Assessing the impact of emotional and interpersonal intelligence, and physical performance on academic achievement in sports students

Evaluación del impacto de la inteligencia emocional e interpersonal, y del rendimiento físico, en el logro académico de los estudiantes de deporte

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Abstract

Introduction: The rationale for this study stems from the need to understand the non-cognitive factors associated with academic achievement among students in sports-related programs, as sports learning requires the integration of academic demands, social interaction, and physical readiness.
Objective: This study examined the effects of emotional intelligence, interpersonal intelligence, and physical performance on academic achievement, as well as the indirect effects of emotional intelligence through interpersonal intelligence and physical performance.
Methodology: An explanatory quantitative design was employed using path analysis within a Structural Equation Modeling framework based on cross-sectional data. The participants were 227 students from sports-related programs at several higher education institutions in Indonesia. The instruments consisted of Likert-scale measures of emotional intelligence, interpersonal intelligence, and physical performance, while academic achievement was measured using Grade Point Average. Instrument testing showed adequate construct validity and reliability. Data were collected through Google Forms using informed consent, screening questions, and response quality checks, then analyzed using SEM with bootstrapping to test direct and indirect effects.
Results: The results showed that emotional intelligence, interpersonal intelligence, and physical performance were all positively associated with academic achievement. Emotional intelligence was also strongly associated with interpersonal intelligence and physical performance, and its indirect effects on academic achievement through both mediators were significant.
Discussion: The novelty of this study lies in its integrated modeling of social and performance pathways linking emotional intelligence to academic achievement across multiple institutions.
Conclusions: Practically, the findings highlight the need for strategies that strengthen emotional regulation, interpersonal competence, and physical performance management to support academic success.

Keywords

Emotional intelligence; interpersonal intelligence; physical performance; academic achievement; sports students; path analysis.

Resumen

Introducción: La justificación de este estudio surge de la necesidad de comprender los factores no cognitivos asociados al rendimiento académico de los estudiantes de programas relacionados con el deporte, ya que el aprendizaje deportivo exige la integración de las demandas académicas, la interacción social y la preparación física.
Objetivo: Este estudio examinó los efectos de la inteligencia emocional, la inteligencia interpersonal y el rendimiento físico sobre el rendimiento académico, así como los efectos indirectos de la inteligencia emocional a través de la inteligencia interpersonal y del rendimiento físico.
Metodología: Se empleó un diseño cuantitativo explicativo mediante análisis de trayectorias dentro del marco de Modelos de Ecuaciones Estructurales, basado en datos transversales. Los participantes fueron 227 estudiantes de programas relacionados con el deporte procedentes de varias instituciones de educación superior en Indonesia. Los instrumentos consistieron en escalas tipo Likert para medir la inteligencia emocional, la inteligencia interpersonal y el rendimiento físico, mientras que el rendimiento académico se evaluó mediante el promedio de calificaciones. La evaluación de los instrumentos mostró una validez de constructo y una fiabilidad adecuadas. Los datos se recopilaron a través de Google Forms, utilizando consentimiento informado, preguntas de selección y controles de calidad de las respuestas, y posteriormente se analizaron mediante Modelos de Ecuaciones Estructurales con bootstrapping para examinar los efectos directos e indirectos.
Resultados: Los resultados mostraron que la inteligencia emocional, la inteligencia interpersonal y el rendimiento físico se asociaron positivamente con el rendimiento académico. La inteligencia emocional también se asoció fuertemente con la inteligencia interpersonal y el rendimiento físico, y sus efectos indirectos sobre el rendimiento académico a través de ambos mediadores fueron significativos.
Discusión: La novedad de este estudio radica en su modelización integrada de las trayectorias sociales y de rendimiento que vinculan la inteligencia emocional con el rendimiento académico en múltiples instituciones.
Conclusiones: En términos prácticos, los hallazgos resaltan la necesidad de estrategias que fortalezcan la regulación emocional, la competencia interpersonal y la gestión del rendimiento físico para apoyar el éxito académico.

Palabras clave

Inteligencia emocional; inteligencia interpersonal; rendimiento físico; rendimiento académico; estudiantes de deporte; análisis de trayectorias.

Introduction

Students in sports-related programs across many countries face complex demands (Della Corte et al., 2025; Liu et al., 2021; Mercader-Rubio et al., 2023). They are required to maintain physical performance, meet academic targets, and remain competitive in team selection processes or sporting competitions (De Aguiar Antunes et al., 2025). Intensive training schedules often conflict with coursework, practicums, and academic evaluations (Jankvist et al., 2020). These pressures may trigger fatigue, reduced learning focus, and poorer physical recovery (Saha et al., 2025). Many sports programs also require teamwork, leadership, and intensive social interaction in both training settings and classroom projects (Rubio et al., 2022; Sharma, 2019). In this context, psychological and social factors become critical determinants, particularly emotional intelligence.

Emotional intelligence is both a pragmatic quality and a concept grounded in robust theoretical frameworks within educational and psychological research (López et al., 2021). Emotional intelligence generally denotes the ability to recognize, comprehend, manage, and utilize emotions to facilitate adaptive behavior and achieve objectives (Rubio et al., 2022). This concept has been extensively examined within prominent theoretical frameworks, especially those that regard emotional intelligence as a collection of emotional-processing skills pertinent to decision-making, self-regulation, and social adaption. In higher education, emotional intelligence is crucial as students must not only excel in academic material but also effectively handle stress, demonstrate perseverance, and respond constructively to both academic and non-academic problems.

Emotional intelligence plays an important role when students regulate their emotions under the pressure of training, competition, and academic assessment (Acebes-Sánchez et al., 2021; López et al., 2021; Lorca et al., 2023). Students who struggle to manage their emotions tend to experience higher levels of stress, become more easily frustrated after failure, and find it more difficult to maintain academic discipline (Fernández-Espínola & Almagro, 2019). Weak emotion regulation may also reduce the quality of decision-making, for example when students must prioritize between training and academic tasks. By contrast, self-awareness and the ability to regulate emotions help students sustain long-term routines and recover motivation after poor performance (Swidan & Fried, 2021). However, the development of emotional intelligence is often not treated as an explicit focus within sports curricula (Kamaruddin et al., 2025). This gap raises questions about the social factor that may operate alongside emotional intelligence, namely interpersonal intelligence.

Interpersonal intelligence necessitates a more defined conceptual foundation. Interpersonal intelligence encompasses the capacity to comprehend others' goals, emotions, and reactions, and to engage effectively in social interactions (Liu et al., 2021; Marheni et al., 2024). This construct is manifested in educational settings through the quality of communication, responsiveness to feedback, collaboration, empathy, and the capacity to cultivate constructive relationships. In sports programs, where participation frequently relies on collaboration and trust, interpersonal intelligence may influence both learning engagement and performance in practical tasks.

Interpersonal intelligence is important because the sports context depends heavily on coordination, communication, and trust within teams. Students with low interpersonal skills often experience conflict, miscommunication, or difficulty accepting feedback from coaches and peers (Abbeduto et al., 2019; Ghanizadeh, 2017). These barriers may disrupt training processes, weaken their sense of belonging to the team, and reduce engagement in group-based academic activities (Sevinc & Lesh, 2017). In sports classes, practical tasks and projects often assess collaboration, meaning that interpersonal problems can directly affect academic evaluation (Liu et al., 2021; Marheni et al., 2024). In addition, poor relationships with coaches or lecturers may limit students' access to guidance and academic support (Della Corte et al., 2025). Because social relationships in sports are highly intensive, this aspect also needs to be examined alongside the most visible factor, namely physical performance.

Physical performance should be regarded not solely as athletic ability, but as a functional state that facilitates participation, endurance, and sustained performance in physically challenging educational settings (López et al., 2021). In sports education, physical performance is intrinsically connected to the capacity to participate in practical courses, fulfill training requirements, and achieve assessment criteria

related to physical proficiency (Fernández-Espínola & Almagro, 2019). This renders physical performance a context-dependent predictor that contrasts with the determinants typically highlighted in non-sport academic environments.

Physical performance forms a foundational aspect of the role of students in sports-related programs, as many practical assessments require physical fitness, motor skills, and consistent performance (De Aguiar Antunes et al., 2025; Fernández-Espínola & Almagro, 2019). Declines in endurance, strength, or coordination may limit participation in training and reduce practical performance outcomes. Recurrent physical fatigue may also impair sleep quality, disrupt concentration, and slow information processing during learning (Saha et al., 2025). These problems often arise when training loads increase without adequate recovery management (Campos et al., 2022). At the same time, strong physical ability does not automatically lead to high academic achievement if students fail to manage their emotions and social relationships effectively (Miguel et al., 2020; Rogowska et al., 2022). This condition points to the need to examine how these three aspects are associated with academic achievement.

In this framework, academic accomplishment should be regarded as a multifaceted consequence. It is influenced not only by cognitive ability but also by students' emotional self-regulation, social and collaborative functioning, and adequate physical preparedness for rigorous academic and practical endeavors (Folgado dos Santos et al., 2020). This viewpoint endorses the notion that academic success in sports-related programs is more effectively elucidated by an integrated model than by discrete predictors.

Academic achievement among students in sports-related programs is typically influenced not only by cognitive ability, but also by affective, social, and physical factors (Kamaruddin et al., 2025; Stoffelsma & Spooren, 2018). Emotional intelligence may help students maintain focus, cope with examination stress, and sustain effective study habits (Bueno et al., 2021). Interpersonal intelligence may strengthen the quality of group work, communication during practical activities, and the ability to receive instructions and feedback (Marheni et al., 2024). Physical performance may support success in practical tasks and reduce disruptions to learning caused by fatigue or injury (Folgado dos Santos et al., 2020; Miguel et al., 2020; Rogowska et al., 2022). When these three factors interact, their impact may take the form of both direct and indirect effects on academic achievement (Folgado dos Santos et al., 2020). Therefore, a model capable of capturing simultaneous pathways of influence is highly relevant, and this leads to the issue of the research gap.

Despite previous research on emotional intelligence, interpersonal dynamics, and physical health concerning educational or performance results, the literature is still fragmented in at least three respects. Many studies primarily examine a single predictor, complicating the comprehension of the interplay among various variables. Secondly, a significant portion of the current research in sports contexts prioritizes physical or psychological performance over academic attainment. Third, insufficient attention has been afforded to the potential that these variables may affect success via both direct and indirect paths within a singular explanatory model. The existing constraints suggest that the current literature has not sufficiently elucidated the relational dynamics among emotional intelligence, interpersonal intelligence, physical performance, and academic achievement in sports-related programs.

This study offers novelty by testing an integrated model that positions emotional intelligence, interpersonal intelligence, and physical performance as predictors of academic achievement within a single framework. Path analysis enables the mapping of both direct and indirect effects, making the findings more operationally useful for intervention. Its theoretical contribution lies in clarifying the relational structure among these constructs in the context of sports education, rather than merely within the context of competitive performance. Its practical contribution is to provide a data-based foundation for student development strategies, such as emotion regulation programs, team communication training, and training load management aligned with academic targets. In addition, this model may help lecturers and coaches align instructional strategies across practical and theoretical components. On this basis, the research questions need to be stated explicitly and in measurable terms.

This study is not merely an analysis of three distinct predictors; rather, it aims to evaluate an integrated explanatory framework based on the special contexts of sports education. The study's innovation resides in the integration of psychological, interpersonal, and physical dimensions into a singular analytical

model centered on academic achievement. This positioning enhances the study's contribution by directly addressing the deficiency of integrative evidence found in prior research.

Based on the foregoing discussion, this study formulates the main research problem as follows: how do emotional intelligence, interpersonal intelligence, and physical performance influence the academic achievement of students in sports-related programs? The next question addresses the pathways of influence, namely whether each variable has a direct effect on academic achievement. A further question examines the underlying mechanism, specifically whether there are indirect effects through the relationships among the constructs, in accordance with the proposed path model. The study also seeks to identify which variable makes the strongest contribution within the model, so that development priorities can be determined. These research questions guide the formulation of hypotheses, the selection of instruments, and the design of a consistent analytical framework. With this formulation, the introduction can be structured to flow from the global context to specific research needs.

Method

Settings

This study employed an explanatory quantitative design using path analysis within a Structural Equation Modeling (SEM) framework to examine the theoretically specified relationships among the variables. This design was selected because the study aimed to estimate the direct and indirect effects of emotional intelligence, interpersonal intelligence, and physical performance on academic achievement within a single integrated model. SEM was considered more appropriate than separate regression analyses because it allows the simultaneous testing of multiple pathways and facilitates comparisons of the relative strength of effects among predictors through path coefficients. Data were collected at a single point in time; therefore, the study used a cross-sectional design, and the interpretation of the findings was directed toward the extent to which the observed pattern of relationships fit the proposed theoretical model. SEM was also selected because emotional intelligence and interpersonal intelligence were treated as latent constructs, meaning that the quality of their measurement needed to be verified through the measurement model before testing the structural model. Accordingly, the analysis began with an evaluation of construct validity and reliability, followed by structural model testing to examine the hypothesized pathways. The directions of the paths were specified on the basis of educational psychology theory and the characteristics of sports learning, which require emotion regulation, social interaction, and physical readiness in both theoretical and practical academic activities. Gender and geographical background were considered descriptive features of participants and were excluded as covariates in the final structural model unless specified by the analytical technique.

Participants

This study involved 227 students enrolled in sports-related programs, recruited from several higher education institutions in Indonesia through online recruitment. The participants were aged 16 to 18 years, with the following age distribution: 19 years (26.9%), 20 years (40.5%), and 21 years (32.6%). The gender composition was dominated by male students (63.0%), while female students accounted for 37.0%. In terms of regional background, the participants came from urban areas (42.3%), rural areas (34.4%), and coastal areas (23.3%), reflecting diverse social and geographical contexts. Participants' academic achievement was classified into three GPA categories. A total of 36.1% of the students were in the high GPA category (≥ 3.50), 44.5% were in the moderate category (3.00 ≤ GPA < 3.50), and 19.4% were in the low category (GPA < 3.00). This distribution indicates that most students in sports-related programs demonstrated moderate to high levels of academic achievement. Descriptively, the mean GPA of the participants was 3.34, with a standard deviation of 0.38 and a range from 2.20 to 3.95. This pattern provides sufficient variation to examine the effects of emotional intelligence, interpersonal intelligence, and physical performance on academic achievement within the path analysis model. The demographic characteristics of the participants are presented in Table 1.

Table 1. Demographic Characteristics of the Participants

Characteristic	Category	n	%
Gender	Male	143	63.0
	Female	84	37.0
Age (years)	19	61	26.9
	20	92	40.5
	21	74	32.6
Regional background	Urban	96	42.3
	Rural	78	34.4
	Coastal	53	23.3
GPA	GPA ≥ 3.50	82	36.1
	3.00 ≤ GPA < 3.50	101	44.5
	GPA < 3.00	44	19.4

Instruments

This study used questionnaires to measure emotional intelligence and interpersonal intelligence, as well as a structured self-report instrument to assess physical performance. All items were developed in a concise and contextually relevant form for students in sports-related programs, and were subsequently reviewed by an expert panel to ensure content appropriateness, clarity of wording, and the relevance of the indicators to the intended constructs. Responses to the psychological constructs were recorded on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree), whereas physical performance was measured using perceptual statements reflecting training capacity, recovery, and performance consistency. Academic achievement was measured using self-reported Grade Point Average (GPA) and categorized for additional analyses when necessary. Construct validity was examined through Confirmatory Factor Analysis (CFA) as part of the SEM procedure, while the empirical validity of the items was evaluated using corrected item-total correlations and internal consistency reliability. The instruments were considered adequate when factor loadings met the minimum threshold, construct reliability indicators reached acceptable levels, and corrected item-total correlations satisfied the established criteria.

Table 2. Summary of the Instruments

Variable	Instrument type	Number of items	Response scale	Example item
Emotional Intelligence (EI)	Likert-scale questionnaire	12	1–5	"I remain calm when pressure from training or examinations increases."
Interpersonal Intelligence (II)	Likert-scale questionnaire	12	1–5	"I express my opinions without triggering conflict within the team."
Physical Performance (PP)	Structured self-report instrument	8	1–5	"I am able to complete intensive training without a substantial decline in performance."
Academic Achievement (AA)	Self-reported academic record	1	Numeric	Current semester GPA / cumulative GPA

Table 3. Examples of Indicators and Measurement Dimensions

Construct	Indicator dimension	Example item
EI	Self-awareness	"I recognize my emotions when my performance declines."
	Emotion regulation	"I control negative emotions during demanding training sessions."
	Self-motivation	"I maintain my motivation to study even when my training schedule is demanding."
	Emotional empathy	"I notice changes in my peers' emotions during training."
II	Effective communication	"I explain training ideas clearly to my peers."
	Collaboration	"I align my role effectively during group practical tasks."
	Conflict management	"I resolve differences of opinion in a constructive manner."
	Social support	"I provide support when a peer experiences a decline in performance."
PP	Endurance	"I remain physically stable throughout long training sessions."
	Recovery	"I recover quickly after intensive training."
	Strength/functional capacity	"I am able to carry out physical tasks in accordance with the demands of practical coursework."
	Training consistency	"I engage in physical training regularly each week."

The construct validity findings indicated that all indicators aligned effectively with their designated constructs. The factor loadings were 0.62 to 0.84 for emotional intelligence, 0.60 to 0.82 for interpersonal intelligence, and 0.58 to 0.79 for physical performance. The AVE values were 0.55, 0.52, and 0.50, respectively, signifying satisfactory convergent validity. Composite Reliability ratings varied between 0.88 and 0.92, whereas Cronbach's alpha values ranged from 0.87 to 0.91, indicating robust internal

consistency among the instruments. Furthermore, the adjusted item-total correlation analysis demonstrated that all maintained items satisfied the necessary empirical validity requirement and hence did not necessitate removal. Discriminant validity was affirmed, as the square root of the Average Variance Extracted (AVE) for each construct surpassed the correlations among constructs. The results indicated that the instruments were deemed valid and reliable for later structural investigation.

Table 4. Results of Construct Validity and Instrument Reliability Testing

Construct	Factor Loading Range	AVE	Composite Reliability	Cronbach's Alpha	Interpretation
Emotional Intelligence	0.62–0.84	0.55	0.92	0.91	Valid and highly reliable
Interpersonal Intelligence	0.60–0.82	0.52	0.91	0.89	Valid and reliable
Physical Performance	0.58–0.79	0.50	0.88	0.87	Valid and reliable

Procedures

Data were collected through an online survey administered via Google Forms to facilitate efficient and standardized recruitment of participants across multiple higher education institutions. The first page provided study information, including the purpose of the study, the voluntary nature of participation, the estimated completion time, and a confidentiality statement, followed by informed consent before respondents could proceed. Inclusion criteria were verified through screening questions to ensure that respondents were students in sports-related programs and were between 16 and 18 years of age, so that only eligible respondents could access the main questionnaire. The questionnaire was organized sequentially, beginning with demographic information, followed by the emotional intelligence scale, the interpersonal intelligence scale, and finally the physical performance measure, with a consistent response format used throughout to minimize response errors. To maintain data quality, the questionnaire included attention-check items to identify careless responses, along with technical settings to limit multiple submissions from the same account. The survey link was distributed through official channels and academic networks, including course lecturers, student sports organizations, and inter-university networks, thereby widening participant reach while maintaining relevance to the target population. Data collection was terminated once the required sample size had been achieved, after which data cleaning was conducted by excluding incomplete responses, responses that did not meet the inclusion criteria, and responses flagged as invalid based on the quality screening procedures, before the statistical analyses were performed.

Analysis

Data analysis was organized into descriptive and inferential stages to examine the structural relationships among the study variables. Descriptive analysis was used to summarize the characteristics of the data and the general tendencies of the variables, including means, standard deviations, minimum and maximum values, as well as frequency distributions for demographic variables and GPA categories. This stage was intended to ensure that the data distribution was adequate and to provide an initial context before testing the relationships among variables. Subsequently, the assumptions underlying the analysis were examined, including outlier detection, assessment of univariate and multivariate normality, and checks for multicollinearity among the exogenous variables to ensure the stability of parameter estimation.

Inferential analysis was conducted using Structural Equation Modeling (SEM) based on path analysis to test the direct and indirect relationships among variables. Once the measurement model was found to be acceptable, the analysis proceeded to the structural model to estimate path coefficients and their significance. Model fit was evaluated using several goodness-of-fit indices, namely the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR), with the acceptance criteria based on commonly used guidelines in the SEM literature. Direct, indirect, and total effects were analyzed inferentially, and the significance of mediation effects was tested using a bootstrap procedure with confidence intervals. The hypotheses tested in this study included the following:

H1: Emotional intelligence positively predicts academic achievement.

H2: Interpersonal intelligence positively predicts academic achievement.

H3: Physical performance positively predicts academic achievement.

H4: Emotional intelligence positively predicts interpersonal intelligence.

H5: Emotional intelligence positively predicts physical performance.

H6: Emotional intelligence has an indirect positive effect on academic achievement through interpersonal intelligence and/or physical performance.

All hypotheses were tested at the 0.05 significance level, and the results were reported using standardized path coefficients, p-values, and model fit indices to support a comprehensive interpretation of the findings.

Results

Descriptive Analysis

Descriptive analysis was conducted as a preliminary step to provide an overview of the characteristics and distributional tendencies of the data across all study variables. This analysis aimed to identify the levels of emotional intelligence, interpersonal intelligence, physical performance, and academic achievement among students in sports-related programs based on mean scores and standard deviations. Descriptive statistics were also used to examine the distribution of scores across each dimension, thereby allowing the variation in the data to be understood before testing the structural relationships. The results of this descriptive analysis provided an important foundation for interpreting the inferential findings from the path analysis, as they reflected the initial empirical profile of the constructs under investigation.

Table 5 shows that the emotional intelligence scores of students in sports-related programs were in the high category across all measured dimensions. The overall mean score for emotional intelligence was 3.86, with a standard deviation of 0.54, indicating that respondents' scores tended to be above the midpoint of the scale with relatively moderate variation. Self-awareness had the highest mean score (M = 3.92; SD = 0.58), followed by emotional empathy (M = 3.88; SD = 0.59), self-motivation (M = 3.85; SD = 0.56), and emotion regulation (M = 3.78; SD = 0.61). The differences in mean scores across dimensions were relatively small, suggesting a fairly even distribution of scores across the aspects of emotional intelligence. The standard deviations for each dimension ranged from 0.56 to 0.61, indicating that the variation in responses among students remained within a reasonable range. Overall, these descriptive data portray a relatively homogeneous emotional intelligence profile, with consistently high scores across all measured dimensions.

Table 1. Descriptive Statistics for Emotional Intelligence

Dimension	M	SD	Category
Self-Awareness	3.92	0.58	High
Emotion Regulation	3.78	0.61	High
Self-Motivation	3.85	0.56	High
Emotional Empathy	3.88	0.59	High
Emotional Intelligence (Total)	3.86	0.54	High

Table 6 shows that interpersonal intelligence among students in sports-related programs was generally high at both the overall level and across most of its dimensions. The overall mean score for interpersonal intelligence was 3.83, with a standard deviation of 0.52, indicating that respondents' scores tended to be above the midpoint of the scale with relatively moderate variation. At the dimensional level, social support had the highest mean score (M = 3.94; SD = 0.57), followed by collaboration (M = 3.89; SD = 0.55) and effective communication (M = 3.81; SD = 0.60), all of which were in the high category. Conflict management had the lowest mean score (M = 3.67; SD = 0.64) and fell within the moderate-to-high category. The standard deviations across the dimensions ranged from 0.55 to 0.64, indicating that variation in responses among students remained within a reasonable range. Overall, these data show a relatively even distribution of scores, with no substantial differences in mean values across dimensions.

Table 2. Descriptive Statistics for Interpersonal Intelligence

Dimension	M	SD	Category
Effective Communication	3.81	0.60	High
Collaboration	3.89	0.55	High
Conflict Management	3.67	0.64	Moderate-High
Social Support	3.94	0.57	High
Interpersonal Intelligence (Total)	3.83	0.52	High

Table 7 shows that physical performance among students in sports-related programs was relatively high at both the overall level and across most of its dimensions. The overall mean score for physical performance was 3.80, with a standard deviation of 0.55, indicating that respondents' scores tended to be above the midpoint of the scale with relatively moderate variation. At the dimensional level, training consistency had the highest mean score (M = 3.91; SD = 0.57), followed by strength/functional capacity (M = 3.82; SD = 0.58) and endurance (M = 3.76; SD = 0.62). Recovery had the lowest mean score (M = 3.69; SD = 0.65), although it remained above the midpoint of the scale. The standard deviations across the dimensions ranged from 0.57 to 0.65, with the greatest variation observed in the recovery dimension. Overall, the differences in mean scores across dimensions were relatively small, suggesting that the respondents' physical performance profile was fairly even across the measured dimensions.

Table 3. Descriptive Statistics for Physical Performance

Dimension	M	SD	Category
Endurance	3.76	0.62	High
Recovery	3.69	0.65	Moderate-High
Strength/Functional Capacity	3.82	0.58	High
Training Consistency	3.91	0.57	High
Physical Performance (Total)	3.80	0.55	High

Table 8 shows that the academic achievement (GPA) of students in sports-related programs had a mean of 3.34, with a standard deviation of 0.38. The GPA ranged from 2.20 to 3.95, indicating variation in academic performance across respondents. The relatively small standard deviation suggests that GPA scores were moderately clustered around the mean, although the observed range still reflects diversity in academic achievement. Descriptively, these findings indicate that respondents' GPA tended to be above the midpoint of the higher education grading scale. The variation observed in GPA supports the use of structural analysis, as it provides sufficient score differentiation for examining relationships among variables in the subsequent stage.

Table 4. Descriptive Statistics of Academic Achievement

Variable	M	SD	Range
Academic Achievement (GPA)	3.34	0.38	2.20–3.95

Based on the descriptive statistics, emotional intelligence, interpersonal intelligence, and physical performance among students in sports-related programs were generally relatively high, with moderate variation. Academic achievement also showed a mean that tended toward the upper range, with a sufficiently wide spread of scores to reflect adequate variability. Overall, the distribution of data across all variables indicated that scores tended to be above the midpoint of the scale, with no indication of extreme dispersion. This pattern suggests that the data were adequate for proceeding to the analysis of structural relationships. This conclusion is descriptive in nature and does not imply causal relationships among the variables.

Inferential Analysis and Hypothesis Testing

Hypothesis testing was conducted to examine the direct and indirect effects among variables in the proposed path analysis model. This stage aimed to assess whether the structural relationships formulated on the basis of the theoretical framework were supported by the empirical data. The analysis focused on the estimation of standardized path coefficients and their significance levels in order to determine the direction and strength of the relationships among variables. In addition to direct effects, the testing also included an evaluation of mediation effects through the estimation of indirect effects using a

bootstrap procedure. The results of the hypothesis testing are presented systematically to provide an inferential basis for answering the research questions that were formulated. The results of the direct effect testing among variables are presented in Table 9. This table reports the estimated standardized path coefficients, standard errors, and significance levels for each relationship tested in the structural model. This presentation is intended to show the direction and strength of the effects of each exogenous variable and mediator on academic achievement, while also serving as the basis for determining whether the research hypotheses were supported or rejected.

Table 5. Results of Direct Effects Testing

Hypothesis	Path	Standardized β	SE	p-value	Hypothesis Support
H1	Emotional Intelligence → Academic Achievement	0.21	0.07	0.004	Supported
H2	Interpersonal Intelligence → Academic Achievement	0.29	0.06	< 0.001	Supported
H3	Physical Performance → Academic Achievement	0.24	0.06	0.001	Supported
H4	Emotional Intelligence → Interpersonal Intelligence	0.52	0.05	< 0.001	Supported
H5	Emotional Intelligence → Physical Performance	0.47	0.06	< 0.001	Supported

The results of the analysis showed that emotional intelligence had a positive and significant effect on academic achievement (β = 0.21, p = 0.004). Interpersonal intelligence also had a positive and significant effect on academic achievement (β = 0.29, p < 0.001). In addition, physical performance had a positive and significant effect on academic achievement (β = 0.24, p = 0.001). Within the internal pathways of the model, emotional intelligence had a positive and significant effect on interpersonal intelligence (β = 0.52, p < 0.001) and on physical performance (β = 0.47, p < 0.001). The magnitudes of these two coefficients were higher than that of the direct path to academic achievement, indicating that changes in emotional intelligence were followed by greater changes in interpersonal intelligence and physical performance in the tested model.

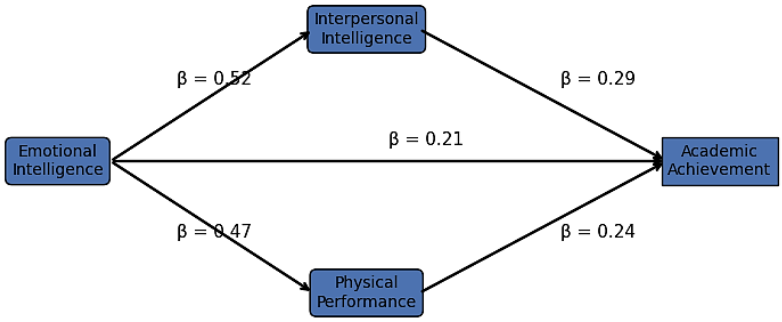
In addition to the direct effects, the analysis also examined indirect effects among variables through the mediation mechanisms specified in the path analysis model. The indirect effects were tested using a bootstrap procedure to ensure the stability of the estimates and the accuracy of the confidence intervals. A summary of the mediation effect results is presented in Table 10.

Table 6. Results of Indirect Effect Testing (Indirect Effects, Bootstrap)

Hypothesis	Mediation Pathway	Indirect β	95% CI	p-value	Interpretation
H6a	Emotional Intelligence → Interpersonal Intelligence → Academic Achievement	0.15	[0.08, 0.24]	0.002	Significant
H6b	Emotional Intelligence → Physical Performance → Academic Achievement	0.11	[0.05, 0.20]	0.004	Significant
Total	Total indirect effect: Emotional Intelligence → (Interpersonal Intelligence and/or Physical Performance) → Academic Achievement	0.26	[0.14, 0.36]	< 0.001	Significant

Table 10 shows that emotional intelligence exerted significant indirect effects on academic achievement through two mediating pathways. The pathway through interpersonal intelligence yielded an indirect effect of β = 0.15 (p = 0.002), whereas the pathway through physical performance yielded an indirect effect of β = 0.11 (p = 0.004). The 95% confidence intervals for both pathways did not include zero, confirming that each mediation effect was statistically significant. The total indirect effect of emotional intelligence on academic achievement through both mediators was also significant (β = 0.26, p < 0.001). These findings suggest that the contribution of emotional intelligence to academic achievement operates not only through a direct pathway, but also through the mediating roles of interpersonal intelligence and physical performance.

Figure 1. Path Analysis Results



The path model shows that emotional intelligence played a central role in the relational structure among the variables, both through its direct and indirect effects on academic achievement. The direct path from emotional intelligence to academic achievement (β = 0.21) indicates that the ability to regulate emotions was associated with academic performance, although its strength was more moderate than that of the indirect pathways. This pattern suggests that the effect of emotional intelligence on academic achievement did not operate in isolation, but rather through intermediary mechanisms in the context of students in sports-related programs.

The mediating role of interpersonal intelligence and physical performance was clearly evident. The path coefficient from emotional intelligence to interpersonal intelligence (β = 0.52) was the largest in the model, indicating that emotional capacity was strongly related to the ability to interact, communicate, and collaborate effectively. This pathway then extended to academic achievement through interpersonal intelligence (β = 0.29), which represented the strongest direct effect on academic achievement in the model. This pattern indicates that social and relational dimensions played an important role in mediating the influence of emotional intelligence on academic outcomes.

In addition to the social pathway, emotional intelligence was also strongly associated with physical performance (β = 0.47), which in turn had a positive effect on academic achievement (β = 0.24). This finding confirms that physical capacity and performance consistency contributed to the academic success of students in sports-related programs, and that this contribution was partly shaped by emotional intelligence. Thus, physical performance functioned as a functional mediating pathway that complemented the social mediation pathway through interpersonal intelligence.

Overall, the model shows that interpersonal intelligence had the strongest direct effect on academic achievement, whereas emotional intelligence functioned as an upstream factor shaping the quality of social relationships and physical performance. This structure suggests that the academic achievement of students in sports-related programs is determined not only by cognitive or academic factors, but also by the integration of emotional, social, and physical capacities. These findings provide a conceptual basis for emphasizing the importance of a holistic approach to student development in sports education, with emotional intelligence positioned as a foundation for strengthening interpersonal competence and physical performance in ways that support academic achievement.

Discussion

The findings indicate that emotional intelligence, interpersonal intelligence, and physical performance were all positively associated with academic achievement among students in sports-related programs. However, the structural pattern suggests that these variables did not contribute equally. Emotional intelligence showed a positive association with academic achievement, indicating that students who are better able to regulate emotions, cope with pressure, and maintain emotional stability also tend to demonstrate better academic performance. In the context of sports education, where academic demands often coexist with intensive training and performance evaluation, this finding is consistent with the view that emotional regulation supports persistence, focus, and disciplined learning behavior (Della

Corte et al., 2025; Liu et al., 2021; Marheni et al., 2024; Wei et al., 2020). This interpretation must be approached with caution, given the current data were obtained cross-sectionally and depended on self-reported measurements for essential dimensions. Consequently, the identified correlation should not be construed as conclusive proof of a unilateral causal effect. Nevertheless, the direct pathway from emotional intelligence to academic achievement was not the most dominant one, suggesting that its role becomes more meaningful when examined together with intermediary variables.

This outcome underscores the significance of emotional intelligence in challenging educational environments, however it also prompts a more critical analysis. The impact of emotional intelligence may be contingent upon the manner in which academic performance is defined in sports-related programs, where self-regulation, perseverance, and adaptability to pressure are likely to be more evident than in less performance-focused academic environments (Rincón et al., 2025). Moreover, prior research has highlighted cognitive, motivational, or instructional variables as more significant predictors of achievement, indicating that emotional intelligence should be regarded as one crucial factor among many, rather than as a universally preeminent determinant of academic success.

Among the predictors included in the model, interpersonal intelligence emerged as the strongest predictor of academic achievement. This finding highlights the importance of relational competence in sports-related learning environments, where teamwork, communication, coordination, and responsiveness to feedback are embedded in both practical and academic activities (Kamaruddin et al., 2025; Miguel et al., 2020; Rogowska et al., 2022). Academic success in this context appears to depend not only on individual cognitive ability, but also on the quality of interaction that students build with peers, lecturers, and coaches. Nevertheless, this discovery should not be hastily extrapolated outside the current setting. The significant role of interpersonal intelligence may indicate the collaborative and practice-oriented nature of sports-related programs, where students' academic involvement is intricately linked to communication, coordination, and social adaptation. In various higher education environments with reduced collaborative intensity, the relative efficacy of this predictor may vary. This result suggests that interpersonal competence is not a peripheral attribute, but a central component of academic functioning in sports education. It also implies that academic development strategies for sports students may be less effective if they focus only on cognitive or disciplinary aspects without strengthening collaborative and communicative capacities. Another issue worthy of consideration is that the significant predictive capacity of interpersonal intelligence may possibly partially stem from the conceptual closeness between some elements of academic performance in sports education and the social behaviors assessed by the instrument. Consequently, the result holds theoretical significance; but, it must be taken with an understanding that the strength of the connection may be influenced by the particular educational situation and the methodology of measurement employed.

Physical performance was also positively associated with academic achievement, indicating that physical readiness remains an important part of academic functioning in sports-related programs. This pattern is understandable because practical coursework often requires endurance, coordination, consistency, and participation in physically demanding activities (De Aguiar Antunes et al., 2025; Fernández-Espínola & Almagro, 2019; López et al., 2021). Students with better physical condition may be better positioned to sustain engagement in practice-based learning and to avoid disruptions related to fatigue, poor recovery, or reduced participation. Nonetheless, the interpretation of this association should be approached with caution, given physical performance in the current study was evaluated via self-report rather than objective physical assessment. The data are thus interpreted as indicative of perceived physical preparation or performance capabilities concerning academic demands, rather than as direct measurements of athletic performance. At the same time, the findings show that physical performance should not be interpreted in isolation. Its role in the model appears to be connected to broader psychological processes, particularly emotional intelligence, which was also strongly associated with physical performance. This result expands the interpretation of emotional intelligence beyond social adjustment, suggesting that it may also support training discipline, self-control, and adaptation to performance pressure. This pattern indicates that the academic significance of physical performance may be contingent upon context. In sports programs, physical preparedness is expected to correlate more directly with academic results due to the close association between practical evaluations and participation criteria with physical performance. Conversely, in academic environments that depend more on classroom-based cognitive activities, the strength of this link may be diminished.

A key contribution of this study lies in the indirect pathways identified in the model. Emotional intelligence was associated with academic achievement not only directly, but also indirectly through interpersonal intelligence and physical performance. This finding suggests that the influence of emotional intelligence is better understood as a foundational factor that operates through social and performance-related channels rather than as a standalone predictor. In practical terms, students who are better able to regulate their emotions may also be more capable of building effective relationships, maintaining constructive communication, and sustaining performance consistency, all of which are relevant to academic achievement (Ghanizadeh, 2017; Ridwan et al., 2023; Şahin et al., 2020). The mediation pattern therefore provides a more comprehensive explanation of academic achievement in sports-related programs by linking emotional, social, and physical dimensions within a single structural framework. This mediation pattern should not be overly understood in causal terms. The study's cross-sectional approach indicates that the observed indirect pathways represent statistically probable relational patterns rather than temporally validated processes. Future research employing longitudinal or experimental methodologies is necessary to determine if emotional intelligence indeed precedes alterations in interpersonal functioning, physical preparedness, and academic performance across time.

These findings carry important implications for student development in sports education. Interventions should not focus exclusively on academic remediation or physical conditioning, but should integrate emotional regulation, interpersonal competence, and performance management in a coordinated manner. Programs that strengthen self-regulation, team communication, conflict management, and recovery awareness may offer a more effective basis for improving academic achievement (Abbeduto et al., 2019; Panaoura, 2024; Rincón et al., 2025). The novelty of this study lies in its integrated modeling of emotional intelligence, interpersonal intelligence, physical performance, and academic achievement within one structural model, while also demonstrating that indirect pathways constitute a central explanatory mechanism. Thus, the study contributes both conceptually and practically by offering a more operational understanding of how academic achievement can be supported in higher education settings that combine academic and performance demands. Nonetheless, the practical ramifications must be understood within the confines of the study. The results were obtained from self-reported data collected at a single time period inside a unique educational context, perhaps constraining greater generalizability. The study's relevance is mostly in offering an integrated explanatory framework rather than demonstrating conclusive causal relationships among factors, which can guide future research and focused interventions in sports-related education.

Conclusions

This study shows that the academic achievement of students in sports-related programs is associated with a combination of emotional, social, and physical performance factors within an interconnected relational structure. The relationship pattern indicates that interpersonal intelligence and physical performance function as important pathways through which emotional intelligence contributes to academic achievement. The central implication of these findings is that academic success among students in sports-related programs needs to be understood more holistically, as relational aspects and performance readiness emerged as components that cannot be overlooked. The results also show that the contribution of emotional intelligence becomes stronger when it operates through intermediary mechanisms, suggesting that efforts to strengthen emotional competence should be directed toward the development of social skills and performance consistency.

This study has several limitations. First, the cross-sectional design does not allow strong causal conclusions to be drawn. Second, the use of self-report measures may introduce perceptual bias and social desirability bias. In addition, the online recruitment procedure may have introduced participation bias, as respondents who chose to complete the survey may have had characteristics that do not fully represent the target population. Academic achievement was also measured using self-reported GPA, meaning that the accuracy of the data depended on the accuracy of respondents' reports. Furthermore, the study did not include several potentially relevant confounding variables, such as weekly training load, sleep quality, study strategies, or institutional academic support.

Future research is recommended to employ longitudinal or experimental designs to examine the direction of relationships and the mechanisms of change over time. Measures of physical performance should

be complemented with objective fitness tests, and academic achievement should be verified through institutional records to strengthen validity. Further studies should also examine the role of moderators, such as type of sport, training intensity, athlete status, or institutional context, to determine whether the strength of the relationships differs across groups. In addition, the model may be extended by incorporating learning-process variables such as self-regulated learning, grit, or academic engagement in order to provide a more comprehensive explanation of academic achievement. Intervention studies targeting emotion regulation and interpersonal skills in sports-related higher education settings are also important to evaluate the effectiveness of evidence-based programs..

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