causal model. The construct validity and instrument reliability are tested using the measurement model, also known as the outer model. A validity testing is used to characterize how closely an instrument is connected to or capable of measuring the things it is designed to measure. If the collected data and the actual data that occurs in the research object are consistent, the study is deemed successful.

The measurement of the degree of correlation between variables and indicators is known as convergent validity. In this case, if the loading factor is more than 0.6, the indicator is regarded as a legitimate measure of its variable (Hair et al., 2024). To make sure respondents comprehend the statements on the questionnaire, validity testing is employed. According to a different viewpoint, loading factor values between 0.50 and 0.60 and Average Variance Extracted (AVE) >0.50 are indicative of appropriate validity. The reliability of the questionnaire is explained by the Average Variance Extracted (AVE), which is deemed reliable if its value is higher than 0.5. When a set of indicators reflects a hidden variable and captures its fundamental features, it is said to have convergent validity. A reliability test called Cronbach's Alpha is used to support composite reliability results. If a variable's Cronbach's Alpha value is higher than 0.7, it is regarded as dependable.

Table 2 Validity, Reliability and AVE

Construct	Cronbach Alpha	Composite Reliability	AVE
School Environment	0.876	0.954	0.619
Physical Environment	0.764	0.894	0.542
Social Environment	0.801	0.832	0.510
Motivation	0.843	0.987	0.621
Physical Activity Behaviour	0.856	0.914	0.544

3.2 Discriminant validity

Cross-loading measures between indicators and their constructs is used to assess the validity of a measurement model called discriminant validity, which employs reflective indicators. The measurement block is superior to the others if the correlation between the constructs and measurement indicators is greater than the correlation with other constructs. Comparing the average variance extracted (AVE) square root values is another way to evaluate discriminant validity (Hair et al., 2024).

Table 3: Discriminant validity

	1	2	3	4	5
Physical Activity Behaviour	0.832				
Motivation	0.609	0.816			
Physical Environment	0.497	0.749	0.798		
Social Environment	0.654	0.715	0.734	0.776	
School Environment	0.578	0.598	0.687	0.711	0.754

3.3 Assessment of R-Square, Effect Size and Model Fit

The structural model results suggest strong predictive capability and good overall fit (Amini et al., 2019; Hair et al., 2024). The Physical Activity Behaviour represents an R-square value of 0.653; therefore the model's predictors account for a significant 65.3% of variance, which shows a very strong effect. In addition, Motivation has an R-square value of 0.409 meaning the school environment explains a significant 40.9% of variance. Effect sizes that support the practical significance of the paths with values of 0.293 and 0.348, both are large effect sizes indicating a significant effect. Finally, a Standardized Root Mean Square Residual (SRMR) value of 0.075 is below the recommended cut-off of 0.08, it provides confidence in the model fit because the observed correlations are only slightly different from the predicted correlations.

Table 4: R-Square, Effect Size and Model Fit

variables	R-Square	F-Square	**SRMR**
Physical Activity Behaviour	0.653	0.293	0.075
Motivation	0.409	0.348	

3.4 Structural Model

As per the recommended indicators, we next examined the structural model using the bootstrapping procedure and he 5,000 subsamples using SmartPLS 3.3.3 software (Hair et al., 2024). The t-statistic values from the estimation of path coefficients are used to evaluate the strength of the influence among variables, and to evaluate the strength of the relationship among the directions of those same variables. The findings shows that school environment has direct significant impact on physical activity behaviour (T=2.102, P=0.036). Also, school environment has direct significant impact on motivation (T=45.066, P=0.000). Furthermore, motivation has direct significant and negative impact on physical activity behaviour (T=7.890, P=0.000). This unexpected finding of a negative relationship between motivation and physical activity (PA) necessitates a careful and critical discussion, as it is contradictory to generally accepted theories of motivation like Self-Determination Theory. This unexpected finding may not suggest shortcomings in the fundamentally sound theory, but may reflect nuances when applying the theory; for example, the relations may be more complex when considering the context in which it is used (and in this case study). One such nuance could be a measurement-related issue in which the measures did not distinguish between intrinsic motivation (instead of just participating in PA for enjoyment) and extrinsic motivation. In an inactive population, it is possible that a high amount of externally-driven motivation could not translate into a high amount of sustained PA. Instead, it may induce an experience of pressure to comply with external motivation to engage in PA from attitudes that result in resentment and potentially negative relationships with physical activity.

However, motivation mediates the relationship among school environment and physical activity behaviour (T=2.071, P=0.039). Physical (T=27.776, P=0.000) and social environments (T=32.418, P=0.000) jointly contribute to the school environment.

Table 5: Assessment of Structural Model

Hypothesis	Path Coefficient	Mean	SD	T Statistics	P Values
H1: School Environment -> Physical Activity Behaviour	-0.201	-0.195	0.096	2.102	0.036
H2: School Environment -> Motivation	0.825	0.825	0.018	45.066	0.000
H3: Motivation -> Physical Activity Behaviour	-0.558	-0.565	0.071	7.890	0.000
H4: Motivation* School Environment -> Physical Activity Behaviour	-0.109	-0.106	0.053	2.071	0.039
H5a: Physical Environment -> School Environment	0.541	0.542	0.019	27.776	0.000
H5b: Social Environment -> School Environment	0.530	0.529	0.016	32.418	0.000

Findings of this study reinforce the central role of the school environment in shaping children's health behaviours. The direct, significant, and positive association between the school environment and physical activity (PA) behaviour coheres with the socio-ecological model's claim that behaviour is embedded within nested contexts, including the school microsystem, and aligns with evidence that supportive, well-resourced physical and social settings are associated with higher student PA (Terrón-Pérez et al., 2021; Özbay et al., 2025; Riani, 2024). Although some studies have reported weaker or indirect associations, the present pattern indicates that the school environment can itself function as a strong situational lever for PA. This points toward interventions and policies that explicitly target environmental conditions, not only individual dispositions ,to enable and sustain students' engagement in PA.

The strong, direct influence of school context and climate on student motivation also fits a substantial literature base. When a school's social climate promotes positive values, peer collaboration, and a sense of relatedness, students are more likely to internalize reasons to be active; when the physical environment is structured, adequately resourced, and predictable, students experience competence because learning tasks are manageable and progression is visible (Moon & Lee, 2025; Alwan et al., 2024). Our data support this rationale and suggest the school should be understood as a dynamic system, rather than a passive backdrop: contextual features appear to contribute directly to the motivational profiles observed here. Where previous work often focused on individual predictors, these results highlight that addressing context at the system level is a plausible and efficient route to raising motivation across an entire school or cohort.

Aligned with Self-Determination Theory, children's internal motivation is generally a substantial predictor of PA. Intrinsic motives ,enjoyment, challenge, and satisfaction are repeatedly linked to sustained participation (Thompson et al., 2020). At the same time, our sample exhibited a counter-intuitive negative association between motivation and PA in this cross-section. One interpretation is that elevated motivation scores among inactive children may reflect a predominance of controlled, obligation-based regulation (e.g., pressure or guilt), which can produce short-term compliance followed by disengagement or burnout (Mak, 2021; Moschogianni, 2025). This underscores the need to distinguish motivational quality (autonomous vs. controlled) rather than treating motivation as a unitary dose. Crucially, motivation significantly mediated the link between the school environment and PA, clarifying a mechanism by which supportive physical and social environments such as well-equipped spaces and encouraging teachers, translate into behaviour (Henning et al., 2022; Lotfinezhad, & Tahmasebpoor, 2025). Effective intervention, therefore, requires more than creating opportunities: it must intentionally cultivate an environment that nurtures and sustains higher-quality motivation.

The results also affirm that "school environment" is multidimensional, comprising distinct yet interconnected physical and social components. This operationalization mirrors prior research that treats the environment through both lenses (Bielec and Omelan, 2022; Rafiq et al., 2022). The physical dimension facilities, maintenance, equipment, and safe access, sets the baseline for participation, but it is insufficient on its own to sustain PA. A complementary social climate ,norms of inclusion, warm teacher&student relationships, peer support, and fair participation structures, is needed to activate and maintain behaviour. Consistent with the literature, our data support addressing these dimensions in an integrated fashion when seeking to build or protect children's health-related behaviours.

Theoretically, two implications follow, First, the strong and independent contributions of physical and social components to the higher-order environment construct argue against treating "school environment" as a singular variable. Tangible (physical) and intangible (social) features must be measured, resourced, and improved together; neglecting either weakens the overall effect. Second, the overall environment → motivation → behaviour linkage provides a coherent pathway connecting context to outcomes. Rather than merely documenting a direct environment–behaviour path, our findings indicate that a positive environment elevates motivation, which in turn relates to PA (Ryan & Deci, 2024; Thompson et al., 2020; Ndagijimana et al., 2024). Although the motivation to PA path was negative in this snapshot likely reflecting controlled motives among inactive students, the mediated pattern still identifies motivation as the bridge from

environmental affordances to behaviour, and it signals where theory and practice should focus: on cultivating autonomous forms of regulation.

Professional development for teachers is a critical component of this process. Educators should be equipped to provide autonomy-supportive communication, design progressive and achievable challenges, offer formative, competence-building feedback, and promote peer collaboration and relatedness. These skills are as essential as ensuring that school spaces—classrooms, corridors, and playgrounds—are clean, safe, and well-equipped. The finding that motivation mediates the relationship between the school environment and physical activity behaviour highlights an essential design principle for health-promotion programs: schools must create environments that make physical activity desirable, doable, and meaningful, not merely available.

Curricular and teacher-education reforms are therefore urgent. Beyond sport-specific instruction or generic activity promotion, teacher professional learning should prioritize needs-supportive pedagogies that foster intrinsic motivation in children. These approaches include autonomy support (providing voice, options, and rationale), competence support (offering scaffolded progressions and constructive feedback), and relatedness support (encouraging warmth, inclusion, and peer connection). Curricula should move away from fixed, uniform structures toward flexible frameworks that provide multiple pathways into movement—such as incorporating yoga, hiking, or dance—so that a greater number of students can find activities that resonate personally and encourage sustained engagement. In this integrated model, the physical environment initiates participation, the social environment sustains engagement, and needs-supportive teaching transforms activity into habit.

Collectively, these implementation insights and research directions underscore that cultivating active, motivated students requires more than providing resources—it demands environments and pedagogies that empower children to find lasting joy and meaning in movement.

4. Conclusion

This study aimed to examine how the school environment—encompassing its physical and social dimensions—influences children's motivation and physical activity (PA) behaviour, and to determine whether motivation mediates this relationship among inactive school children in South Punjab, Pakistan. The main findings are as follow:

1. The school environment showed a strong positive association with both motivation and children's physical activity behaviour, confirming its critical role in promoting health-oriented engagement.
2. Motivation significantly mediated the relationship between the school environment and PA, indicating that supportive contexts enhance activity through motivational pathways.
3. A negative relationship between motivation and PA among inactive chi`ldren suggests that controlled, externally driven motives may not sustain participation, emphasizing the need to foster intrinsic motivation.
4. Comprehensive, environment-based approaches that integrate physical resources with autonomy-supportive and inclusive teaching practices offer effective strategies for activating and retaining inactive students.

This study is limited by its cross-sectional design, single-region sampling, and reliance on self-report measures, which restrict causal inference and generalizability. Future research should employ longitudinal and experimental or quasi-experimental designs with objective PA measures, disaggregate motivational sub-types, and use mixed methods to capture contextual nuance. Broader, multi-site samples and implementation-focused evaluations (including feasibility and cost-effectiveness) are needed to guide scalable, equitable school-based strategies.

Statements and Declarations

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Data availability

The data used in this research are provided in the text of the article.

Conflicts of interest

The author of this paper declared no conflict of interest regarding the authorship or publication of this paper.

Author contribution

Asia Bano: Design, Analysis, and Interpretation of data, Writing- Original draft preparation, Visualization; Sareena Hanim Hamzah: Conceptualization, Methodology, Eliza Hafiz: Analysis and Interpretation of data.

AI Use Declaration

This study did not incorporate artificial intelligence techniques; instead, all analyses and optimizations were conducted using conventional and widely accepted analytical methods. The language and presentation was improve using ChatGPT.

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