Examining the effects of spatial thinking, emotional intelligence, and self-efficacy on academic achievemen among students in sports education programs

Examinando los efectos del pensamiento espacial, la inteligencia emocional y la autoeficacia sobre el rendimiento académico de estudiantes en programas de educación deportiva

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Abstract

Introduction: Student academic achievement in higher education is shaped not only by cognitive capabilities but also by affective attributes. Despite the recognized role of spatial thinking and emotional intelligence in academic performance, the interplay between these variables, particularly through the mediating function of self-efficacy, has not been sufficiently explored
Objective: This study aims to examine the direct and indirect effects of spatial thinking ability and emotional intelligence on academic achievement, with self-efficacy as a mediator.
Methodology: Employing a quantitative ex post facto design, data were collected from 387 university students enrolled in Sports Education Programs using standardized instruments measuring spatial thinking, emotional intelligence, self-efficacy, and academic outcomes. Data were analyzed using path analysis to evaluate both direct and mediated relationships among variables.
Results: The findings indicate that spatial thinking exerts a significant direct influence on self-efficacy (β = 0.194) and academic achievement (β = 0.398), whereas emotional intelligence significantly predicts self-efficacy (β = 0.269) but not academic achievement directly (β = 0.052). Self-efficacy itself shows a strong direct effect on academic achievement (β = 0.360) and serves as a significant mediator in the relationships involving both predictors..
Discussion: These results highlight the importance of integrating cognitive and emotional skills development to enhance learners' academic resilience.
Conclusions: Educational programs should incorporate spatial reasoning tasks and emotional self-regulation strategies to strengthen students' belief in their academic abilities and improve performance outcomes.

Keywords

Spatial thinking; emotional intelligence; self-efficacy; academic achievement; ex post facto; path analysis.

Resumen

Introducción: El rendimiento académico de los estudiantes en la educación superior se configura no solo por las capacidades cognitivas, sino también por los atributos afectivos. A pesar del papel reconocido del pensamiento espacial y la inteligencia emocional en el desempeño académico, la interacción entre estas variables, particularmente a través de la función mediadora de la autoeficacia, no ha sido suficientemente explorada.
Objetivo: Este estudio tiene como objetivo examinar los efectos directos e indirectos del pensamiento espacial y la inteligencia emocional sobre el rendimiento académico, considerando la autoeficacia como variable mediadora.
Metodología: Utilizando un diseño cuantitativo ex post facto, se recolectaron datos de 387 estudiantes universitarios matriculados en programas de Educación Deportiva mediante instrumentos estandarizados que midieron el pensamiento espacial, la inteligencia emocional, la autoeficacia y los resultados académicos. Los datos fueron analizados mediante análisis de trayectorias (path analysis) para evaluar las relaciones directas y mediadas entre las variables.
Resultados: Los hallazgos indican que el pensamiento espacial ejerce una influencia directa significativa sobre la autoeficacia (β = 0.194) y el rendimiento académico (β = 0.398), mientras que la inteligencia emocional predice significativamente la autoeficacia (β = 0.269), pero no el rendimiento académico de forma directa (β = 0.052). La autoeficacia muestra un efecto directo fuerte sobre el rendimiento académico (β = 0.360) y actúa como un mediador significativo en las relaciones que involucran a ambos predictores.
Discusión: Estos resultados destacan la importancia de integrar el desarrollo de habilidades cognitivas y emocionales para mejorar la resiliencia académica de los estudiantes.
Conclusiones: Los programas educativos deberían incorporar tareas de razonamiento espacial y estrategias de autorregulación emocional para fortalecer la creencia de los estudiantes en sus capacidades académicas y mejorar los resultados de desempeño.

Palabras clave

Pensamiento espacial; inteligencia emocional; autoeficacia; rendimiento académico; ex post facto; análisis de trayectorias.

Introduction

In the context of modern education, academic achievement remains a primary indicator of learning success and a predictor of students' future potential (Folgado dos Santos et al., 2020; Miguel et al., 2020; Ridwan et al., 2023). For students enrolled in sports education programs, balancing physical training with academic demands presents a significant challenge. While cognitive ability is often regarded as the primary determinant of academic achievement, recent studies suggest that non-cognitive factors, such as spatial thinking ability (Casadiego et al., 2023), emotional intelligence (Acebes-Sánchez et al., 2021; López et al., 2021), and self-efficacy (Campos et al., 2022; Suria Martinez, 2023), also play a critical role, particularly among students whose learning activities are closely tied to physical and spatial components. Accordingly, spatial reasoning, emotional intelligence, and self-efficacy are essential internal attributes that should be cultivated through instructional activities, especially for students in sports education programs, in order to support optimal academic outcomes.

Unlike general students, those enrolled in sports education programs encounter distinctive dual demands: excelling in physical performance through intensive training and competitions while simultaneously meeting academic expectations. This constant dual pressure often generates stress, fatigue, and frustration, which, if unmanaged, can negatively impact their academic performance. Such conditions make the examination of spatial thinking, emotional intelligence, and self-efficacy particularly relevant, as these internal attributes may serve as crucial resources to help students regulate pressure, adapt to competing demands, and sustain academic achievement despite the challenges inherent in sports-focused education (Acebes-Sánchez et al., 2021; Davis et al., 2019; Engelke & Frederickson, 2022).

Spatial thinking skills are essential not only in subjects such as mathematics and science, but also in sports disciplines that require visualization, mental rotation, and problem-solving in dynamic contexts (Haciomeroglu et al., 2013; Kotsopoulos et al., 2017). In sports education programs, where bodily movement and spatial awareness are routinely practiced, students have the potential to enhance their spatial thinking abilities through physical activities (Andersen et al., 2001; Casadiego et al., 2023; Şahin et al., 2020). However, the extent to which these skills contribute to academic achievement remains underexplored, particularly among students participating in sports-focused educational programs. Therefore, further investigation is needed to understand how spatial thinking, developed through physical engagement in sports education, may contribute to improved academic outcomes.

Emotional intelligence has also emerged as a key predictor of academic achievement, particularly among students engaged in physically demanding and competitive programs (Fernández-Espínola & Almagro, 2019; Martinez-Lorca et al., 2023; Sánchez Molina et al., 2021). The ability to regulate emotions, maintain motivation, and demonstrate empathy plays a significant role in learning success (Cifuentes & Mena, 2023; Rubio et al., 2022). For students in sports education programs, who often face pressure from competition and performance expectation, emotional intelligence can serve as both a protective and promotive factor within the academic domain (Lorca et al., 2023). Beyond shaping social interactions, emotional intelligence is closely associated with students' capacity for self-regulation, frustration management, and sustained learning commitment under high-pressure conditions (Marheni et al., 2024). Thus, fostering emotional intelligence represents a strategic approach to helping students in sports education programs cope adaptively with pressure while remaining focused on achieving academic success.

Another critical internal factor is self-efficacy, defined as students' belief in their ability to successfully complete academic tasks. According to social-cognitive learning theory, self-efficacy influences motivation, learning strategies, and persistence in the face of challenges (Street et al., 2022; Yurekli et al., 2020). Among students in sports education programs, self-efficacy related to physical performance may be well developed; however, this does not necessarily translate to strong academic self-efficacy, highlighting the need for targeted investigations into their academic self-efficacy profiles (Campos et al., 2022; Suria Martinez, 2023). High self-efficacy enables students to set challenging learning goals, take initiative, and persist when encountering academic obstacles (Rogowska et al., 2022; Turan & Koç, 2018; Wei et al., 2020). Therefore, a deeper understanding of the academic self-efficacy of sports education students is essential for designing interventions that foster greater confidence and resilience in academic learning contexts.

Each of the three factors, spatial thinking, emotional intelligence, and self-efficacy, has individually been linked to academic achievement in various studies (Ihsan et al., 2024). However, research that integrates

all three within a single predictive model, particularly among students in sports education programs, remains scarce. Theoretical foundations suggest that self-efficacy may serve as a mediating variable, bridging the influence of spatial thinking and emotional intelligence on academic outcomes (Liu et al., 2021). This underscores the importance of a holistic approach that simultaneously considers cognitive, affective, and motivational dimensions in understanding students' academic achievement. By examining the simultaneous relationships among these three variables, research can offer a more comprehensive view of the internal factors that influence academic success. Moreover, such findings could inform the design of more targeted development programs tailored to the specific needs of students in sports education programs.

Although numerous prior studies have examined the influence of spatial ability, emotional intelligence, and self-efficacy on academic achievement in general populations, few have specifically explored these relationships among students in sports education programs, who may possess distinct cognitive and affective profiles. Furthermore, the mediating role of self-efficacy in linking spatial thinking and emotional intelligence to academic outcomes has received limited empirical attention in this context. The rationale for this study lies in the need for an interdisciplinary approach that integrates cognitive, affective, and motivational aspects to better understand the learning dynamics of students with high levels of physical activity. The novelty of this study rests in its attempt to construct a predictive model that simultaneously examines the relationships among spatial thinking ability, emotional intelligence, self-efficacy, and academic achievement, particularly among students in sports education programs, a population that remains underrepresented in empirical research.

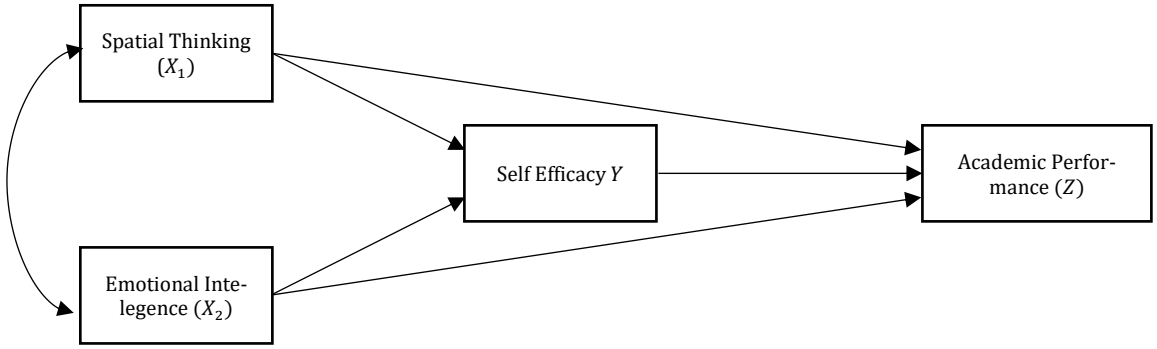
Building upon the aforementioned background, this study aims to examine the direct and indirect effects of spatial thinking ability and emotional intelligence on the academic achievement of students in sports education programs, with self-efficacy serving as a mediating variable. The practical implications of this research may inform educators and coaches in designing instructional interventions that foster students' academic potential while taking into account the psychological characteristics associated with athletic engagement. This study is expected to offer both theoretical and practical contributions by deepening the understanding of internal factors that influence academic success in non-traditional educational settings, and by providing a foundation for more integrated interventions that bridge cognitive, affective, and motivational domains within sports education.

Method

Settings

An ex-post facto approach was employed in this study, as the variables under investigation, spatial thinking ability, emotional intelligence, self-efficacy, and academic achievement, represent existing conditions that cannot be manipulated directly by the researcher. This approach allows for the analysis of causal relationships based on retrospective data, relying on theoretical frameworks and empirical evidence to examine inter-variable influences without experimental intervention. According to Sharma (2019) and Lacruz & Cunha (2018), ex-post facto designs are particularly appropriate when the variables under investigation cannot be directly manipulated, but theoretical reasoning and prior empirical findings provide a strong basis for inferring causal directions. The study was conducted during the odd semester at a private university located in central Indonesia, which offers an undergraduate program in sports education. The site was purposively selected based on the presence of an active sports education department and a sufficient student population to support the research implementation. The primary focus of this study is on early- to mid-semester students enrolled in the Physical Education, Sports, and Health program, with the aim of analyzing the relationships among students' internal factors (namely spatial thinking, emotional intelligence, and self-efficacy) and their academic achievement, particularly in conceptually and theoretically oriented courses. The research design is illustrated in Figure 1.

Figure 1. Research Design



Based on the theoretical framework and previous studies, the following hypotheses were proposed:

H1: Spatial thinking ability has a direct positive effect on students' academic achievement.

H2: Emotional intelligence has a direct positive effect on students' academic achievement.

H3: Spatial thinking ability positively influences self-efficacy.

H4: Emotional intelligence positively influences self-efficacy.

H5: Self-efficacy has a direct positive effect on students' academic achievement.

H6: Self-efficacy mediates the relationship between spatial thinking ability and academic achievement.

H7: Self-efficacy mediates the relationship between emotional intelligence and academic achievement.

Participants

The population of this study comprised all students enrolled in the sports education program at a private university located in central Indonesia. This undergraduate program offers a bachelor's degree in physical education, with a curriculum that integrates both theoretical and practical courses. The target population consisted of active students from semesters I to VI during the 2023/2024 academic year. The sampling technique employed was proportional stratified random sampling, taking into account the distribution of students across different semester levels to ensure representation of varying degrees of academic experience. The sample size was determined using Slovin's formula with a 5% margin of error, resulting in a total of 387 students. The sample was proportionally drawn from several class groups at each semester level, and respondents were selected randomly. This sampling strategy ensured that the selected participants were representative of the broader student population in the sports education program, particularly for analyzing the relationships among spatial thinking ability, emotional intelligence, self-efficacy, and academic achievement. The demographic characteristics of the sample are presented in Table 1.

Table 1. Research Sample Demographics

Background Participants	N	Study Samples
Educational Background		
Physical Education and Sports Science (PESS)	212	55%
Coaching Education	103	27%
Health and Recreation Studies	72	18%
Gender		
Female	232	60%
Male	155	40%
School Origin		
Urban	312	81%
Rural	75	19%
Cumulative Grade Point Average (GPA)		
Above 3, 51	278	72%
Between 3, 00 and 3, 50	109	28%

A total of 387 students from a sports education program at a private university in central Indonesia participated as the research sample. The majority of participants came from the Physical Education and Sports Science track (55%), followed by Sports Coaching Education (27%) and Health and Recreation Studies (18%). This composition reflects a predominance of students with high exposure to physical and spatial activities, which prior studies have associated with enhanced spatial reasoning skills (Casadiego et al., 2023; Şahin et al., 2020). In terms of gender distribution, the sample was predominantly male (60%), with females comprising 40%. Prior research has shown that gender differences are often linked to variations in emotional regulation and academic self-confidence (Haciomeroglu et al., 2013; Kotsopoulos et al., 2017). Most participants (81%) reported urban backgrounds, studies have indicated that urban environments typically provide greater access to educational facilities and social support, which can contribute to the development of self-efficacy and emotional intelligence (Liu et al., 2021; Wei et al., 2020). Additionally, 72% of participants had a GPA above 3.50, indicating strong academic achievement, which may reflect the positive role of the three internal factors examined in this study: spatial thinking ability, emotional intelligence, and self-efficacy.

Instrument

This study employed four types of instruments, each designed to measure one of the primary variables under investigation. First, the academic achievement test consisted of 30 multiple-choice items aimed at assessing participants' cognitive-level academic achievement. Second, the spatial thinking test comprised 10 open-ended questions developed to evaluate key components of spatial processing relevant to the context of sports education. These components included spatial visualization (the ability to mentally imagine the movement and positional changes of the body or objects in space), mental rotation (the ability to rotate mental representations of direction and body or equipment positions), spatial orientation (the ability to understand one's own position or that of other players within a game area or field), and spatial relation (the ability to recognize and interpret relationships among objects or players in dynamic situations). This instrument aimed to assess students' capacity to mentally represent, interpret, and solve complex spatial problems that commonly arise in sports activities, such as tactical gameplay, field navigation, or movement planning.

Third, the emotional intelligence scale consisted of 30 statements based on Goleman's five key domains: self-awareness, emotional regulation, self-motivation, empathy, and social skills. Although validated instruments such as the Emotional Competence Inventory (ECI) developed by Boyatzis et al. (2000) are available, this study employed a researcher-developed scale adapted from Goleman's theoretical model to better align with the cultural and contextual characteristics of Indonesian sports education students. The choice was also motivated by the need for an instrument that is concise, practical to administer within classroom settings, and capable of capturing context-specific aspects of students' emotional regulation in competitive and physically demanding environments. The adaptation process involved expert judgment from specialists in educational psychology and sports education to ensure content validity.

Fourth, the self-efficacy scale included 10 items adapted from the General Self-Efficacy Scale (GSE), which measures three core dimensions: magnitude, strength, and generality. All instruments underwent validation procedures covering content, construct, and empirical validity, as well as reliability testing to ensure internal consistency. For the non-test instruments, a four-point Likert scale was used, and response scores were converted to an interval scale using the cumulative normal deviation approach to meet the assumptions of parametric statistical analysis.

Procedure

The data collection procedures in this study were carried out in six sequential and complementary stages. The first stage involved the development of test blueprints and instruments for each variable: academic achievement, spatial thinking ability, emotional intelligence, and self-efficacy. The blueprints were constructed based on indicators derived from relevant theoretical frameworks to ensure construct validity and measurability. The second stage consisted of expert validation by three professionals specializing in educational evaluation, educational psychology, and sports education. Feedback from these validators was incorporated into the third stage, which involved revising and finalizing the instruments(this included refining item wording, adjusting indicators, and eliminating items deemed inappropriate).

In the fourth stage, the revised instruments were pilot-tested with a group of students possessing similar characteristics to the main research sample. The results of the pilot test were used to examine empirical validity through Pearson correlation analysis and to assess reliability using Cronbach's Alpha and the Kuder-Richardson Formula 20 (KR-20), ensuring that only valid and reliable items were retained for the main data collection. The fifth stage entailed the implementation of data collection at the selected research site, a private university in central Indonesia. Data were collected in accordance with a schedule agreed upon with the study program, during which students completed the spatial thinking and academic achievement tests, as well as questionnaires on emotional intelligence and self-efficacy. The final stage involved collecting the completed instruments and checking for data completeness. Subsequently, the data were processed and prepared for further analysis. For non-test instruments, ordinal scale responses were converted to interval data using the cumulative normal deviation method to meet the assumptions of parametric statistical analysis.

Analysis

Data analysis in this study was conducted in two stages: descriptive and inferential analysis. Descriptive analysis was employed to comprehensively depict the profiles of students' spatial thinking ability, emotional intelligence, self-efficacy, and academic achievement by calculating the mean, standard deviation, variance, as well as minimum and maximum scores. Variable categorization was based on value intervals and normal distribution, allowing the identification of general tendencies and the distinctive characteristics of each variable across the student group.

Inferential analysis was conducted using path analysis to examine the direct and indirect causal relationships among spatial thinking ability, emotional intelligence, self-efficacy, and academic achievement. Prior to model estimation, several statistical assumptions were tested to ensure the accuracy of the interpretation. Normality testing was conducted to confirm that the distribution of scores across all four variables followed a normal pattern, thereby reducing bias in the estimation of causal relationships involving spatial thinking, emotional intelligence, self-efficacy, and academic achievement. Linearity testing was performed to verify that the relationships between variables (such as between spatial thinking and self-efficacy or between emotional intelligence and academic achievement) were proportionate across the full range of scores, ensuring that the resulting path coefficients accurately reflected consistent associations. Multicollinearity testing was conducted to ensure that spatial thinking and emotional intelligence, as predictors of both self-efficacy and academic achievement, contributed complementary rather than redundant information, thereby allowing for a clear interpretation of each variable's unique effect.

Residual homoscedasticity testing was conducted to ensure that the prediction errors in the relationships among variables were evenly distributed across all levels of the predictors. This condition is essential for accurately estimating the mediating role of self-efficacy. Additionally, the assumption of unidirectional (recursive) causal relationships was verified to confirm that the paths among variables aligned with the theoretical framework. For instance, spatial thinking ability and emotional intelligence were modeled as predictors of self-efficacy, which in turn influenced academic achievement, with no feedback loops that could obscure the direction of causality. With all assumptions satisfied, the path analysis provided a valid representation of the direct and indirect contributions of spatial thinking, emotional intelligence, and self-efficacy in shaping the academic achievement of students in sports education programs.

Results

Description of Spatial Thinking Ability

Based on the descriptive analysis presented in Table 2, the spatial thinking ability of students in the sports education program tended to be low. Among the 387 students, spatial thinking scores ranged from 0 to 36, with a mean score of 16.09 and a standard deviation of 6.26. This indicates that most students mastered less than half of the components assessed in the spatial thinking test. The variance of 39.14 reflects a considerable degree of variability in students' spatial information processing abilities. This wide score dispersion suggests that although the overall average was low, a small number of students demonstrated relatively higher levels of spatial thinking ability. This is further supported by the

frequency distribution data, which show that only 2.84% of the students reached the moderate or higher category.

Table 2. Descriptive Statistics of Spatial Thinking Ability

Statistic	Value
Sample Size	387
Maximum Score	36
Minimum Score	0
Mean Score	16,0878553
Standard Deviation	6,255975
Variance	39,13722

To provide a more in-depth representation of sports education students' spatial thinking ability, descriptive data are presented based on four core components of spatial thinking relevant to physical and cognitive activities (Table 3). The analysis revealed substantial variation across the four measured components. Among them, *spatial visualization* yielded the highest mean score of 4.15 (SD = 1.12), indicating that most students were reasonably capable of mentally visualizing movement and positional transformations of the body or objects in space. However, in the *mental rotation* component, the average student score was only 3.45 (SD = 1.29), suggesting that the ability to mentally rotate representations of body orientation or sports equipment remains relatively weak compared to other components.

The *spatial orientation* component recorded a mean score of 3.82 (SD = 1.21), reflecting a reasonably good level of spatial awareness among students in recognizing their own position and that of other players within the game area. In contrast, the *spatial relation* component (associated with the ability to comprehend spatial relationships between players and objects in dynamic contexts) yielded the lowest mean score of 3.33 (SD = 1.18). This suggests that students still experience difficulties in interpreting and responding to complex movement patterns, such as those involved in team formations or tactical play scenarios.

Table 3. Descriptive Statistics by Spatial Thinking Components

Spatial Thinking Component	Mean	Standard Deviation (SD)
spatial visualization: Students' ability to mentally visualize body or object movement and positional transformation is relatively well-developed.	4,15	1,12
mental rotation: Students' ability to perform mental rotation remains at a moderate to low level, which may hinder quick decision-making during movement-based activities.	3,45	1,29
spatial orientation: Students' awareness of relative position in game space is fairly adequate	3,82	1,21
spatial relation Students' ability to identify and interpret spatial relationships among objects or players is relatively weak	3,33	1,18

Overall, these findings indicate that while students' spatial visualization skills are relatively well-developed, the components of mental rotation and spatial relation require greater attention in the context of spatially grounded cognitive training within sports education.

Emotional Intelligence Description

Interpretation of the emotional intelligence scores (Table 4) indicates that, overall, students' emotional intelligence levels fall within a relatively high category, as reflected by a mean score of 95.73 within a score range of 73.1 to 118.1. This suggests that the majority of students in the sample demonstrated well-developed abilities in key emotional domains, including self-awareness, constructive emotional regulation, self-motivation, empathy, and the ability to build healthy interpersonal relationships.

Interpretation of the emotional intelligence scores (Table 4) indicates that, overall, students' emotional intelligence levels fall within a relatively high category, with a mean score of 95.73 (range 73.1–118.1). The standard deviation of 8.93 and variance of 79.81 indicate a moderate level of variability among individuals, suggesting that while most students scored relatively high, some scored considerably above or below the average.

Table 4. Descriptive Statistics of Emotional Intelligence

Statistic	Value
Sample Size	387
Maximum Score	118,1
Minimum Score	73,1
Mean Score	95,72727777
Standard Deviation	8,93338554
Variance	79,80537721

Self-Efficacy Description

Descriptive analysis of self-efficacy revealed that scores among the 387 students ranged from 10.0 to 40.7, with a mean of 27.28 and a standard deviation of 4.94. The variance of 24.42 reflects a moderate degree of variability in students' confidence in their academic abilities. The mean score, which falls within the moderate range, indicates that students generally possess a fair level of self-belief in completing academic tasks; however, there remains room for improvement, particularly among those whose scores fall in the lower range. The detailed descriptive statistics are presented in Table 5.

Table 5 Statistik Deskriptif Self Efficacy

Statistic	Value
Sample Size	387
Maximum Score	40,7
Minimum Score	10,0
Mean Score	27,28194527
Standard Deviation	4,941229438
Variance	24,41574836

These findings suggest that some students may experience doubt regarding their own capabilities, particularly when faced with complex or abstract learning challenges.

Academic Achievement Description

Based on the results of the descriptive analysis, students' academic achievement scores ranged from 10.34 to 93.10, with a mean score of 47.60. The standard deviation of 21.17 and variance of 448.12 indicate a high level of variability in academic achievement across individuals. The large standard deviation suggests that the score distribution is widely dispersed from the mean, reflecting a substantial gap between students with high and low academic achievement. The high variance further highlights the heterogeneity in students' understanding of sport content, encompassing both fundamental conceptual knowledge and the ability to solve procedural and applied problems. The descriptive statistics are presented in Table 6.

Table 6. Statistics of Academic Achievement

Statistic	Value
Sample Size	387
Maximum Score	93,10
Minimum Score	10,34
Mean Score	47,59868128
Standard Deviation	21,16879746
Variance	448,1179861

The mean score, which remains below the national standard passing threshold, indicates that the majority of students have not yet achieved an optimal level of mastery in sport content.

Inferential Analysis

To examine the structural relationships among the variables in this study, path analysis was conducted using SPSS version 26 and AMOS. Prior to performing the path analysis, all data were tested to ensure that the basic statistical assumptions were met..

Multicollinearity Test

This test was conducted to determine whether strong linear relationships existed among the predictor variables within each substructure of the model. The results of the multicollinearity test are presented in Table 7, indicating that all Variance Inflation Factor (VIF) values were below 10, and all Tolerance values exceeded 0.1. For instance, in the first substructure, the paths X1 → Y and X2 → Y showed VIF values of 1.017 and Tolerance values of 0.983. Similarly, in the second substructure, the path Y → Z yielded a VIF value of 1.141 and a Tolerance value of 0.877. These results indicate the absence of multicollinearity symptoms in the research model.

Table 7. Multicollinearity Test Results

Substructure	Path	*Tolerance*	VIF	Remark
1	$X_1 \rightarrow Y$	0,983	1,017	No multicollinearity detected
	$X_2 \rightarrow Y$	0,983	1,017	No multicollinearity detected
	$X_1 \rightarrow Z$	0,943	1,060	No multicollinearity detected
2	$X_2 \rightarrow Z$	0,909	1,100	No multicollinearity detected
	$Y \rightarrow Z$	0,877	1,141	No multicollinearity detected

Note: VIF < 10 and Tolerance > 0.1 indicate that multicollinearity is not present among predictor variables.

Homoscedasticity Assumption

This test was conducted to ensure that the residual variances remained constant across all levels of the predictor variables. The Glejser test was employed for this purpose, and the results indicated that all significance values for the regression paths exceeded 0.05. For instance, the significance value for the path X1 → Y was 0.734, and for Y → Z, it was 0.315, as presented in Table 8. These results confirm that there was no indication of heteroscedasticity, and thus, the assumption of homoscedasticity was satisfied.

Table 8. Homoscedasticity Test Results (Glejser Method)

Substructure	Path	Significance	Remark
1	$X_1 \rightarrow Y$	0,734	No heteroscedasticity detected
	$X_2 \rightarrow Y$	0,101	No heteroscedasticity detected
	$X_1 \rightarrow Z$	0,132	No heteroscedasticity detected
2	$X_2 \rightarrow Z$	0,567	No heteroscedasticity detected
	$Y \rightarrow Z$	0,315	No heteroscedasticity detected

The model employed in this study was recursive, meaning that all relationships among variables were unidirectional, with no reciprocal effects. It consisted of two exogenous variables (spatial thinking ability and emotional intelligence) and two endogenous variables (self-efficacy and academic achievement). This specification satisfies a key requirement in path analysis by avoiding estimation bias that may result from simultaneous or bidirectional relationships..

Linearity Test

The linearity test was conducted to ensure that the relationships between predictor and dependent variables were linear in nature. The results of the linearity test, performed using the lack-of-fit method, are presented in Table 9. All significance values exceeded 0.05. For instance, the path X1 → Y yielded a significance value of 0.178, while Y → Z produced a value of 0.166. These results indicate that the relationships among the variables in the model are linear, and thus the linearity assumption is satisfied.

Table 9. Linearity Test Results

‘	Path	Significance
1	$X_1 \rightarrow Y$	0,178
	$X_2 \rightarrow Y$	0,758
	$X_1 \rightarrow Z$	0,152
2	$X_2 \rightarrow Z$	0,217
	$Y \rightarrow Z$	0,166

Based on the overall results of assumption testing—including data scale, multicollinearity, homoscedasticity, linearity, and model recursiveness—it can be concluded that the dataset is suitable for analysis using path analysis techniques. Accordingly, the theoretical model and research hypotheses were tested using AMOS to estimate both direct and indirect effects among the variables under investigation.

Path analysis

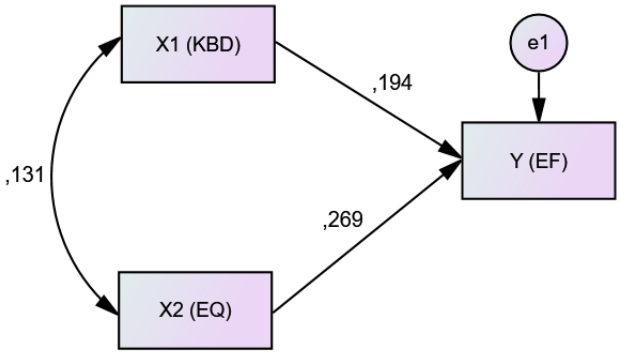
Path analysis was conducted to examine the causal relationships among four variables, comprising two exogenous variables (Spatial Thinking Ability and Emotional Intelligence), one mediating variable (Self-Efficacy), and one endogenous variable (Academic Achievement). The analysis was carried out through two substructures and supported by SPSS version 26 and AMOS version 24 to estimate path coefficients and determine the significance of relationships among the variables..

Based on the analysis results for Substructure 1, as presented in Table 10, it was found that Spatial Thinking Ability (X1) and Emotional Intelligence (X2) jointly contributed 12.3% to the variance in Self-Efficacy (Y), with a coefficient of determination of $R^2 = 0.123$. The remaining 87.7% of the variance was accounted for by other variables not included in the model. Individually, Spatial Thinking Ability had a significant effect on Self-Efficacy, with a standardized path coefficient of 0.194 and a t-value of 4.022 ($p < 0.05$). Similarly, Emotional Intelligence also showed a significant effect on Self-Efficacy, with a standardized path coefficient of 0.269 and a t-value of 5.576 ($p < 0.05$). The path model for Substructure 1 is illustrated in Figure 2.

Table 10 Results of Substructure1 Analysis

Model	Standardized Coefficient Beta	T	Sig. coefficient	R^2	F	Sig. Anova
Sub_1				0,123	27,034	0,000
$X_1 \rightarrow Y$	0,194	4,022	0,000			
$X_2 \rightarrow Y$	0,269	5,576	0,000			
$X_1 \leftrightarrow X_2$	0,131					

Figure 2 Path Model Diagram for Substructure 1



These findings highlight the important roles of both predictor variables, spatial thinking ability and emotional intelligence, in shaping students' self-efficacy. Spatial thinking ability, which reflects an individual's capacity to visualize, manipulate, and interpret spatial relationships within a representation, appears to enhance students' sense of capability and confidence in completing academic tasks that involve abstract conceptual understanding or geometric visualization. Meanwhile, high emotional intelligence enables students to recognize, regulate, and constructively apply emotions, which in turn strengthens their belief in their personal ability to complete tasks and achieve goals.

Substructure 2: The Influence of Spatial Thinking Ability, Emotional Intelligence, and Self-Efficacy on Academic Achievement

Substructure 2 examined the effects of spatial thinking ability, emotional intelligence, and self-efficacy on students' academic achievement, as presented in Tables 11, 12, and 13. The analysis revealed that these three variables collectively contributed 37.2% to the variance in academic achievement, as indicated by the coefficient of determination ($R^2 = 0.372$). This means that more than one-third of the variation in students' achievement can be explained by the combined effects of cognitive-spatial abilities, emotional competencies, and academic self-belief.

Table 11. Results of Substructure 2 Analysis

Model	Standardized Coefficient Beta	T	Sig. coefficient	R^2	F	Sig. Anova
Sub_2				0,372	75,735	0,000
$X_1 \rightarrow Z$	0,398	9,543	0,000			
$X_2 \rightarrow Z$	0,052	1,237	0,217			
$Y \rightarrow Z$	0,360	8,315	0,000			

Table 12. Indirect Effect Test Results

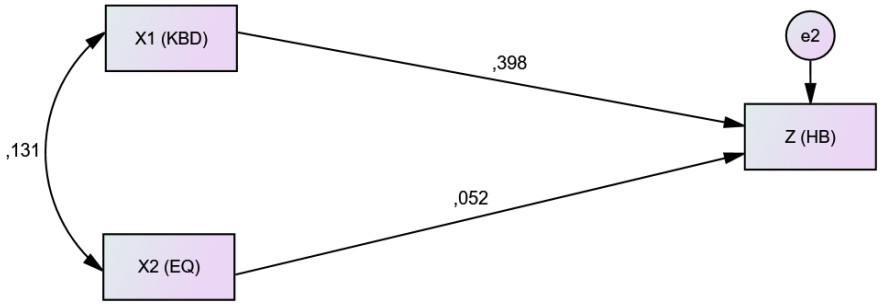
	X_2	X_1	Y
Y	0,000	0.000	0,000
Z	0,097	0,070	0,000

Table 13. Unstandardized Coefficients – Substructure 1 and 2

Variable	Beta (Unstandardized)	Standard Error (SE)
$X_1 \rightarrow Y$	0,153	0,038
$X_2 \rightarrow Y$	0,149	0,027
$X_1 \rightarrow Z$	1,344	0,141
$X_2 \rightarrow Z$	0,124	0,101
$Y \rightarrow Z$	1,540	0,185

Individually, spatial thinking ability exhibited the strongest and most significant effect on academic achievement ($\beta = 0.398$; $t = 9.543$; $p < 0.05$). This finding affirms that students with well-developed spatial skills (such as the ability to visualize shapes, understand rotations or transformations, and interpret spatial relationships among objects) are more likely to demonstrate a deeper understanding of concepts. Self-efficacy also showed a significant effect on academic achievement ($\beta = 0.360$; $t = 8.315$; $p < 0.05$), indicating that students with greater confidence in their academic abilities tend to perform better. In contrast, emotional intelligence did not demonstrate a statistically significant direct effect on academic achievement ($\beta = 0.052$; $t = 1.237$; $p > 0.05$). This suggests that while emotional intelligence contributes to the development of self-efficacy (as evidenced in Substructure 1), its impact on academic achievement is primarily indirect. A visual representation of this model is provided in Figure 3.

Figure 3. Substructure Model 2



Overall, these findings suggest that in the context of sport learning, strengthening spatial ability and enhancing self-efficacy are two key priorities that should be emphasized. Meanwhile, interventions targeting affective aspects (such as emotional intelligence) may serve as foundational support for students' self-regulation, even if they do not directly impact academic achievement. A cognitively and affectively integrated instructional strategy thus represents a relevant and effective approach to fostering optimal learning outcomes.

Indirect Effects: The Mediating Role of Self-Efficacy

The path analysis results for indirect effects revealed the significant mediating role of self-efficacy in bridging the relationship between spatial thinking ability and emotional intelligence with academic achievement. These findings suggest that the development of students' academic self-belief plays a crucial role in amplifying the impact of both cognitive and affective factors on academic achievement.

First, spatial thinking ability was found to have a significant indirect effect on achievement through self-efficacy, with an effect size of 0.070. The Sobel test yielded a z-value of 3.6246 ($p = 0.0003 < 0.05$), indicating a statistically significant mediating effect. This suggests that students with strong spatial skills not only demonstrate direct understanding of sport content, but also develop higher academic self-confidence, which in turn contributes to their academic success..

Second, emotional intelligence also demonstrated a significant indirect effect on academic achievement through self-efficacy, with an effect size of 0.097 and a Sobel test result of $z = 4.5996$ ($p = 0.0000 < 0.05$). This indicates that self-efficacy serves as a critical pathway through which students with high emotional intelligence are able to actualize their academic potential. The ability to manage emotions, recognize one's own feelings, and sustain internal motivation ultimately strengthens their confidence in overcoming academic challenges. visual representation of these findings is presented in Figure 4 and Table 4.

Figure 4 Diagram Path Analysis

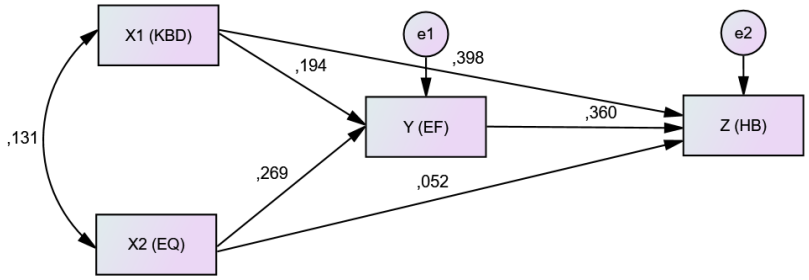


Table 14. Calculation of the Influence of Exogenous Variables on Endogenous Variables After Analysis

Variable	Direct to		Indirect to Z	Total Direct to Z
	Y	Z		
X_1	0,194	0,398	0,070	0,468
X_2	0,269	0,052	0,097	0,149
Y	-	0,360	-	0,360

Based on the results of the analysis and hypothesis testing, the path coefficients and residual error values for Structural Equations 1 and 2 are presented as follows:

$$Z = 0{,}398X1 + 0{,}052X2 + 0{,}360Y$$

$$Y = 0{,}194X1 + 0{,}269X2$$

Furthermore, a comparison of the total effects of each exogenous variable on academic achievement, as presented in Table 14, reveals that spatial thinking ability contributes a total effect of 0.468, comprising a direct effect of 0.398 and an indirect effect of 0.070. This indicates that spatial ability is the most dominant factor influencing students' academic achievement in sport. In contrast, emotional intelligence contributes a smaller total effect of 0.149, which includes a direct effect of 0.052 and an indirect effect

of 0.097. Meanwhile, self-efficacy contributes a direct effect of 0.360 on academic achievement, with no indirect pathways involved.

Discussion

The analysis revealed that both spatial thinking ability and emotional intelligence had a positive and statistically significant effect on self-efficacy. Students with high spatial thinking ability tend to be more confident in completing academic tasks, as they are capable of mentally visualizing, manipulating, and evaluating objects or concepts in space. This ability provides cognitive advantages when facing problems that require understanding of spatial relationships (Casadiego et al., 2023; Kotsopoulos et al., 2017; Şahin et al., 2020). When students feel capable of flexibly constructing and exploring visual representations, they develop a belief in their capacity to overcome academic challenges, thereby strengthening their self-efficacy (Montenegro et al., 2018; Yao, 2022). In this sense, spatial thinking contributes not only to cognitive performance but also reinforces affective dimensions through positive self-perception. However, not all components of spatial thinking contribute positively to self-efficacy. For instance, fluency in generating multiple spatial representations or ideas may lead to confusion or self-doubt if not accompanied by adequate evaluative mechanisms. Therefore, the relationship between spatial thinking and self-efficacy may be influenced by the task context, learning strategies, and students' prior experiences of success.

Emotional intelligence plays a crucial role in shaping students' self-belief within academic contexts (Acebes-Sánchez et al., 2021; Cifuentes & Mena, 2023; Mercader-Rubio et al., 2023). Students who are able to understand and regulate their emotions effectively tend to exhibit greater emotional stability when facing academic pressure or failure (Rubio et al., 2022). This capacity supports the development of a positive self-perception, which is reflected in higher levels of self-efficacy. Such students are also more likely to sustain intrinsic motivation, maintain focus, and engage productively with their learning environment, all of which reinforce their confidence in their academic abilities (Khozaei et al., 2022; Mercader-Rubio et al., 2023; Rogowska et al., 2022). Although the relationship between emotional intelligence and self-efficacy is generally positive, not all individuals respond to emotional experiences in the same way. Some students may possess strong emotional intelligence yet still harbor doubts about their academic competence due to prior academic failures or unsupportive learning environments (Nolte & Pamperien, 2017). This highlights the complex nature of the relationship, which may be influenced by mediating variables such as social support, goal orientation, or task perception. For sports education students, who frequently face dual demands from both athletic training and academic performance, emotional intelligence provides an essential resource for maintaining confidence and stability in their studies.Therefore, efforts to strengthen academic self-efficacy in higher education should involve the simultaneous and context-sensitive development of both spatial thinking skills and emotional intelligence

Furthermore, the integration of spatial thinking ability and emotional intelligence can generate a positive synergy in the development of students' academic self-efficacy. When confronted with complex academic tasks, spatial thinking enables students to visually and flexibly explore multiple solution pathways, while emotional intelligence helps them remain calm, focused, and motivated in completing the task (Casadiego et al., 2023; Kotsopoulos et al., 2017). This combination allows students not only to understand problems at a deeper level but also to believe in their ability to overcome them. In other words, academic success is shaped not solely by cognitive strength, but also by affective capacity, particularly the ability to manage emotions and maintain confidence in one's academic potential (Ogrodzka-Mazur et al., 2017; Suria Martinez, 2023). This synergy is especially critical for students in sports education programs, where academic persistence must coexist with physically demanding training schedules and competitive pressures. These insights highlight the importance of instructional approaches that foster both cognitive and affective domains in a balanced manner, in order to cultivate resilient and self-directed learners capable of facing academic challenges independently.

The analysis showed that spatial thinking ability and self-efficacy had a significant positive effect on academic achievement, whereas emotional intelligence did not demonstrate a statistically significant direct effect. Spatial thinking ability was found to have a positive and significant direct effect on aca-

demic achievement. This finding suggests that students with strong spatial skills tend to better comprehend abstract concepts, visually organize information, and approach academic tasks with greater flexibility. Even in closed-ended problems with a single correct answer, spatial thinking plays a role in enabling students to explore multiple solution strategies before selecting the most effective one (Harris et al., 2023). This result aligns with the view that spatial thinking is not only relevant in domains such as geometry or visual sciences, but also contributes to overall academic achievement due to its association with mental representation and information manipulation. In the context of sports education, this reinforces the idea that spatial skills practiced during athletic performance (such as tactical visualization, positional awareness, and movement planning) can also support success in theoretical and conceptual academic learning.

While emotional intelligence contributed positively to academic achievement, its influence was not statistically significant. This suggests that, in certain contexts, affective factors such as emotional regulation, empathy, and self-awareness may not serve as primary determinants of academic success, particularly when academic tasks are predominantly driven by logical and cognitive demands (Cifuentes & Mena, 2023; Martinez-Lorca et al., 2023; Syamsinar, 2024). Nevertheless, emotional intelligence remains important as a supporting factor for emotional stability and resilience in the face of academic pressure, even if its role does not always manifest directly in measurable academic outcomes (Fernández-Espínola & Almagro, 2019; López et al., 2021; Marheni et al., 2024; Rubio et al., 2022). Self-efficacy demonstrated a significant direct effect on academic achievement. Students who believe in their capabilities tend to be more motivated, persistent, and resilient when facing academic challenges. This confidence enables them to set higher learning goals, manage their time effectively, and seek alternative strategies when encountering obstacles (Liu et al., 2021; Street et al., 2022). For students in sports education programs, this role of self-efficacy is even more decisive, as they must consistently balance study demands with training and competition, making strong self-belief essential to academic survival and success.

Furthermore, the interaction among these three variables suggests that optimal academic achievement does not rely solely on cognitive strength, such as spatial thinking, but also on affective and metacognitive capacities embedded within self-efficacy. When students are able to combine visual-spatial representation with a strong sense of self-belief, they not only gain a conceptual understanding of the material but also develop the courage to experiment, fail, and learn through the process. This holistic interaction is particularly urgent to investigate in the context of sports education students, who represent a population often overlooked in prior research despite their unique dual responsibility of academic achievement and athletic performance. This underscores the need for instructional strategies that simultaneously cultivate spatial, emotional, and psychological capacities to holistically enhance academic achievement

Conclusions

Based on the analysis and discussion, this study concludes that spatial thinking ability, emotional intelligence, and self-efficacy contribute to students' academic achievement, both directly and indirectly. Spatial thinking emerged as the most dominant predictor, influencing both self-efficacy and academic achievement. Students who are able to flexibly visualize concepts tend to exhibit greater confidence in completing academic tasks. Self-efficacy also played a significant mediating role, linking cognitive and affective factors to academic outcomes. In contrast, emotional intelligence (although positively associated with self-efficacy) did not have a statistically significant direct effect on academic achievement. This suggests that emotional intelligence serves more as a psychological support mechanism than a primary determinant of academic success.

This study has several limitations. First, the use of a correlational quantitative design does not allow for the establishment of explicit causal relationships. Second, the sample was drawn from a single educational institution, which may limit the generalizability of the findings to other cultural or institutional contexts. Third, the reliance on self-report instruments may introduce subjective bias from respondents. Fourth, the analysis did not explore the specific contributions of individual dimensions within spatial thinking or emotional intelligence to self-efficacy and academic achievement. Given these findings and limitations, future research is recommended to adopt a mixed-methods approach in order to gain a more

comprehensive understanding, both quantitatively and qualitatively. Further studies should also examine which specific dimensions of spatial thinking and emotional intelligence are most relevant to academic achievement, and include participants from diverse institutions to enhance the generalizability of results. Additionally, experimental studies (such as interventions focused on enhancing self-efficacy through visualization training or emotional regulation) could serve as more applicable alternatives for translating research into practice.

The findings of this study underscore the importance of strengthening instructional strategies that integrate both cognitive and affective dimensions of student development. University lecturers and curriculum designers are encouraged to design learning activities that stimulate visual representation and promote spatial exploration, while simultaneously fostering students' academic self-efficacy. Emotional skills training, such as self-regulation, perseverance, and intrinsic motivation, should also be incorporated to help students cope with academic pressures. Thus, improving academic achievement should not be viewed solely through the lens of intellectual capacity. Rather, it requires a synergistic interplay of cognitive, affective, and metacognitive competencies, cultivated through contextualized and sustained pedagogical practices. This integrated approach may contribute to the development of resilient, confident, and conceptually competent learners in higher education settings

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References

Acebes Sánchez, J., Granado Peinado, M., & Marchena Giráldez, C. (2021). Relación entre inteligencia emocional y ansiedad en un club de fútbol sala de Madrid (Relationship between emotional intelligence and anxiety in a futsal club from Madrid). Retos, 39, 643–648. https://doi.org/10.47197/retos.v0i39.81975

Andersen, M. B., Van Raalte, J. L., & Brewer, B. W. (2001). Sport psychology service delivery: Staying ethical while keeping loose. *Professional Psychology: Research and Practice*, *32*(1), 12 -28. https://doi.org/10.1037/0735-7028.32.1.12

Boyatzis, R., Goleman, D., & Rhee, K. (2000). Clustering competence in emotional intelligence: Insights from the Emotional Competence Inventory (ECI). In *Handbook of Emotional Intelligence*.

Campos, M. J. C., Ferreira, J. C., Morais, M., & Rodrigues, G. (2022). Validación de la versión Portuguesa de la self-efficacy scale for physical education teacher education major toward children with disabilities (Validation of the Portuguese version of the self-efficacy scale for physical education teacher education major. Retos, 45, 558–565. https://doi.org/10.47197/retos.v45i0.91868

Casadiego, A. M., Bermejo, V. S., & Fernandez, V. B. (2023). Spatial thinking skills mediated by communication processes in preschool children. *Retos*, *48,* 74–85. https://doi.org/10.47197/retos.v48.89684

Cifuentes, J. D. H., & Mena, E. B. (2023). The emotional intelligence in university students from Colombia and Spain who practice relaxation techniques. *Retos*, *49*, 478–484. https://doi.org/10.47197/retos.v49.98006

Davis, P., Halvarsson, A., Lundström, W., & Lundqvist, C. (2019). Alpine Ski Coaches' and Athletes' Perceptions of Factors Influencing Adaptation to Stress in the Classroom and on the Slopes. *Frontiers in Psychology*, *10(1), 124 - 135*. https://doi.org/10.3389/fpsyg.2019.01641

Engelke, E. C., & Frederickson, K. (2022). Dual Collegiate Roles—The Lived Experience of Nursing Student Athletes. *Journal of Nursing Education*, *61*(3), 177 - 122. https://doi.org/10.3928/01484834-20220109-01

Falcón Miguel, D., Sevil-Serrano, J., Peñarrubia-Lozano, C., & Abós-Catalán, Ángel. (2021). Efecto de la combinación metodológica de aula invertida e instrucción entre pares en las calificaciones académicas de estudiantes universitarios de Ciencias de la Actividad Física y del Deporte (Effect of the methodological combination based on flipped c. Retos, 41, 47–56. https://doi.org/10.47197/retos.v0i41.83984

Fernández-Espínola, C., & Almagro, B. J. (2019). Relación entre motivación e inteligencia emocional en Educación Física: una revisión sistemática (Relation between motivation and emotional intelligence in Physical Education: A systematic review). Retos, 36, 584–589. https://doi.org/10.47197/retos.v36i36.64968

Folgado dos Santos, J. M., Patricio Duarte Petrica, J. M., Serrano, J. J. M., Batista, M. A. da S., Honório, S. A. de A., & Maia, L. A. C. R. (2020). The attention of students during physical education class based on academic performance (La atención de los estudiantes durante la clase de educación física basada en el rendimiento académico). Retos, 38, 222–228. https://doi.org/10.47197/retos.v38i38.74650

Haciomeroglu, E. S., Chicken, E., & Dixon, J. K. (2013). Relationships between Gender, Cognitive Ability, Preference, and Calculus Performance. *Mathematical Thinking and Learning*, *15*(3), 175–189. https://doi.org/10.1080/10986065.2013.794255

Harris, D., Logan, T., & Lowrie, T. (2023). Spatial visualization and measurement of area: A case study in spatialized mathematics instruction. *Journal of Mathematical Behavior*, *70*(May 2022), 101038. https://doi.org/10.1016/j.jmathb.2023.101038

Ihsan, H., Bernard, B., & Sa'diyyah, F. N. . (2024). Pengaruh Kecerdasan Linguistik, Kecerdasan Emosional, Kecerdasan Adversitas, dan Kecerdasan Spasial terhadap Hasil Belajar Geometri Peserta Didik. *Kognitif: Jurnal Riset HOTS Pendidikan Matematika*, *4*(1), 307–318. https://doi.org/10.51574/kognitif.v4i1.1475

Khozaei, S. A., Zare, N. V., Moneghi, H. K., Sadeghi, T., & Taraghdar, M. M. (2022). Effects of quantum-learning and conventional teaching methods on learning achievement, motivation to learn, and retention among nursing students during critical care nursing education. *Smart Learning Environments*, *9*(1), 323 - 341. https://doi.org/10.1186/s40561-022-00198-7

Kotsopoulos, D., Zambrzycka, J., & Makosz, S. (2017). Gender Differences in Toddlers' Visual-Spatial Skills. *Mathematical Thinking and Learning*, *19*(3), 167–180. https://doi.org/10.1080/10986065.2017.1328634

Lacruz, A., & Cunha, E. (2018). Project management office in non-governmental organizations: an ex post facto study. *Revista de Gestao*, *25*(2), 212 - 227. https://doi.org/10.1108/REGE-03-2018-033

Liu, L., Luo, X., & Wang, Y. (2021). Student self-efficacy on personal and social responsibility within a sport education model. *Revista de Cercetare Si Interventie Sociala*, *72(1), 236 - 247*. https://doi.org/10.33788/rcis.72.15

López, S. G., Zurita Ortega, F., Ubago Jiménez, J. L., & González Valero, G. (2021). Importancia de la actividad física sobre la inteligencia emocional y diferencias de género (Impact of physical activity on emotional intelligence and sex differences). Retos, 42, 636–642. https://doi.org/10.47197/retos.v42i0.86448

Martínez-Lorca, M., Zabala-Baños, M. C., Morales Calvo, S., Romo, R. A., & Martínez-Lorca, A. (2023). Assessing emotional, empathic and coping skills in Spanish undergraduates in Health Sciences and Social Sciences. *Retos*, *47*, 126–137. https://doi.org/10.47197/retos.v47.94344

Marheni, E., S, A., Purnomo, E., Nina, J., & Cahyani, F. I. (2024). Integración de la inteligencia emocional y la educación mental en el deporte para mejorar la resiliencia personal de los adolescentes (Integrating Emotional Intelligence and Mental Education in Sports to Improve Personal Resilience of Adolescents). Retos, 51, 649–656. https://doi.org/10.47197/retos.v51.101053

Martinez-Lorca, M., Criado-Álvarez, J. J., Aguado Romo, R., & Martinez-Lorca, A. (2023). The impact of mental health, affectivity, emotional intelligence, empathy and coping skills in Occupational Therapy students. Retos, 50, 113–126. https://doi.org/10.47197/retos.v50.99384

Mercader-Rubio, I., Ángel, N. G., Silva, S., Furtado, G., & Brito-Costa, S. (2023). Intrinsic Motivation: Knowledge, Achievement, and Experimentation in Sports Science Students—Relations with Emotional Intelligence. *Behavioral Sciences*, *13*(7), 136 - 147. https://doi.org/10.3390/bs13070589

Montenegro, P., Costa, C., & Lopes, B. (2018). Transformations in the Visual Representation of a Figural Pattern. *Mathematical Thinking and Learning*, *20*(2), 91–107. https://doi.org/10.1080/10986065.2018.1441599

Nolte, M., & Pamperien, K. (2017). Challenging problems in a regular classroom setting and in a special foster programme. *ZDM - Mathematics Education*, *49*(1), 121–136. https://doi.org/10.1007/s11858-016-0825-5

Ogrodzka-Mazur, E., Szafrańska, A., Malach, J., & Chmura, M. (2017). The use of E-learning resources by academic teachers– A Polish-Czech comparative study. *New Educational Review*, *50*(4), 169–185. https://doi.org/10.15804/tner.2017.50.4.14

Ridwan, M. ., Syam Tuasikal, A. R., Januarumi Marhaendra, F., Oky Ristanto, K. ., Gazali, N. ., Monterrosa-Quintero, A., … Setiawan, E. . (2023). ¿La preparación tecnológica y la psicología se correlacionan con el rendimiento académico de los estudian-tes-atletas de élite a nivel universitario? (Technology Readiness and Psychological Correlate with Academic Achievement of Elite Student-Athletes at the College Level?). *Retos*, *50*, 628–634. https://doi.org/10.47197/retos.v50.99398

Rogowska, A. M., Tataruch, R., Niedźwiecki, K., & Wojciechowska-Maszkowska, B. (2022). The Mediating Role of Self-Efficacy in the Relationship between Approach Motivational System and Sports Success among Elite Speed Skating Athletes and Physical Education Students. *International Journal of Environmental Research and Public Health*, *19*(5), 156 - 172. https://doi.org/10.3390/ijerph19052899

Rubio, I. M., Ángel, N. G., Esteban, M. D. P., & Ruiz, N. F. O. (2022). Emotional Intelligence as a Predictor of Motivation, Anxiety and Leadership in Athletes. *International Journal of Environmental Research and Public Health*, *19*(12), 7521 - 7534. https://doi.org/10.3390/ijerph19127521

Şahin, Ş., Şahin, E., Sağdilek, E., Vatansever, Ş., Birinci, Y. Z., Güngör, A. K., & Kızıltan, E. (2020). The Comparison of Mental Rotation Performances and Academic Achievements in Students of the Faculty of Sport Sciences and Education Sciences. *Journal of Education and Learning*, *9*(3), 76 - 82. https://doi.org/10.5539/jel.v9n3p66

Sánchez Molina, A., González Martí, I., & Hernández Martínez, A. (2021). Percepción del profesorado de Educación Física sobre el Aprendizaje Cooperativo y su relación con la Inteligencia Emocional (Physical Education teacher´s perception of Cooperative Learning and its relation to Emotional Intelligence). Retos, 41, 735–745. https://doi.org/10.47197/retos.v41i0.86198

Sharma, R. R. (2019). Evolving a Model of Sustainable Leadership: An Ex-post Facto Research. *Vision*, *23*(2), 152 - 169. https://doi.org/10.1177/0972262919840216

Street, K. E. S., Malmberg, L. E., & Stylianides, G. J. (2022). Changes in students' self-efficacy when learning a new topic in mathematics: a micro-longitudinal study. *Educational Studies in Mathematics*, *111*(3), 515–541. https://doi.org/10.1007/s10649-022-10165-1

Suria Martínez, R. (2023). Relación entre dimensiones de autoeficacia y metas académicas en estudiantes universitarios con movilidad reducida (Relationship between dimensions of self-efficacy and academic goals in university students with reduced mobility). Retos, 48, 420–428. https://doi.org/10.47197/retos.v48.97029

Syamsinar, S. (2025). Pengaruh Efikasi Diri, Kemandirian Belajar dan Keterampilan Sosial terhadap Hasil Belajar Matematika Melalui Motivasi Berprestasi . *Kognitif: Jurnal Riset HOTS Pendidikan Matematika*, *5*(1), 96–109. https://doi.org/10.51574/kognitif.v5i1.1963

Turan, M. B., & Koç, K. (2018). The impact of self-directed learning readiness on critical thinking and self-efficacy among the students of the school of physical education and sports. *International Journal of Higher Education*, *7*(6), 98 - 105. https://doi.org/10.5430/ijhe.v7n6p98

Wei, C., Su, R., & Hsu, M. (2020). Effects of tpsr integrated sport education model on football lesson students' responsibility and exercise self-efficacy. *Revista de Cercetare Si Interventie Sociala*, *71(1), 126 - 136*. https://doi.org/10.33788/rcis.71.8

Yao, X. (2022). Representation transformations in transition from empirical to structural generalization. *Journal of Mathematical Behavior*, *66*(April), 100964. https://doi.org/10.1016/j.jmathb.2022.100964

Yurekli, B., Isiksal Bostan, M., & Cakiroglu, E. (2020). Sources of preservice teachers' self-efficacy in the context of a mathematics teaching methods course. *Journal of Education for Teaching*, *00*(00), 1–15. https://doi.org/10.1080/02607476.2020.1777068

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