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Building Mental Well-being through Physical Literacy: The Role of Physical Activity from an Embodied Cognition Perspective

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Abstract

This study examines the relationship between Physical Literacy (PL) and mental well-being among university students, with physical activity functioning as a mediating variable through the Embodied Cognition framework. A cross-sectional study was conducted with 195 active students from the Faculty of Sports and Health Education at Universitas Pendidikan Indonesia, Bandung. Data were collected using the Student Physical Literacy Questionnaire, the International Physical Activity Questionnaire-Short Form (IPAQ-SF), and the Student Well-being Scale. Mediation analysis was performed using PROCESS Macro for SPSS version 4.2, Model 4. Results revealed that PL significantly predicts physical activity ($\beta = 0.27$, $p < 0.005$), and both PL and physical activity significantly influence mental well-being ($\beta = 0.21$ and $\beta = 0.36$ respectively, $p < 0.005$). The total effect of PL on mental well-being was 0.40 ($p < 0.005$), consisting of a direct effect of 0.27 (67.5%) and an indirect effect through physical activity of 0.13 (32.5%). Bootstrap confidence intervals (0.06-0.21) confirmed significant partial mediation. The findings affirm the embodied cognition perspective, suggesting that physical literacy plays an essential role in promoting mental well-being both directly and through physical activity. This study provides empirical evidence for integrating physical literacy development into mental health promotion strategies within higher education contexts.

How to Cite

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INTRODUCTION

Physical Activity (PA) is widely recognized as a fundamental element in mental health promotion efforts, particularly among adolescents and university students. Various studies demonstrate that routine engagement in physical activity can reduce symptoms of depression, anxiety, and stress, while enhancing cognitive flexibility, emotional regulation, and subjective well-being (Christodoulides et al., 2023; Gao et al., 2024). However, students often face challenges in maintaining adequate physical activity due to academic pressures and lifestyle transitions. Therefore, it is important to understand not only behavioral factors but also upstream psychological determinants that support engagement in physical activity, one of which is Physical Literacy (PL).

PL is defined as motivation, confidence, physical competence, knowledge, and understanding to value and take responsibility for physical activity throughout life (Whitehead, 2010). This concept represents a holistic approach encompassing affective, cognitive, and physical aspects. Research shows that individuals with high levels of PL have better life satisfaction, stronger psychological resilience, and lower stress levels (Gao et al., 2024; Leung et al., 2025; R. Ma et al., 2021). Nevertheless, the mechanisms by which PL enhances mental well-being have not been extensively explained, particularly the role of physical activity as a mediating variable. Several preliminary studies indicate that PL encourages engagement in physical activity, which ultimately contributes to psychological well-being (Christodoulides et al., 2023; Shanshan et al., 2025).

In recent decades, an increasing number of countries and regions have recognized PL as a primary goal of physical education (PE). Several countries have even integrated PL into national policies and educational curricula (Barnett et al., 2019; Gleddie & Morgan, 2021; Green et al., 2018; Houser & Kriellaars, 2023; Lundvall, 2015; Whitehead, 2010). The International Charter of Physical Education, Physical Activity, and Sport affirms that physical education has a strategic role in developing students' PL (UNESCO, 2015). Additionally, UNESCO's QPE Guidelines for policymakers also encourage systematic promotion of PL in global education systems (McLennan, 2015). The United Nations has even proposed PL as part of global goals in achieving the 2030 Sustainable Development Goals (SDGs) (Dudley & Cairney, 2021). At the national level, Canada has made PL the foundation in physical education, elite sports, and public health promotion (Tremblay, 2010). The United States has established PL as a learning outcome in National Physical Education Standards (Lin et al., 2020; Seymour & Clark, 2024). Recognition of the importance of PL is also present in the United Kingdom(Carl et al., 2022), Australia (Keegan et al., 2019), and China (Chen et al., 2020; R.-S. Ma et al., 2020).

Various international policies such as the Global Action Plan for Physical Activity (World Health Organization, 2019), physical quality (McLennan & Thompson, 2015), and the 2030 Sustainable Development Goals (UN) have positioned PL as a primary strategy. At the national level, Canada, the United States, Australia, China, and European countries have integrated PL into their physical education and health promotion policies (Qian et al., 2025).

In the theoretical framework, Embodied Cognition (EC) provides an important foundation for understanding the relationship between body, action, and psychological functions. Rooted in phenomenological and pragmatic philosophy (Dewey, 1998; Faella et al., 2025; Merleau-Ponty, 1945; Whitehead, 2007), EC states that cognitive processes are influenced by the body's interaction with the environment. In this context, PL is not merely a set of skills but also an embodied disposition that shapes how one responds to experiences (Whitehead, 2010). Physical activity becomes both a means and result of body-based learning, making the body central to the formation of physical and mental well-being (Faella et al., 2025; Shapiro & Stolz, 2018).

Cognitive embodiment refers to an empirical framework that rarely integrates Physical Literacy, Physical Activity, and Mental Well-being from an empirical standpoint. Novelty, wherein the study provides an investigation into these relationships within Indonesia's higher education, where cross-cultural evidence on embodied cognition and physical literacy remains scarce, is another important contribution of the study. Gap of theory between physical education and psychology, along with embodied cognition, is addressed by this study, thus providing culturally relevant insight for health promotion in Southeast Asian countries.

This research aims to fill this gap by examining the influence of Physical Literacy on students' mental well-being, with physical activity as a mediating variable, through an Embodied Cognition approach. Theoretically, this study operationalizes embodied cognition in an empirical mediation model. Practically, the results of this

research can provide strategic recommendations for developing contextual and sustainable physical education-based health promotion policies, particularly in higher education environments in Indonesia.

METHODS

This study employs a quantitative approach with a cross-sectional study design based on Embodied Cognition (EC) theory to examine the mediating role of physical activity in the relationship between physical literacy and mental well-being among Indonesian university students. The EC framework argues that cognitive and emotional processes are fundamentally shaped by bodily experiences and sensorimotor interactions with the environment (Barsalou, 2008; Lakoff & Johnson, 1999). In this theoretical context, physical literacy represents an embodied disposition that influences physical engagement and psychological outcomes through interconnected cognitive-motor pathways.

Participants in this study consisted of 195 actively enrolled students from the Faculty of Sports and Health Education at Universitas Pendidikan Indonesia, Bandung, recruited through stratified random sampling to ensure demographic representation. Inclusion criteria specified full-time enrollment status, ages between 18-25 years, and absence of diagnosed physical or psychological conditions that might confound the measured relationships. The sample demonstrated adequate power ($1-\beta = 0.85$) to detect medium effect sizes ($f^2 = 0.15$) in multiple regression analysis with three predictors at $\alpha = 0.05$.

Physical Literacy Assessment. Physical literacy was measured using the Student PA Questionnaire (PPLI) developed and validated by (R.-S. Ma et al., 2020). This 18-item instrument uses a five-point Likert scale (1 = strongly disagree, 5 = strongly agree) to assess 18 points. The Perceived Physical Literacy Instrument (PPLI) demonstrated excellent psychometric properties in the current sample (Cronbach's $\alpha = 0.79$-0.83), with confirmatory factor analysis supporting the four-factor structure CFI = 0.99, RMSEA = (0.03).

Physical Activity Measurement. Physical activity levels were quantified using the International Physical Activity Questionnaire-Short Form (IPAQ-SF) (Craig et al., 2003), a validated instrument for assessing physical activity across diverse populations. The IPAQ-SF captures frequency, intensity, and duration of walking, moderate-intensity, and vigorous-intensity activities during the previous seven days. Metabolic equivalent (MET) values were calculated using established protocols: walking = 3.3 METs, moderate activity = 4.0 METs, vigorous activity = 8.0 METs. Total weekly physical activity was expressed as MET-minutes per week.

Mental well-being assessment used the Student Wellbeing Scale (SWBS) questionnaire adapted from (Khatri et al., 2024). This 23-item instrument measures various dimensions of psychological well-being including emotional regulation, life satisfaction, stress management, and academic self-efficacy. Items are rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), with higher scores indicating greater well-being. The scale demonstrated strong internal consistency ($\alpha = 0.82$) and convergent validity with established well-being measures.

Data collection was conducted entirely through a secure online platform using Google Forms to ensure participant accessibility and response quality. Participants received detailed information about research objectives, voluntary participation, and confidentiality protection. Electronic consent was obtained prior to questionnaire administration. The survey platform implemented forced response protocols to minimize missing data while allowing participants to withdraw at any time. Data collection occurred over a four-week period during the academic semester to capture representative activity and well-being patterns.

Data analysis employed a systematic approach using PROCESS Macro for SPSS version 4.2 (Hayes, 2018), specifically implementing Model 4 for simple mediation analysis. This approach allows simultaneous estimation of direct and indirect effects while providing bias-corrected bootstrap confidence intervals for mediation effects.

The mediation model tested three key relationships: (1) the effect of physical literacy on physical activity (path a), (2) the effect of physical activity on mental well-being controlling for physical literacy (path b), and (3) the direct effect of physical literacy on mental well-being controlling for physical activity (path c'). The indirect effect was calculated as the product of paths a and b (ab), representing the effect mediated through physical activity.

Bootstrap resampling with 5,000 iterations generated bias-corrected 95% confidence intervals for all effects. Mediation was considered statistically significant when bootstrap confidence intervals excluded zero. Effect sizes were interpreted using Cohen's conventions, with additio-

nal consideration of practical significance in the educational context.

RESULTS AND DISCUSSION

The following are the results and findings of the research:

Table 1. Respondent Characteristics

Characteristic	Total (N)	Boys (n=122)	Girls (n=73)	Total (N=195)	Range (Min-Max)
Age(Year)	195	21.31 ± 1.95	21.95 ± 1.93	21.55 ± 1.96	19–25
High (cm)	195	168.93 ± 4.81	165.48 ± 5.21	167.64 ± 5.22	155–182
Weight (kg)	195	59.40 ± 6.53	60.29 ± 7.15	59.73 ± 6.77	50–80

Based on **Table 1** regarding respondent characteristics, the number of participants in this study was 195, with 122 males and 73 females. The average age was 21.55 years with a range from 19 to 25 years. Additionally, weight and height were reported with an average height for all participants of 167.64 cm and weight of 59.73 kg. These data provide a good overview both demographically and anthropometrically about the profile of subjects to be used in further analysis.

Table 2. Respondent Characteristics

Equation	Effect	F	p	β
PL → PA	Direct	0,6770833	.00	.27
PL, PA → MWB	Mediation	26.16.00	.00	PL = .21PA = .36
PL → MWB	Total Effect	20.03	.00	.31

Based on **Table 2**, the regression analysis results for the three equations in the mediation model show that PL significantly affects PA with a p-value <0.005, indicating that PL predicts increased PA. In the mediation model, both PL and PA significantly affect MWB with p-values <0.005. Furthermore, the total effect model shows that PL directly and significantly affects MWB with a p-value <0.05, confirming a strong relationship between PL and MWB before considering PA mediation

Table 3. Total Effect, Direct Effect, and Indirect Effect Test Results

Effect type	Effect	BootSE	t	p	LLCI	ULCI	c'_cs	Effect %
Total Effect	0,4	0,09	4,48	.00	0,22	0,58	0,31	100%
Direct Effect	0,27	0,09	3,12	.00	0,1	0,44	0,21	67,50%
Indirect Effect (via PA)	0,13	0,04	-	-	0,06	0,21	-	32,50%

Table 3 shows that the total effect, direct effect, and indirect effect analysis results reflect the overall influence of PL on MWB with a p-value <0.005 and a total effect of 0.40, which is divided into a direct effect of 0.27 (67.5%) and an indirect effect through PA of 0.13 (32.5%). The mediation effect is significant because the BootLLCI and BootULCI values (0.06-0.21) do not include zero, indicating that PA serves as a partial mediator in the relationship between PL and MWB.

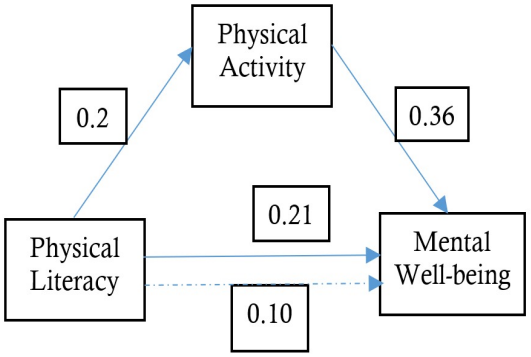

Figure 1. Mediation diagram model.

Based on **Figure 1**, which shows that PA plays an important role in mediation. The bootstrap method was used with the purpose of repeating sampling 5,000 times to test the mediation effect. The 95% confidence interval for the mediation effect path 1 does not include 0, indicating that the mediation effect is statistically significant.

The findings of this study consistently demonstrate that Physical Literacy (PL) is an important predictor of participation in physical activity (PA), and both contribute positively to students' mental well-being (Mental Well-being/ MW). These results strengthen the theoretical model based on Embodied Cognition Theory (ECT), which views bodily engagement as a means of forming meaning, identity, and psychological balance (Dewey, 1998; Faella et al., 2025; Merleau-Ponty, 1945; Whitehead, 2007).

Support for H1 that PL influences PA aligns with findings from (Christodoulides et al., 2023), which show that students with high PL levels are more physically active and have healthier lifestyle habits. Other studies (Gao et al., 2024) and (Leung et al., 2025) reinforce that affective dimensions of PL, such as motivation and confidence, are key determinants of student engagement in physical activity. However, some

research (Cairney et al., 2019; Martín-Rodríguez et al., 2024) indicates that factors such as enjoyment can be important mediators suggesting that PL alone is insufficient to optimally promote PA without other affective aspects that strengthen the value of bodily experience.

Regarding H2 and H3, these findings also affirm the positive relationship between PA and mental well-being. Students who are more physically active report better emotional regulation, greater resistance to academic stress, and improvements in positive psychological aspects such as self-esteem and sense of purpose. This is consistent with findings by (Shanshan et al., 2025), and supported by meta-analyses showing protective effects of PA against depression risk among young adults. The fact that physical activity mediates the relationship between PL and MW (H4) indicates that PL is not merely a theoretical construct but has practical implications in promoting healthy behavioral change.

From an Embodied Cognition perspective, these findings suggest that PL can be understood as an embodied disposition namely, the ability to consciously engage in meaningful and directed bodily activities, which then shape self-awareness and psychological well-being. The body in this context is not merely a tool but an integral part of the subject who learns, feels, and develops. In line with the views of (Whitehead, 2010) and (Martín-Rodríguez et al., 2024), PL must be understood as a social experience embedded in cultural and institutional contexts.

Furthermore, this research provides important contextual contributions for Southeast Asia, particularly Indonesia, which has been underrepresented in PL and mental health literature. As demonstrated by (Amoah, 2018; Wu et al., 2024), students in developing countries face complex challenges related to limited sports infrastructure, sociocultural pressures toward academic achievement, and lack of comprehensive campus health programs. Therefore, the results of this study can serve as a policy foundation for strengthening body literacy-based physical education in higher education.

However, this research has several limitations. First, the cross-sectional design limits causal conclusions between variables. Second, data collection using online questionnaires is self-reported, potentially generating social bias and inaccurate subjective perceptions. Third, the study focuses only on the context of students in Indonesia, thus limiting generalization to other age groups or countries with different cultural structures and educational systems. Fourth, this research has not explored contextual factors such as physical environment quality, cultural norms toward the body, or forms of social support that may moderate the relationship between PL, PA, and mental well-being.

For future research, it is recommended to use longitudinal or experimental designs to test causal relationships more strongly and deeply. Future research can also explore additional mediating and moderating variables, such as social support, body identity, self-awareness, or body satisfaction. Additionally, cross-cultural studies are important to understand how embodied dimensions of physical literacy are influenced by local cultural values, sports infrastructure, and physical education systems. Integration of qualitative approaches is also needed to explore students' subjective meanings of bodily experiences and physical activity in daily academic life.

Practical and Theoretical Practice

The theoretical implications of this study include the need to expand the application of Embodied Cognition Theory in psychology and health education studies, particularly those involving interactions between body and mental state. By proving that PL plays a role in mental well-being through PA, this study encourages strengthening the position of PL as a multidimensional variable that is cognitively, affectively, and contextually relevant. From a practical perspective, the results of this research can serve as a foundation for developing mental health promotion policies based on physical activity and body literacy in campus environments. Implementation of PL-based physical education learning interventions emphasizing body awareness, reflection, and meaningful experiences can be a preventive strategy to reduce psychological pressure and enhance students' mental resilience.

CONCLUSION

This study shows that Physical Literacy (PL) has positive direct and indirect contributions to students' mental well-being through Physical Activity (PA). Students with high physical literacy tend to be more physically active and have better levels of psychological well-being. These findings support the Embodied Cognition framework, which emphasizes that the body, through meaningful physical experiences, is the foundation of cognitive and affective processes. Thus, PL is important not only as an individual competency but also as an integrative educational and health strategy.

REFERENCES

Amoah, P. A. (2018). Social participation, health literacy, and health and well-being: A cross-sectional study in Ghana. SSM - Population Health, 4(November 2017), 263–270. https://doi.org/10.1016/j.ssmph.2018.02.005

Barnett, L. M., Dudley, D. A., Telford, R. D., Lubans, D. R., Bryant, A. S., Roberts, W. M., Morgan, P. J., Schranz, N. K., Weissensteiner, J. R., Vella, S. A., Salmon, J., Ziviani, J., Okely, A. D., Wainwright, N., Evans, J. R., & Keegan, R. J. (2019). Guidelines for the selection of physical literacy measures in physical education in Australia. Journal of Teaching in Physical Education, 38(2), 119–125. https://doi.org/10.1123/jtpe.2018-0219

Barsalou, L. W. (2008). Grounding symbolic operations in the brain's modal systems. Embodied Grounding: Social, Cognitive, Affective, and Neuroscientific Approaches, 9–42.

Cairney, J., Dudley, D., Kwan, M., Bulten, R., & Kriellaars, D. (2019). Physical Literacy, Physical Activity and Health: Toward an Evidence-Informed Conceptual Model. Sports Medicine, 49(3), 371–383. https://doi.org/10.1007/s40279-019-01063-3

Carl, J., Barratt, J., Wanner, P., Töpfer, C., Cairney, J., & Pfeifer, K. (2022). The Effectiveness of Physical Literacy Interventions: A Systematic Review with Meta-Analysis. In Sports Medicine (Vol. 52, Issue 12). Springer International Publishing. https://doi.org/10.1007/s40279-022-01738-4

Chen, S. T., Tang, Y., Chen, P. J., & Liu, Y. (2020). The Development of Chinese Assessment and Evaluation of Physical Literacy (CAEPL): A Study Using Delphi Method. International Journal of Environmental Research and Public Health, 17(8). https://doi.org/10.3390/ijerph17082720

Christodoulides, E., Tsivitanidou, O., Sofokleous, G., Grecic, D., Sinclair, J. K., Dana, A., & Ghorbani, S. (2023). Does Physical Activity Mediate the Associations between Physical Literacy and Mental Health during the COVID-19 Post-Quarantine Era among Adolescents in Cyprus? Youth, 3(3), 823–834. https://doi.org/10.3390/youth3030053

Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., Pratt, M., Ekelund, U., Yngve, A., Sallis, J. F., & Oja, P. (2003). International physical activity questionnaire: 12-Country reliability and validity. Medicine and Science in Sports and Exercise, 35(8), 1381–1395. https://doi.org/10.1249/01.MSS.0000078924.61453.FB

Dewey, J. (1998). The essential Dewey, volume 1: pragmatism, education, democracy (Vol. 1). Indiana University Press.

Dudley, D., & Cairney, J. (2021). Physical literacy: Answering the call for quality education and sustainable development. Prospects, 50, 5–11.

Faella, P., Digennaro, S., & Iannaccone, A. (2025). Educational practices in motion: a scoping review of embodied learning approaches in school. Frontiers in Education, 10(May). https://doi.org/10.3389/feduc.2025.1568744

Gao, T. Y., Huang, F. H., Liu, T., Sum, R. K. W., De Liu, J., Tang, D., Cai, D. Y., Jiang, Z. K., & Ma, R. S. (2024). The role of physical literacy and mindfulness on health-related quality of life among college students during the COVID-19 pandemic. Scientific Reports, 14(1), 1–9. https://doi.org/10.1038/s41598-023-50958-9

Gleddie, D. L., & Morgan, A. (2021). Physical literacy praxis: A theoretical framework for transformative physical education. Prospects, 50(1), 31–53.

Green, N. R., Roberts, W. M., Sheehan, D., & Keegan, R. J. (2018). Charting physical literacy journeys within physical education settings. Journal of Teaching in Physical Education, 37(3), 272–279. https://doi.org/10.1123/jtpe.2018-0129

Hayes, A. F. (2018). Partial, conditional, and moderated moderated mediation: Quantification, inference, and interpretation. Communication Monographs, 85(1), 4–40. https://doi.org/10.1080/03637751.2017.1352100

Houser, N., & Kriellaars, D. (2023). "Where was this when I was in Physical Education?" Physical literacy enriched pedagogy in a quality physical education context. Frontiers in Sports and Active Living, 5(May), 1–11. https://doi.org/10.3389/fspor.2023.1185680

Keegan, R. J., Barnett, L. M., Dudley, D. A., Telford, R. D., Lubans, D. R., Bryant, A. S., Roberts, W. M., Morgan, P. J., Schranz, N. K., Weissensteiner, J. R., Vella, S. A., Salmon, J., Ziviani, J., Okely, A. D., Wainwright, N., & Evans, J. R. (2019). Defining physical literacy for application in Australia: A modified delphi method. Journal of Teaching in Physical Education, 38(2), 105–118. https://doi.org/10.1123/jtpe.2018-0264

Khatri, P., Duggal, H. K., Lim, W. M., Thomas, A., & Shiva, A. (2024). Student well-being in higher education: Scale development and validation with implications for management education. International Journal of Management Education, 22(1), 100933. https://doi.org/10.1016/j.ijme.2024.100933

Lakoff, G., & Johnson, M. (1999). Philosophy in the flesh: The cognitive unconscious and the embodied mind: How the embodied mind creates philosophy. Basic Books New York.

Leung, W. K. C., Sum, R. K. W., & Lam, S. C. (2025). Relationships between perceived physical literacy and mental health in tertiary education students: a scoping review. BMC Public Health, 25(1), 117. https://doi.org/10.1186/s12889-025-21337-y

Lin, Y. T., Chen, M. C., Ho, C. C., & Lee, T. S. (2020). Relationships among leisure physical activity,

sedentary lifestyle, physical fitness, and happiness in adults 65 years or older in Taiwan. International Journal of Environmental Research and Public Health, 17(14), 1–12. https://doi.org/10.3390/ijerph17145235

Lundvall, S. (2015). Physical literacy in the field of physical education - A challenge and a possibility. Journal of Sport and Health Science, 4(2), 113–118. https://doi.org/10.1016/j.jshs.2015.02.001

Ma, R.-S., Sum, R. K. W., Hu, Y. N., & Gao, T. Y. (2020). Assessing factor structure of the simplified Chinese version of Perceived Physical Literacy Instrument for undergraduates in Mainland China. Journal of Exercise Science and Fitness, 18(2), 68–73. https://doi.org/10.1016/j.jesf.2020.01.001

Ma, R., Liu, T., Raymond Sum, K. W., Gao, T., Li, M., Choi, S. M., Huang, Y., & Xiang, W. (2021). Relationship Among Physical Literacy, Mental Health, and Resilience in College Students. Frontiers in Psychiatry, 12(December), 1–8. https://doi.org/10.3389/fpsyt.2021.767804

Martín-Rodríguez, A., Gostian-Ropotin, L. A., Beltrán-Velasco, A. I., Belando-Pedreño, N., Simón, J. A., López-Mora, C., Navarro-Jiménez, E., Tornero-Aguilera, J. F., & Clemente-Suárez, V. J. (2024). Sporting Mind: The Interplay of Physical Activity and Psychological Health. Sports, 12(1), 1–41. https://doi.org/10.3390/sports12010037

McLennan, N., & Thompson, J. (2015). Quality physical education (QPE): Guidelines for policy makers. Unesco Publishing.

Merleau-Ponty, M. (1945). (1996c). Phenomenology of perception (C. Smith, Trans.).

Qian, H., Ren, X., Wang, H., & Zou, Y. (2025). Global Insights and Key Trends in Physical Literacy Research: A Bibliometric Analysis and Literature Review from 2007 to 2024. Journal of Multidisciplinary Healthcare, 18, 2039–2055. https://doi.org/10.2147/JMDH.S515715

Seymour, C., & Clark, L. (2024). Marking Our Flags: Introducing the New 2024 National Physical Education Standards. Journal of Physical Education, Recreation & Dance, 95(6), 8–13.

Shanshan, Z., Ping, T., Jiabin, L., Tianzhuo, L., Xiaomei, L., Bolei, W., Leifu, D., & Jianfeng, T. (2025). Relationship between physical literacy and mental health in adolescents: a moderated mediation model with resilience and physical activity as variables. Frontiers in Psychology, 16. https://doi.org/10.3389/fpsyg.2025.1518423

Shapiro, Lawrence, & Stolz, Steven A. (2018). Embodied cognition and its significance for education. Theory and Research in Education, 17(1), 19–39. https://doi.org/10.1177/1477878518822149

Valentini, M., & Guarnacci, S. (2021). Embodied cognition, effective learning and physical activity as a shared feature: Systematic review. Journal of Human Sport and Exercise, 16(Proc2), 539–552. https://doi.org/10.14198/jhse.2021.16.Proc2.38

Whitehead, M. (2007). Physical literacy: Philosophical considerations in relation to developing a sense of self, universality and propositional knowledge. Sport, Ethics and Philosophy, 1(3), 281–298. https://doi.org/10.1080/17511320701676916

Whitehead, M. (2010). Physical literacy: Throughout the lifecourse. Routledge.

World Health Organization. (2019). Suicide worldwide in 2019: Global Health Estimates. In World Health Organization,Geneva. https://apps.who.int/iris/rest/bitstreams/1350975/retrieve

Wu, J., Kuan, G., Wang, Y., Liu, Z., Hu, X., Kueh, Y. C., & Zhang, X. (2024). Examining the relationship between physical literacy and resilience against COVID-19-induced negative mental states in Chinese adolescents. BMC Public Health, 24(1), 1–7. https://doi.org/10.1186/s12889-024-18842-x.