# Psychosocial predictors of academic achievement in physical education among Indonesian university students: Testing the mediating role of mental toughness

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## ABSTRACT

**Background:** Academic performance in this context is conceptualized holistically, encompassing the integration of cognitive, affective, psychomotor, and physical achievements. Grounded in Self-Determination Theory and Social Cognitive Theory, the study posits that physical activity interest and social skills serve as predictors of both mental toughness and academic outcomes.

**Objectives:** This study examines the mediating role of mental toughness in the relationship between physical activity interest, social skills, and academic performance among university students enrolled in physical education programs.

**Methods:** A quantitative approach was employed, involving the administration of structured questionnaires to 235 active students. Data were analyzed using Structural Equation Modeling with a Partial Least Squares approach to assess construct validity and the relationships among variables.

**Results:** The results reveal that interest in physical activity and social skills has a significant influence on both mental toughness and academic performance. However, mental toughness did not serve as a substantial mediator within the proposed model.

**Conclusions:** These findings underscore the critical direct roles of affective and social factors in predicting academic success in physical education contexts. Theoretically, this study clarifies the functional position of mental toughness, while practically, it promotes the development of instructional strategies that enhance intrinsic motivation and collaborative skills within physical education curricula.

**Keywords:** academic achievement; higher education; mental toughness; physical activity interest; physical education; social skills.

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## INTRODUCTION

Physical education at the higher education level is not solely focused on physical development, but also plays a significant role in promoting students' psychosocial growth (Li, 2011; Synytsia et al., 2025) and academic development (Machado et al., 2021; Trudeau & Shephard, 2010). In this context, academic success is not determined merely by cognitive ability but also encompasses affective, psychomotor, and physical dimensions, which are integral components of learning outcomes in higher education physical education programs. This indicates that academic achievement in physical education is inherently holistic (Sprake & Walker, 2015; Syaukani et al., 2023), reflecting students' ability to integrate theoretical knowledge with practical skills, attitudes, and physical capacities.

One of the key constructs related to students' active engagement in physical education is their interest in physical activity (Lobo et al., 2023). This interest can be explained through the lens of Self-Determination Theory (SDT), which has been widely employed to understand individual engagement in physical education and sports contexts (Deci et al., 2017; Vasconcellos et al., 2020). SDT posits that intrinsic motivation emerges when individuals experience autonomy, competence, and relatedness as basic psychological needs (Gerber et al., 2012; Ryan & Deci, 2020). Students who fulfill these needs through physical education activities are more likely to engage physically and cognitively in the learning process. In the present study, SDT is not modeled explicitly but rather serves as a theoretical foundation for understanding the emergence of interest in physical activity, as has been established in previous research (Chen et al., 2020; Deci et al., 2017; Vasconcellos et al., 2020).

Moreover, social skills are a critical competency within physical education environments that emphasize teamwork, collaboration, and interpersonal interaction. The development of these skills can be explained by Social Cognitive Theory (SCT), which views social learning as a product of the reciprocal interaction between personal, environmental, and behavioral factors (Bandura, 1999). Physical education students acquire social competencies through observation, modeling, and direct engagement within dynamic social contexts.

In this framework, mental toughness is positioned as a mediating variable, functioning as a psychological mechanism that links students' affective and social experiences with their academic outcomes. Based on theoretical assumptions and empirical evidence, mental toughness is believed to develop through active participation in physical activity and positive social experiences, which subsequently enhance students' focus, resilience to stress, and academic motivation (Crust & Clough, 2011; Gerber et al., 2013). In other words, mental toughness serves as a bridge through which physical activity interest and social skills exert their full impact on academic achievement (Li et al., 2024; Mahoney et al., 2014). Thus, in the present model, mental toughness is examined as a potential mediator that explains the indirect influence of affective and social variables on academic performance (Liu & Huang, 2021). Although conceptually associated with performance-related resilience in competitive sport settings (Ventaja-Cruz et al., 2025), the role of mental toughness in academic contexts remains inconsistently evidenced in the literature (Fullerton et al., 2021; Kóródi & Szabó, 2019; Rudd et al., 2023).

Although extensive research has been conducted on physical activity interest, social skills, and mental toughness in Western contexts, studies in Indonesia remain relatively limited. Most previous research has focused on the relationship between

motivation and participation in physical activities (Purwandari, 2023; Syaukani et al., 2023) or highlighted the role of soft skills in physical education learning (Synytsia et al., 2025). However, studies specifically examining mental toughness as a psychological variable that mediates affective and social factors in relation to the academic achievement of physical education students in Indonesia are still scarce.

Several prior studies have highlighted pertinent limitations. For instance, Gerber et al. (2012) identified a correlation between physical activity and mental toughness; however, their investigation was confined to general health contexts, rather than academic achievement within physical education. Additionally, Crust et al. (2014) emphasized the importance of mental toughness for performance, although their research primarily focused on competitive sports environments rather than students enrolled in physical education programs. More recently, Li et al. (2024) examined the influence of sports interest on students' academic stress. Nonetheless, this study did not simultaneously investigate the interrelationships among interest, social skills, and mental toughness in predicting academic performance.

In light of these limitations, this study introduces a novel contribution by examining the mediating role of mental toughness in the relationship between interest in physical activity, social skills, and academic achievement, particularly within the context of higher education physical education in Indonesia. The theoretical contribution of this research lies in enriching the discourse on psychosocial factors in physical education by critically positioning mental toughness within an academic prediction model. From a practical perspective, the findings of this study are expected to provide strategic recommendations for lecturers and curriculum developers in physical education to emphasise the enhancement of students' interest in physical activity and social skills as more effective pathways to support academic achievement, rather than relying solely on the development of mental toughness.

Based on the aforementioned background, this study aims to examine both the direct and indirect effects of physical activity interest, social skills, and mental toughness on the academic performance of students enrolled in physical education. Employing the Structural Equation Modeling–Partial Least Squares (SEM-PLS) approach, the study is expected to make both theoretical and practical contributions to the development of a psychosocial-based model of physical education.

# METHODS

## Study Design and Participants

This study employed a quantitative approach to test a theoretically formulated model empirically. The quantitative method was chosen as it is appropriate for analyzing causal relationships among physical activity interest (PAI), social skills (SS), mental toughness (MT), and academic performance (AP), as recommended in previous methodological literature (Hair et al., 2017).

The study population consisted of students enrolled in a Physical Education program at an Indonesian university. A purposive sampling method was utilised, with the inclusion criteria as follows: (1) active student status, (2) participation in physical education courses or sports activities, either on or off campus, and (3) voluntary consent to participate in the study. The sample consisted of 235 Physical Education students, of whom 207 were male (88%), and 28 were female (12%), with a mean age of 20.6 years (SD = 1.4). This gender distribution aligns with the typical

demographic profile of Physical Education students in Indonesian universities, where male enrolment predominates.

## Ethical approval statement

The research process commenced with securing formal approval from both faculty and study programme administrators. Data collection was facilitated through an online questionnaire distributed via Google Forms. Prior to participation, individuals were informed about the study's objectives, data confidentiality measures, and the informed consent procedure. The questionnaire was designed to be completed within 10 to 15 minutes. Ethical clearance for this research was granted by the Research Ethics Committee of Universitas Muhammadiyah Surakarta, under Approval No. 1612/A.3-III/FKIP/X/2025. Participation in the study was entirely voluntary, and all participants provided written informed consent prior to data collection. Throughout the research, strict confidentiality and anonymity were maintained.

## Research Instruments

All constructs were measured using structured questionnaire items adapted from previously validated instruments. The questionnaire consisted of four main sections corresponding to the research variables. Respondents were asked to rate each item using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Physical Activity Interest (PAI). This construct measures the degree of students' engagement and enthusiasm in physical activities. The items were adapted from the instrument developed by Chen et al. (2020), encompassing aspects such as motivation, participation, and enjoyment. An example item is: "I feel enthusiastic about participating in physical activities outside of class hours".

Social Skills (SS). This construct was adapted from the Social Skills Rating System (SSRS) developed by Gresham & Elliot (1990), and applied in the physical education context by Poulou (2017). It assesses students' abilities to communicate, cooperate, and resolve interpersonal conflicts within social environments.

Mental Toughness (MT). Mental toughness was measured using the MTQ-18 scale, developed by Clough et al. (2002) and further validated by Gresham (2016). This scale comprises four dimensions: emotional control, commitment, challenge, and confidence. An example item is: "I stay focused even when under academic pressure."

Academic Performance (AP). Academic performance was measured based on students' self-perceptions of their academic outcomes. This method has been validated in prior educational psychology studies (Richardson et al., 2012). The scale includes indicators such as academic achievement, classroom participation, and task completion.

The research instruments were reviewed by three experts in physical education and sport psychology to ensure content validity. Reliability testing was conducted by calculating composite reliability and Cronbach's alpha using SEM-PLS analysis. All constructs met the recommended thresholds for reliability (CR $\geq$ 0.70) and convergent validity (AVE $\geq$ 0.50), as per the guidelines proposed by Hair et al. (2017).

## Data Analysis

Data were collected online using the Google Forms platform and subsequently exported to Microsoft Excel format for processing using SmartPLS version 4.1.1.2. The data analysis was conducted in two stages: (1) evaluation of the measurement model (outer model) to assess the validity and reliability of the constructs, and (2)

evaluation of the structural model (inner model) to examine the relationships among variables using bootstrapping with 5,000 resamples. Acceptance criteria included loading values greater than 0.70, AVE ≥ 0.50, CR ≥ 0.70, and statistical significance at $p < 0.05$.

# RESULTS

## Measurement Model Evaluation

The measurement model was evaluated by testing the reliability and validity of each construct using outer loading values, Average Variance Extracted (AVE), and Composite Reliability (CR) (Table 1). Most indicators demonstrated loading values above 0.70, indicating an adequate contribution to their respective constructs. However, a few indicators had loading values between 0.60 and 0.70. According to Hair et al. (2017), indicators within this range may be retained if they do not significantly reduce the values of AVE and CR. All constructs in the model met the recommended thresholds of AVE > 0.50 and CR > 0.70, supporting the conclusion that the model possesses satisfactory convergent validity and construct reliability.

**Table 1.** Construct Reliability, Convergent Validity, and Outer Loading Values

| Construct | CR | AVE | Cronbach's Alpha | Indicator | Outer Loading | Remarks |
|---|---|---|---|---|---|---|
| Physical Activity Interest (PAI) | 0.858 | 0.549 | 0.794 | PAI_1 | 0.786 | Acceptable |
| | | | | PAI_2 | 0.759 | Acceptable |
| | | | | PAI_3 | 0.667 | Retained |
| | | | | PAI_4 | 0.657 | Retained |
| | | | | PAI_5 | 0.822 | Acceptable |
| Social Skills (SS) | 0.925 | 0.711 | 0.897 | SS_1 | 0.857 | Acceptable |
| | | | | SS_2 | 0.895 | Acceptable |
| | | | | SS_3 | 0.794 | Acceptable |
| | | | | SS_4 | 0.888 | Acceptable |
| | | | | SS_5 | 0.774 | Acceptable |
| Mental Toughness (MT) | 0.880 | 0.596 | 0.830 | MT_1 | 0.714 | Acceptable |
| | | | | MT_2 | 0.793 | Acceptable |
| | | | | MT_3 | 0.726 | Acceptable |
| | | | | MT_4 | 0.821 | Acceptable |
| | | | | MT_5 | 0.799 | Acceptable |
| Academic Performance (AP) | 0.928 | 0.721 | 0.903 | AP_1 | 0.809 | Acceptable |
| | | | | AP_2 | 0.862 | Acceptable |
| | | | | AP_3 | 0.858 | Acceptable |
| | | | | AP_4 | 0.881 | Acceptable |
| | | | | AP_5 | 0.833 | Acceptable |

## Structural Model Evaluation (Inner Model)

The structural model was assessed to determine the relationships among latent constructs. Evaluation was based on the coefficient of determination ($R^2$), path coefficients (β), and confidence intervals. The model structure is illustrated in Figure 1, which presents the standardized path coefficients and $R^2$ values.

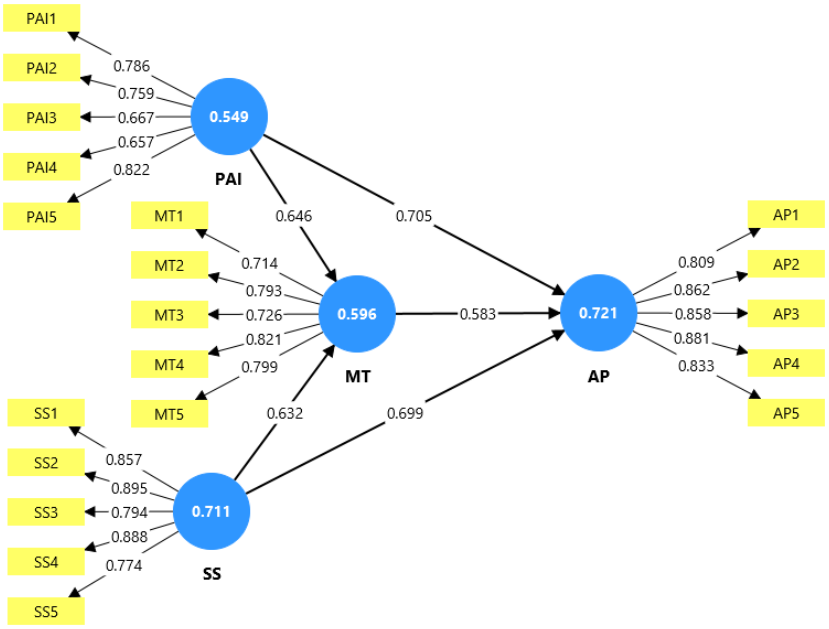


**Figure 1.** Structural Model with Standardized Path Coefficients (PLS-Algorithm Output)

## Coefficient of Determination ($R^2$)

$R^2$ values indicate the proportion of variance explained by the independent variables. As presented in Table 2, Mental Toughness (MT) has an $R^2$ value of 0.470, meaning that Physical Activity Interest (PAI) and Social Skills (SS) together explain 47% of the variance in MT. Academic Performance (AP) has an $R^2$ of 0.575, indicating that MT, PAI, and SS collectively account for 57.5% of the variance in AP.

**Table 2.** Construct Reliability, Convergent Validity, and Outer Loading Values

| Endogenous Construct | $R^2$ Value | Interpretation |
|---|---|---|
| Mental Toughness (MT) | 0.470 | Moderate (PAI and SS explain 47% of variance) |
| Academic Performance (AP) | 0.575 | Moderate to substantial (MT, PAI, and SS explain 57.5% of variance) |

## Path Coefficients and Bootstrapping Results

Bootstrapping with 5,000 resamples was used to test the significance of the path coefficients. As shown in Table 3, all paths except MT → AP were statistically significant, as indicated by confidence intervals that did not include zero.

**Table 3.** Construct Reliability, Convergent Validity, and Outer Loading Values

| Path | Coefficient (β) | 95% CI (Lower – Upper) | Remarks |
|---|---|---|---|
| MT → AP | 0.127 | -0.000 – 0.258 | Not Significant |
| PAI → AP | 0.366 | 0.212 – 0.505 | Significant |
| PAI → MT | 0.394 | 0.249 – 0.533 | Significant |
| SS → AP | 0.347 | 0.189 – 0.505 | Significant |
| SS → MT | 0.340 | 0.184 – 0.488 | Significant |

The findings indicate that both Physical Activity Interest and Social Skills have significant direct effects on Mental Toughness and Academic Performance. Mental Toughness, however, did not significantly mediate the relationship between the exogenous variables and Academic Performance.

## DISCUSSION

The first significant finding of this study is that both Physical Activity Interest (PAI) and Social Skills (SS) have a direct and substantial effect on Academic Performance (AP). This result emphasizes that affective and social competencies are foundational predictors of student achievement in Physical Education contexts. In particular, students who are intrinsically motivated to participate in physical activities and those who demonstrate strong interpersonal abilities tend to achieve better academic outcomes. This finding is consistent with prior research showing that motivation and social engagement are critical for sustained academic involvement (Chen et al., 2020; Poulou, 2017; Vasconcellos et al., 2020).

Second, while PAI and SS significantly predicted Mental Toughness (MT), the mediating role of MT was not supported in this study. Unlike Crust & Clough (2011) and Gerber & Terblanche (2012), who reported that mental toughness strongly influenced performance in competitive sport settings, this study shows that MT plays a weaker role in supportive academic environments. One possible explanation is that the academic challenges faced by Indonesian Physical Education students may not be intense enough to activate the adaptive functions of mental toughness fully. This aligns with studies highlighting that MT is more relevant under high-pressure conditions, such as those found in elite sports (Hardy et al., 2014; Piggott et al., 2019).

Third, this study provides novel insights by situating the psychosocial model within the Indonesian higher education context. Compared to findings from Western settings (Liu & Huang, 2021; Vasconcellos et al., 2020), the direct effects of motivation and social factors appear stronger, suggesting that academic environments with less competitive stress rely more heavily on collaborative dynamics. These results challenge the assumption that MT universally serves as a mediator, instead positioning affective and social factors as more dominant predictors of academic achievement in non-competitive Physical Education settings.

From a practical standpoint, the findings have important implications for the design of Physical Education curricula. Rather than focusing solely on cultivating mental toughness, PE lecturers should design collaborative-based instructional strategies that strengthen social skills and intrinsic motivation. Group projects, cooperative learning methods, and peer mentoring can serve as practical pedagogical approaches to enhance students' academic performance. Such strategies align with the holistic mission of Physical Education in Indonesia, which emphasizes not only physical development but also psychosocial and academic growth.

### Limitations of the study

This study has several limitations that should be acknowledged. First, the use of a cross-sectional design limits the ability to infer causal relationships among physical activity interest, social skills, mental toughness, and academic performance, as the data capture only a single moment in time. Second, all variables were measured using self-report questionnaires, which may introduce response bias, including social desirability and inaccurate self-assessment. Third, the sample was drawn from a single Indonesian university with a predominantly male student population, which restricts the generalizability of the findings to more diverse physical education settings. Additionally, the non-significant mediating role of mental toughness may be influenced by contextual factors such as the relatively low-pressure academic environment, suggesting that different results might emerge in competitive or high-stress contexts. Finally, future studies should incorporate longitudinal or

experimental approaches, include more heterogeneous samples, and integrate objective performance indicators to strengthen the robustness of the conclusions.

## CONCLUSIONS

This study examined the mediating role of Mental Toughness (MT) in the relationship between Physical Activity Interest (PAI), Social Skills (SS), and Academic Performance (AP) among Indonesian university students in Physical Education programs. The findings revealed three main points. First, PAI and SS demonstrated strong direct effects on AP, confirming the central role of affective and social competencies in predicting student achievement. Second, although PAI and SS significantly predicted MT, their mediating role was not supported, suggesting that MT plays a weaker function in supportive academic environments compared to competitive sport settings. Third, by situating the psychosocial model within the Indonesian higher education context, this study provides novel evidence that social and motivational variables exert a more substantial direct influence on academic success than resilience-related constructs.

From a theoretical perspective, these results contribute to refining psychosocial models in Physical Education by challenging the assumption that MT universally acts as a mediator. Instead, the findings highlight the importance of acknowledging the direct impact of affective and social factors in less competitive academic contexts.

From a practical standpoint, the study offers important implications for curriculum design and instructional practices. Physical Education lecturers should prioritize strategies that cultivate students' interest in physical activity and strengthen social skills through collaborative and team-based learning methods. Such approaches may be more effective in supporting academic performance than focusing solely on developing mental toughness.

Future research is recommended to adopt longitudinal designs to capture developmental changes in psychosocial factors over time and to test the model in competitive sport or high-pressure educational contexts. Such studies will help clarify the contextual boundaries of MT and further validate the role of psychosocial variables in promoting student success in Physical Education.

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## DATA AVAILABILITY

All data supporting the findings of this study are included in the article and its supplementary materials. Additional datasets are available from the corresponding author upon reasonable request.

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## CONFLICT OF INTEREST

The authors hereby declare that this research is free from any conflict of interest with any party.

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