



Actividad física, autoestima y confianza comunicativa en estudiantes universitarios indonesios: un análisis de mediación

Physical Activity, Self-Esteem, and Communicative Confidence among Indonesian University Students: A Mediation Analysis

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Abstract

Introduction: Physical activity is increasingly recognised as a multidimensional health and educational resource. However, its potential contribution to communicative confidence through self-esteem remains underexplored in university populations. **Objective:** This study examined whether self-esteem statistically mediates the relationship between physical activity and communicative confidence among university students in Indonesia. **Methodology:** A quantitative cross-sectional mediation design was applied to 256 complete student responses. Physical activity, self-esteem, and communicative confidence were measured using 10 Likert-type indicators for each construct. Descriptive statistics, internal-consistency analysis, Pearson correlations, ordinary least squares regression, and 5,000-sample bootstrap mediation analysis were conducted. **Results:** Physical activity was positively correlated with self-esteem ($r = .604$, $p < .001$) and communicative confidence ($r = .325$, $p < .001$), while self-esteem was positively correlated with communicative confidence ($r = .563$, $p < .001$). The indirect effect of physical activity on communicative confidence through self-esteem was significant ($ab = .365$, 95% bootstrap CI [.268, .477]). After self-esteem was entered, the direct effect of physical activity on communicative confidence was no longer significant ($c' = -.024$, $p = .721$), which is consistent with an indirect-only statistical pathway. **Conclusions:** Self-esteem may be an important psychosocial mechanism linking physical activity with communicative confidence. Because the design was cross-sectional and the measures were researcher-adapted self-report instruments, the findings should be interpreted as associative and replicated using stronger measurement models and longitudinal or intervention designs.

Keywords

Physical Activity; Self-Esteem; Communicative Confidence; University Students; Mediation Analysis; Indonesia.

Resumen

Introducción: La actividad física se reconoce cada vez más como un recurso multidimensional para la salud y la educación. Sin embargo, su posible contribución a la confianza comunicativa a través de la autoestima sigue siendo poco explorada en poblaciones universitarias. **Objetivo:** Este estudio examinó si la autoestima media estadísticamente la relación entre la actividad física y la confianza comunicativa en estudiantes universitarios de Indonesia. **Metodología:** Se aplicó un diseño cuantitativo transversal de mediación a 256 respuestas estudiantiles completas. La actividad física, la autoestima y la confianza comunicativa se midieron mediante 10 indicadores tipo Likert por constructo. Se realizaron estadísticos descriptivos, análisis de consistencia interna, correlaciones de Pearson, regresión de mínimos cuadrados ordinarios y mediación bootstrap con 5.000 remuestreos. **Resultados:** La actividad física se correlacionó positivamente con la autoestima ($r = .604$, $p < .001$) y la confianza comunicativa ($r = .325$, $p < .001$), mientras que la autoestima se correlacionó positivamente con la confianza comunicativa ($r = .563$, $p < .001$). El efecto indirecto de la actividad física sobre la confianza comunicativa a través de la autoestima fue significativo ($ab = .365$, IC bootstrap del 95% [.268, .477]). Al incluir la autoestima, el efecto directo de la actividad física sobre la confianza comunicativa dejó de ser significativo ($c' = -.024$, $p = .721$), lo que es consistente con una vía estadística indirecta. **Conclusiones:** La autoestima puede constituir un mecanismo psicosocial importante que vincula la actividad física con la confianza comunicativa. Debido al diseño transversal y al uso de instrumentos de autoinforme adaptados por los investigadores, los hallazgos deben interpretarse como asociaciones y replicarse mediante modelos de medición más sólidos y diseños longitudinales o de intervención.

Palabras clave

Actividad física; Autoestima; Confianza comunicativa; Estudiantes universitarios; Análisis de mediación; Indonesia.

Introduction

Physical activity is no longer understood only as a determinant of cardiovascular, metabolic, or musculoskeletal health. In contemporary physical education and sport psychology, it is increasingly positioned as a psychosocial resource that can shape students' self-perception, emotional regulation, social participation, and readiness to engage in educational interaction (Amú-Ruiz et al., 2024; Chen et al., 2025; Hernawan et al., 2024; Lerga-Fuertes et al., 2026; Sandford et al., 2024). This broader framing is especially relevant in higher education, where students are expected not only to be academically competent but also to communicate ideas through presentations, group discussions, seminars, and multilingual learning contexts.

The transition to university life often requires students to negotiate new peer networks, academic expectations, and public forms of participation. For many students, communicative confidence is a decisive factor in whether they ask questions, express disagreement, deliver oral presentations, or use language actively in class. Low communicative confidence may restrict participation even when students possess adequate linguistic knowledge. Thus, confidence in communication is not merely a language-skill issue; it is also a psychological and social readiness issue. This view is consistent with willingness-to-communicate theory, which positions communicative self-confidence, perceived competence, and affective readiness as important antecedents of actual communication behavior (Trigueros et al., 2024; H. Wang et al., 2024; Ye & Hu, 2025).

Physical activity may contribute to communicative confidence through several mechanisms (Pilar León et al., 2024). First, movement-based participation provides repeated experiences of mastery, effort, bodily competence, and performance feedback. Second, many physical activity settings are socially embedded: students cooperate, coordinate, negotiate rules, receive peer recognition, and practise self-presentation in relatively low-stakes environments. Third, physical activity can reduce psychological tension and strengthen positive self-evaluation. These mechanisms are consistent with Self-Determination Theory, which explains how autonomy, competence, and relatedness support motivation and well-being (Amholt et al., 2022; Ferriz et al., 2021). Recent synthesis also suggests that self-esteem, self-efficacy, social connection, and related psychosocial factors may help explain how physical activity contributes to mental health and well-being (White et al., 2024).

Self-esteem is the central psychological bridge proposed in this study. It reflects a person's global evaluation of self-worth and perceived capability (Abramson et al., 2024; Rosenberg, 1965). Students with higher self-esteem are more likely to approach communicative situations as manageable rather than threatening. They may be more willing to speak, ask questions, make linguistic mistakes, and recover from negative feedback. In communication and language-learning theory, this logic is consistent with willingness-to-communicate models, where self-confidence, perceived communicative competence, and affiliation are key antecedents of communicative behavior (Huang & Li, 2024; Szyszka et al., 2026).

Although physical activity has been widely examined in relation to mental health, anxiety, self-concept, depression, and well-being, the specific pathway from physical activity to communicative confidence remains underdeveloped (Bernstein et al., 2024). Existing studies commonly treat physical activity as a direct predictor of psychological health or as part of a broader well-being framework, while communication studies often focus on language anxiety, motivation, perceived communicative competence, and willingness to communicate without considering movement-based experiences (Çakir et al., 2025; Xiang et al., 2026). This leaves a conceptual gap between physical education and communicative development.

The Indonesian university context makes this gap practically important. University students are frequently required to participate in presentations, classroom discussions, collaborative assignments, and academic communication in Indonesian and, in many programs, English. Previous studies in Indonesian higher education, physical activity, and EFL contexts indicate that confidence, anxiety, perceived communicative competence, classroom atmosphere, peer support, and activity type influence students' willingness or unwillingness to communicate (Estrada-Araoz et al., 2024; Hernawan et al., 2024; Miftakh et al., 2025; Solhi & Thumvichit, 2025; Valenzuela Contreras et al., 2024; Zadorozhnyy & Lee, 2025). If physical activity is associated with communicative confidence through self-esteem, campus sport, physical education, and structured movement programs may have benefits beyond fitness alone. They may support broader student development by strengthening the psychological foundations of academic communication.

Accordingly, this study proposes a mediation model in which physical activity is the predictor, self-esteem is the mediator, and communicative confidence is the outcome. The model does not assume that movement directly teaches language skills. Rather, it tests whether physically active students show higher self-esteem and whether this self-esteem is associated with greater confidence in communication and language use. This model is supported by evidence linking physical activity with self-esteem and psychosocial well-being, and by communication theories that position self-confidence as an antecedent of communicative engagement (Bernstein et al., 2024; Purgato et al., 2024; Strachan et al., 2026).

This study addresses four specific gaps: (1) limited integration between physical activity research and communicative confidence as a social-educational outcome; (2) insufficient attention to self-esteem as a psychological mechanism connecting movement behavior to communication-related confidence; (3) limited mediation-based evidence involving Indonesian student data; and (4) limited discussion of how physical education may support language-use confidence through psychosocial development rather than through linguistic instruction alone. The hypotheses were as follows: H1, physical activity positively predicts self-esteem; H2, physical activity positively predicts communicative confidence; H3, self-esteem positively predicts communicative confidence after controlling for physical activity; and H4, self-esteem mediates the relationship between physical activity and communicative confidence.

Method

Research Design

This study used a quantitative cross-sectional mediation design. The analysis tested whether self-esteem statistically explained the association between physical activity and communicative confidence. The analytic approach followed a regression-based mediation framework with bootstrapped confidence intervals for the indirect effect (Zhao et al., 2025). Because the design is cross-sectional, the term mediation is used in a statistical and theoretical sense, not as definitive evidence of causal mediation.

Participants and Data Source

The analytic sample comprised 256 complete responses from undergraduate students enrolled in Physical Education study programmes at selected universities in East Java, Central Java, and the Special Region of Yogyakarta, Indonesia. Participants were recruited using simple random sampling between January and March 2026. Lists of eligible students were obtained from the participating study programmes, each eligible student was assigned a unique identification number, and selection was conducted using a computer-generated random-number procedure. The Google Forms questionnaire link was then sent directly to the selected students.

Eligibility criteria required participants to be active undergraduate students in a Physical Education study programme, aged 17-20 years, enrolled in semesters 3, 4, 5, or 7, and willing to participate voluntarily. The participants had a mean age of 18.20 years (SD = 1.18). The sample comprised 125 male students (48.8%) and 131 female students (51.2%). All submitted questionnaires contained complete responses for the physical activity, self-esteem, and communicative confidence items; consequently, all 256 cases were retained for analysis.

Table 1. Participant and Data Characteristics

Characteristic	Value	Note
Analytic sample	256	Complete responses included in the mediation analysis
Study population	Physical Education undergraduates	Students enrolled at selected Indonesian universities
East Java	162 (63.3%)	Participants from selected universities
Central Java	59 (23.0%)	Participants from selected universities
Special Region of Yogyakarta	35 (13.7%)	Participants from selected universities
Age	17-20 years	M = 18.20; SD = 1.18
Male	125 (48.8%)	Self-reported gender
Female	131 (51.2%)	Self-reported gender
Semester 3	135 (52.7%)	Current semester at data collection
Semester 4	8 (3.1%)	Current semester at data collection
Semester 5	75 (29.3%)	Current semester at data collection
Semester 7	38 (14.8%)	Current semester at data collection
Sampling	Simple random sampling	Selection from lists of eligible students using computer-generated random numbers
Data collection	January-March 2026	Online administration through Google Forms
Missing item responses	0	All 256 cases were complete

Instruments

The study employed three researcher-adapted measures assessing physical activity, self-esteem, and communicative confidence. Each measure consisted of 10 items rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Construct scores were calculated by averaging the relevant item responses, with higher scores indicating higher levels of the measured construct.

The physical activity measure was informed by the frequency, duration, intensity, sport participation, active-mobility, and perceived-benefit dimensions described in the World Health Organization physical activity framework and the International Physical Activity Questionnaire framework (Bull et al., 2020; Craig et al., 2003). The self-esteem measure was developed with reference to Rosenberg's (1965) conceptualisation of global self-esteem. The communicative confidence measure was informed by the willingness-to-communicate model proposed by MacIntyre et al. (1998) and the concept of self-perceived communication competence developed by McCroskey and McCroskey (1988). The measures were treated as researcher-adapted instruments rather than verbatim reproductions of the original scales.

Table 2. Theoretical and Operational Basis of the Study Measures

Construct	Theoretical basis	Code/items	Operational indicators	Scale
Physical Activity	WHO physical activity framework and IPAQ framework	PA1-PA10	Routine activity, sport participation, frequency, duration, intensity, active mobility, and perceived physical benefits	1-5
Self-Esteem	Rosenberg global self-esteem framework	SE1-SE10	Self-worth, self-acceptance, perceived capability, positive self-evaluation, and comfort with oneself	1-5
Communicative Confidence	Willingness-to-Communicate Model and Self-Perceived Communication Competence	CC1-CC10	Confidence in speaking, presenting, asking questions, participating in discussions, and expressing ideas appropriately	1-5

Validity and Reliability

Before the main data collection, the initial 30-item instrument was reviewed by three expert validators with relevant expertise in physical education, psychological assessment, and educational communication. The validators assessed the relevance of each item to its intended construct, clarity of wording, representativeness of the theoretical indicators, suitability of the response format, and contextual appropriateness for Indonesian undergraduate students.

Content validity was evaluated using Aiken's V based on ratings provided on a five-point scale. The coefficients ranged from .83 to 1.00. The mean Aiken's V coefficient was .91 for physical activity, .92 for self-esteem, and .92 for communicative confidence, with an overall mean coefficient of .92. These values indicate strong agreement among the validators regarding item relevance, clarity, theoretical representation, and contextual suitability. Items receiving comparatively lower ratings were revised by simplifying lengthy statements, clarifying potentially ambiguous wording, reducing conceptual overlap, and strengthening alignment with the intended indicators.

Internal consistency was evaluated using Cronbach's alpha, McDonald's omega, corrected item-total correlations, and alpha-if-item-deleted statistics. Physical activity demonstrated $\alpha = .920$ and $\omega = .921$, with corrected item-total correlations ranging from .614 to .785. Self-esteem demonstrated $\alpha = .923$ and $\omega = .925$, with corrected item-total correlations ranging from .607 to .775. Communicative confidence demonstrated $\alpha = .932$ and $\omega = .932$, with corrected item-total correlations ranging from .675 to .765. All corrected item-total correlations exceeded .30, and deleting individual items did not improve the reliability coefficients. Therefore, all 10 items in each construct were retained for subsequent analysis.

Table 3. Content Validity and Internal Consistency of the Measures

Construct	Items retained	Aiken V range	Mean Aiken V	Cronbach α	McDonald ω
Physical Activity	10	.83-1.00	.91	.920	.921
Self-Esteem	10	.83-1.00	.92	.923	.925
Communicative Confidence	10	.83-1.00	.92	.932	.932

Data Collection Procedure

After institutional and ethical approval had been obtained, lists of eligible students were requested from the participating Physical Education study programmes. Eligible students were assigned identification numbers and selected using a computer-generated random-number procedure. The questionnaire link was sent directly to the selected students and was not circulated openly through public social-media groups.

Data were collected through Google Forms between January and March 2026. The opening page of the form explained the purpose of the study, research procedures, voluntary nature of participation, confidentiality safeguards, estimated completion time, and the right to withdraw. Participants accessed the questionnaire items only after providing electronic informed consent. Participation did not affect grades, academic standing, or access to university services. Submitted responses were screened for eligibility, completeness, missing values, and values outside the permitted response range before the anonymised dataset was exported for statistical analysis.

Data Analysis

Data screening preceded the primary analyses and included checks for missing responses, values outside the permitted range, incomplete cases, duplicate records, and irregular response patterns. Descriptive statistics comprised means, standard deviations, minimum and maximum scores, skewness, and kurtosis. Internal consistency was evaluated using Cronbach's alpha, McDonald's omega, corrected item-total correlations, and alpha-if-item-deleted statistics.

Pearson correlations were used to examine the bivariate associations among physical activity, self-esteem, and communicative confidence, while Spearman correlations were calculated as a sensitivity check. The mediation model specified physical activity as the predictor (X), self-esteem as the mediator (M), and communicative confidence as the outcome (Y). The analysis estimated the a path from physical activity to self-esteem, the b path from self-esteem to communicative confidence while controlling for physical activity, the total effect (c), and the direct effect after inclusion of the mediator (c'). The indirect effect was calculated as the product of the a and b coefficients and evaluated using 5,000 bootstrap resamples with a 95% confidence interval. An indirect effect was considered statistically significant when the confidence interval did not include zero. Statistical significance was set at $p < .05$, and the findings were interpreted using unstandardised coefficients, standard errors, standardised coefficients, effect sizes, and confidence intervals.

Ethical Considerations

The study was conducted in accordance with ethical principles for research involving human participants and applicable institutional regulations in Indonesia. Ethical approval was granted by [Institution blinded for peer review] under approval No. 19.06.4/UN32.14.2.1/LT/2026. Institutional permission was also obtained from each participating university before student recruitment and data collection. Before completing the Google Forms questionnaire, participants received information about the purpose of the study, research procedures, potential benefits and risks, voluntary participation, confidentiality, and the right to discontinue without penalty. All participants provided electronic informed consent. For participants aged 17 years, the consent procedure followed the requirements specified in the approved ethical protocol, including parental or guardian permission where required. No names, student identification numbers, email addresses, or other personally identifying information were included in the analytical dataset. The data were stored in password-protected files accessible only to the research team and were used exclusively for research purposes.

Results

Psychometric Screening and Descriptive Statistics

Data screening showed that all 256 cases contained complete responses for the 30 study items. No out-of-range item scores, duplicate records, or fully straight-line response patterns were identified. The three construct means were in the moderate range. Physical activity had a mean score of 3.259 (SD = .586), self-esteem had a mean score of 3.136 (SD = .597), and communicative confidence had a mean score of 3.206 (SD = .614). Internal consistency was strong for physical activity ($\alpha = .920$, $\omega = .921$), self-esteem ($\alpha = .923$, $\omega = .925$), and communicative confidence ($\alpha = .932$, $\omega = .932$).

Table 4. Descriptive Statistics, Reliability, and Category Distribution

Construct	N	Mean	SD	Min	Max	α	ω	Low / Moderate / High
Physical Activity	256	3.259	.586	1.90	5.00	.920	.921	18 / 169 / 69
Self-Esteem	256	3.136	.597	1.70	4.80	.923	.925	27 / 176 / 53
Communicative Confidence	256	3.206	.614	1.30	5.00	.932	.932	22 / 175 / 59

Note. α = Cronbach's alpha; ω = McDonald's omega. Categories used five-point cutoffs: low ≤ 2.33 , moderate = 2.34-3.67, and high > 3.67 .

Table 4 indicates that most participants were classified in the moderate category across the three constructs. The reliability coefficients were high, indicating that the item sets showed strong internal consistency in the analysed sample. These psychometric results provide adequate support for using the mean scores in subsequent correlational and mediation analyses.

Correlations Among Variables

Pearson correlations showed positive associations among all three study variables. Physical activity was positively associated with self-esteem ($r = .604, p < .001$) and communicative confidence ($r = .325, p < .001$). Self-esteem was also positively associated with communicative confidence ($r = .563, p < .001$). Spearman correlations showed the same pattern of results, supporting the robustness of the bivariate associations.

Table 5. Means, Standard Deviations, and Correlations

Variable	Mean	SD	1	2	3
1. Physical Activity	3.259	.586	-		
2. Self-Esteem	3.136	.597	.604***	-	
3. Communicative Confidence	3.206	.614	.325***	.563***	-

Note. *** $p < .001$.

Table 5 supports the logic for testing mediation. The strongest bivariate association was between physical activity and self-esteem, indicating that students with higher physical activity scores tended to report higher self-esteem. Self-esteem was also strongly and positively related to communicative confidence. The smaller but significant correlation between physical activity and communicative confidence indicates that a total association existed before the mediator was entered into the model.

Mediation Analysis

The mediation analysis supported the hypothesised indirect pathway. Physical activity significantly predicted self-esteem ($B = .614, SE = .051, \beta = .604, p < .001$). When both physical activity and self-esteem were entered as predictors of communicative confidence, self-esteem remained significant ($B = .594, SE = .067, \beta = .577, p < .001$), whereas the direct effect of physical activity was not significant ($B = -.024, SE = .068, \beta = -.023, p = .721$). The total effect of physical activity on communicative confidence was significant ($B = .341, SE = .062, \beta = .325, p < .001$). The bootstrapped indirect effect was significant ($ab = .365, 95\% CI [.268, .477]$), indicating that self-esteem mediated the relationship between physical activity and communicative confidence.

Table 6. Regression-Based Mediation Results

Path	B	SE	t	p	β	R ²	Interpretation
PA → SE (a)	.614	.051	12.07	< .001	.604	.364	Supported
SE → CC controlling PA (b)	.594	.067	8.85	< .001	.577	.317	Supported
PA → CC total effect (c)	.341	.062	5.48	< .001	.325	.106	Supported
PA → CC direct effect (c')	-.024	.068	-.36	.721	-.023	.317	Not significant
Indirect effect (ab)	.365	-	-	CI [.268, .477]	.348	-	Mediation supported

Note. PA = Physical Activity; SE = Self-Esteem; CC = Communicative Confidence; bootstrap resamples = 5,000.

Table 6 is the key statistical evidence for the proposed model. The significant a path confirms that physical activity is associated with self-esteem. The significant b path confirms that self-esteem predicts communicative confidence after physical activity is controlled. Most importantly, the indirect-effect confidence interval does not include zero, indicating a statistically significant mediation effect. The non-significant direct effect suggests that the physical activity-communicative confidence association is primarily indirect through self-esteem in this dataset. This pattern should be described as statistical mediation rather than proof of causality.

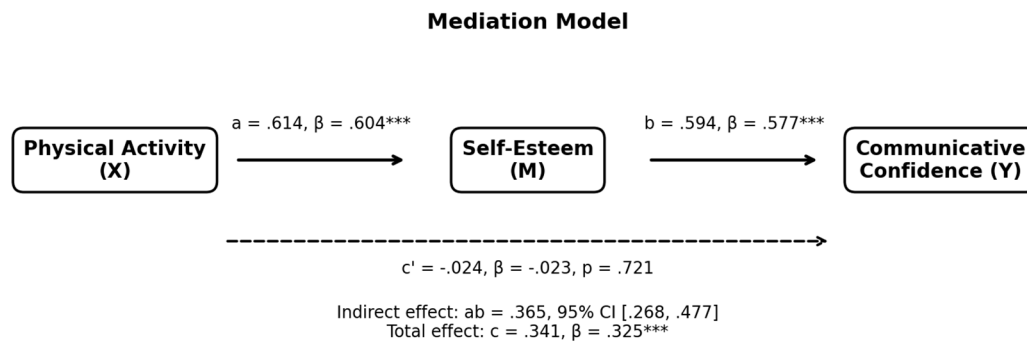


Figure 1. Mediation Model of Physical Activity, Self-Esteem, and Communicative Confidence

Figure 1 visualises the observed mediation pathway. Physical activity is strongly related to self-esteem, and self-esteem is strongly related to communicative confidence. The direct path from physical activity to communicative confidence becomes non-significant when self-esteem is included, while the indirect effect remains significant.

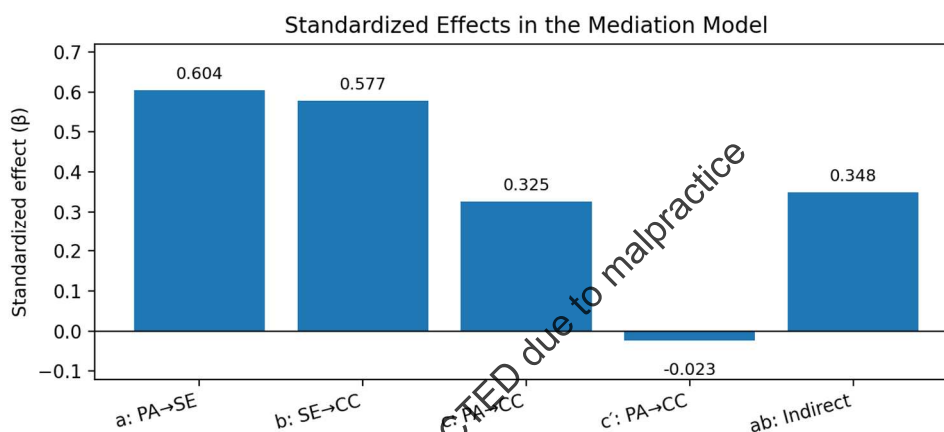


Figure 2. Standardized Effects in the Mediation Model

Figure 2 summarises the standardised effects. The largest standardised coefficient is the path from physical activity to self-esteem ($\beta = .604$), followed by self-esteem to communicative confidence ($\beta = .577$). The standardised total effect of physical activity on communicative confidence is moderate ($\beta = .325$), whereas the direct effect after controlling for self-esteem is very small ($\beta = -.023$).

Discussion

The findings indicate that physical activity is positively associated with self-esteem and communicative confidence, and that self-esteem functions as a statistical mediator between physical activity and communicative confidence. In the study dataset, the total effect of physical activity on communicative confidence was significant, but the direct effect became non-significant after self-esteem was entered. This pattern suggests that the relationship between physical activity and communication-related confidence is primarily explained by students' self-evaluation rather than by physical activity alone.

The positive association between physical activity and self-esteem is consistent with evidence from physical education, sport psychology, and university mental-health research. Dale et al. (2019) synthesised evidence linking physical activity with depression, anxiety, and self-esteem among children and youth. In Retos, Valenzuela Contreras et al. (2024) reported relationships between self-esteem and healthy lifestyle habits in university students, while Estrada-Araoz et al. (2024) found a strong association between physical self-concept and motivation toward physical activity. Amú-Ruiz et al. (2024) also documented the mental-health benefits of physical activity for university populations in a

systematic review and meta-analysis. The present findings align with this literature by showing that students with higher physical activity scores also tended to report higher self-esteem.

The mediation result is also consistent with university-student research that positions self-esteem as a psychological mechanism linking physical activity with broader outcomes. Cao et al. (2023) found that self-esteem mediated the relationship between home-based physical activity and general well-being among university students. Zhao et al. (2025) reported a chain-mediated pathway through self-esteem and psychological capital between physical activity and college students' sense of security. Zhu et al. (2025) found that physical self-esteem and subjective well-being mediated the association between physical activity and prosocial behaviour among college students. Together, these studies support the interpretation that self-esteem may function not only as an outcome of physical activity but also as a pathway connecting activity with broader psychological and social functioning.

The present study extends that line of evidence by shifting the outcome from mental health and well-being to communicative confidence. This extension is theoretically meaningful because communicative confidence involves self-presentation, tolerance of evaluation, and willingness to participate socially. Shang et al. (2021) found that physical exercise was associated with college students' subjective well-being through body image and self-esteem. Although subjective well-being and communicative confidence are distinct outcomes, both may depend partly on positive self-evaluation and approach-oriented social functioning. The current model therefore suggests that the psychosocial correlates of physical activity may include communication-related outcomes.

The finding that self-esteem predicts communicative confidence is consistent with communication and language-learning theory. The willingness-to-communicate framework proposed by Leeming et al. (2024) positions perceived communicative competence and reduced apprehension as central predictors of communication behavior. Namaziandost et al. (2024) also emphasised that willingness to communicate reflects a stable tendency to initiate communication across contexts. In the present model, self-esteem may support this tendency by increasing students' sense that they are worthy, capable, and able to manage mistakes during speaking, questioning, or presenting.

Theoretically, the results can be interpreted through Self-Determination Theory. Physical activity contexts can support competence when students experience skill improvement, autonomy when they choose and regulate movement, and relatedness when they participate with peers. These need-supportive experiences can strengthen self-esteem, which then supports confidence in social and academic communication. This interpretation is consistent with Claes et al. (2026), who reviewed empirical evidence connecting self-determination constructs with exercise and physical activity outcomes.

From a physical education perspective, these findings support a broader understanding of campus physical activity. Physical education and sport programs should not be viewed only as tools for fitness maintenance. When designed with supportive feedback, cooperative learning, and inclusive participation, movement programs can become psychosocial learning environments. Team games, group exercise, outdoor education, and reflective movement tasks can provide opportunities for students to practise leadership, negotiation, self-expression, and peer interaction. These experiences may build the self-esteem that later appears as confidence in classroom communication.

The Indonesian higher education context strengthens the practical relevance of the model. Many students are expected to speak in seminars, present assignments, participate in peer discussions, and use formal Indonesian or English in academic settings. Students who lack confidence may remain silent despite having sufficient knowledge. If self-esteem is a key pathway, then universities can support communicative development not only through language instruction but also through campus activities that enhance psychological readiness, including structured physical activity and student sport programs.

Limitations

Several limitations should be considered. First, the cross-sectional design does not establish temporal ordering or causal mediation; the indirect effect represents a statistical pathway that requires longitudinal or experimental confirmation. Second, all variables were measured by self-report, which

may introduce common-method and social-desirability bias. Third, although participants were recruited from universities in three Indonesian regions, the sample was limited to Physical Education students and was unevenly distributed across regions and semester levels. Fourth, the measures were researcher-adapted instruments; therefore, future studies should replicate their factor structure, measurement invariance, and predictive validity in more diverse student populations.

Future research should use fully validated instruments, include relevant demographic and behavioural covariates, and test the model through longitudinal or intervention designs. Such designs would allow researchers to examine whether structured physical-activity programmes can produce subsequent improvements in self-esteem and communicative confidence over time.

Conclusions

This study examined the relationship between physical activity, self-esteem, and communicative confidence among university students in Indonesia. Physical activity was positively associated with self-esteem and communicative confidence, and the bootstrapped indirect effect through self-esteem was statistically significant. These findings are consistent with a psychosocial pathway in which physically active students report more positive self-evaluations, which in turn are associated with greater confidence in academic communication. The results support the potential value of inclusive campus physical-activity programmes that combine movement, peer interaction, mastery experiences, and supportive feedback. Nevertheless, the cross-sectional design and reliance on researcher-adapted self-report measures preclude causal conclusions and require cautious interpretation. Replication with stronger measurement models, more diverse samples, and longitudinal or experimental designs is needed.

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