The Official Journal of the International Society for Comparative Physical Education and Sport

REVIEW

A Thematic Review of Motivation and Self-Regulation in Physical Education and the Effects on Students' Psychological Well-being

Xihang Miao[1]; Saeid Motevalli[2]; Rui Song[3]; Nadia Samsudin[4]

[1]School of Marxism, Harbin University, Harbi, China; [2]Department of Psychology, Faculty of Social Sciences and Liberal Arts, UCSI University, Kuala Lumpur, Malaysia; [3]Shandong Sport University, Jinan, Shandong, China; [4]Department of Education, Faculty of Social Sciences and Liberal Arts, UCSI University, Kuala Lumpur, Malaysia

Keywords:
educational strategies, mental health, healthy lifestyle, health promotion, quality of life

Recommended Citation:
Miao, X., Motevalli, S., Song, R., & Samsudin, N. (2026). A Thematic Review of Motivation and Self-Regulation in Physical Education and the Effects on Students' Psychological Well-being. *International Sports Studies*, *48*(1), 127-152. https://doi.org/10.69665/iss.v48i1.94

ORCID ID
Xihang Miao
0009-0006-8978-2150
Saeid Motevalli
0000-0002-7131-1207
Rui Song
0000-0002-8777-2200
Nadia Samsudin
0000-0003-3292-2870

Abstract

There is increasing interest in the association between psychological well-being, motivation, physical literacy, self-regulation, and physical education. While the impact of each of these variables on students' health is well established, a comprehensive review of their interconnections has been limited. A thematic literature review was conducted using Web of Science, ScienceDirect, PubMed, and Google Scholar, searching for English-language studies published from 2020 to 2024. The keywords were "self-regulation", "motivation", "physical education", and "psychological well-being". After selection, 82 peer-reviewed articles and relevant books were included from different cultural contexts, using longitudinal, cross-sectional, and survey-based designs. The findings were integrated using a thematic synthesis approach. The review highlights the significance of self-regulation in enhancing physical performance, stress management, attention control, and positive attitudes towards exercise, which are related to psychological well-being and academic success. Motivation, particularly students' motivation, has been identified as a key factor in the development of physical literacy and long-term physical activity engagement. These constructs co-occurred and mutually reinforced one another across studies, with self-regulation and motivation jointly predicting both physical and psychological performance outcomes and indicators of psychological well-being. Improving self-regulation and motivation in physical education could contribute to better psychological well-being and physical literacy among students. These findings have important implications for the development of evidence-based educational programs, educational strategies, and educational policies to promote resilience, lifelong physical activity, and balanced student development.

Introduction

The complex interplay among psychological well-being and physical education in the university student experience is a notable, yet insufficiently synthesised, field of study. A comprehensive understanding of this interaction is essential for enhancing holistic health approaches. Psychological well-being, which includes subjective happiness, life satisfaction,

and strong mental and emotional health, is essential for both individual and community prosperity (Abdullahi et al., 2021; Dhanabhakyam & Sarath, 2023). Although therapies aimed at enhancing well-being, including stress reduction methods and the development of self-awareness, creativity, and emotional intelligence, are gaining traction (Coventry, 2023; Kumar, 2021), a thorough comprehension of the fundamental processes is still lacking. This requires a transdisciplinary approach, acknowledging the crucial role of psychological well-being in enhancing individual resilience and social advancement (Mead et al., 2021).

Despite its complexity, the connection between self-regulation, psychological well-being, and physical education is becoming clearer. According to numerous studies, self-regulation plays a mediating role in the relationship between physical activity and enhanced cognitive and physical fitness. This means that people who are good at controlling their behaviour are more likely to reap the benefits of exercise (Bai et al., 2021; Gea-García et al., 2020). Physical literacy has additionally been identified as a moderating variable in the association between physical activity and self-esteem in participants (She et al., 2023), specifying that physical and cognitive competencies interact in shaping physical activity engagement. Erturan et al. (2020) and Blain et al. (2020) are two studies that highlight the importance of self-efficacy and self-regulation in encouraging physical education and leisure-time physical activity. Taken together, these findings suggest that self-efficacy and emotional intelligence mediate the relationship between physical exercise and subjective well-being, such that individuals with higher regulatory and appraisal capacities report greater psychological benefits from exercise.

A significant gap remains in comprehending the mediating functions of self-regulation and motivation within this intricate interaction. While recent reviews have explored physical activity and well-being in general (Lubans et al., 2016; Mead et al., 2021), they have not specifically investigated the collaborative mediating roles of self-regulation and motivation within the context of physical education, nor have they concentrated on university-aged individuals across varied cultural environments. This study is characterised by its simultaneous integrative focus on these two mechanisms, its limitation to the 2020–2024 timeframe to represent post-pandemic educational reality, and its incorporation of works from many national contexts. Although the impact of self-regulation on the correlation between physical exercise and cognitive/physical fitness is well-documented (Rodríguez et al., 2022), and its extensive effects on well-being and academic engagement are acknowledged, the intricate processes of its influence necessitate more clarification. Likewise, the significant influence of motivation on behaviour and performance, especially in physical education, is an issue that warrants more investigation (Moroz & Shtepa, 2021). Although the individual importance of these characteristics is recognised, their interactive mediating roles within the broader context of psychological well-being and physical education have not been fully integrated in prior reviews.

This review synthesises evidence from 82 peer-reviewed studies published between 2020 and 2024 to construct an integrative thematic framework elucidating how self-regulation and motivation jointly mediate the relationship between psychological well-being and physical education among university students. Rather than offering a formal conceptual model in the conventional sense, this framework aims to organise existing findings thematically around two central mediating pathways —self-regulatory and motivational orientations and map their combined influence on psychological and physical outcomes. It emphasises how motivation and self-regulation mediate the relationship between physical education and psychological well-being by critically analysing 99 studies published between 2020 and 2024.

In contrast to prior thematic reviews that examine these constructs in isolation (Živanović et al., 2021), the current study adopts a holistic lens to demonstrate their interdependence and combined explanatory value. This is specifically relevant considering the known influence of the educational environment on student physical activity engagement (Leo et al., 2022; Wang

et al., 2022), and the significant deficiency of studies investigating the mediating roles of self-regulation and motivation in this context. The study intends to address a significant research gap, providing essential insights for the development of tailored treatments and educational practices that enhance overall well-being and physical performance among China's expanding student demographic.

Methods and Materials

This review adopted a structured narrative and thematic approach to identify and synthesise relevant literature on physical education, motivation, self-regulation and psychological well-being among university students. It does not make any claim to the standards of a systematic review and does not follow PRISMA guidelines, instead prioritising breadth of conceptual coverage and theoretical coherence over exhaustive search completeness.

Search Strategy

A literature search was performed in four databases (Web of Science (WOS), ScienceDirect, PubMed and Google Scholar) from January to May 2024. The Boolean search string used was: (“self-regulation” OR “self-regulation”) AND (“motivation”) AND (“physical education”) AND (“psychological well-being” OR “psychological wellbeing”). In Google Scholar, there is no limit on exportable results, so the searches were limited to the first 200 records, according to relevance, evaluated with the same criteria used in the other databases.

Inclusion and Exclusion Criteria

Sources were included if they (1) were published between 2020 and 2024; (2) were written in English and published in peer-reviewed journals; (3) investigated the role of motivation and/or self-regulation in physical education contexts; and (4) presented findings on the psychological well-being of university students as the target population. Sources were excluded if they were not published in English, were conference abstracts or failed to include physical education and psychological well-being as central constructs. Book chapters or encyclopaedia entries that offered a fundamental theoretical grounding to the key constructs considered in this review were selectively included.

Selection and Evaluation

The selection process was conducted in two stages. The first phase consisted of screening the titles and abstracts of all 317 retrieved records against the inclusion and exclusion criteria. In the second phase, full texts of potentially relevant sources were read and appraised for relevance and methodological clarity. Sources were evaluated based on clarity of research design, adequacy of sample description, and relevance of reported outcomes to review questions. At this stage, sources that did not sufficiently address the relevant constructs or that did not report transparently were excluded.

Following this process, 82 references were identified and cited in this review; 76 peer-reviewed journal articles, four books or book chapters, one dissertation retained for its theoretical contribution, and one encyclopaedia chapter. Of these, 73 references (89.0%) were published between 2020 and 2024, indicating a contemporary and current literature base.

Review Questions for Guidance

The thematic analysis of the included literature was guided by three questions: (1) What is the effect of physical education and physical literacy on students’ psychological well-being? (2) How does motivation influence the impact of physical education on psychological well-being? (3) How does self-regulation influence the impact of physical education and psychological well-being?

Thematic Analysis

Findings were synthesised using a thematic approach following the framework developed by Thomas and Harden (2008) including three phases: (1) coding of key findings from each included source; (2) grouping of initial codes into descriptive themes based on conceptual similarity and recurrence across sources; and (3) development of analytical themes that addressed the review questions beyond the content of individual studies. Initial coding was carried out by the first author and then reviewed by a second reviewer. Themes were discussed and refined until a consensus was reached, guided by their frequency in the literature and their theoretical fit with self-regulation, motivation, physical literacy, and psychological well-being.

Discussion

Physical education and students' psychological well-being

Psychological well-being among university students

Psychological well-being is a multifaceted concept that includes happiness, life satisfaction, and mental and emotional health (Dhanabhakyam & Sarath, 2023). It is regulated by physiological and socio-psychological features and is vital for individual and community health (Abdullahi et al., 2021). Strategies to enhance psychological well-being, including stress reduction, emotional intelligence, and self-awareness development, are gaining traction (Kumar, 2021; Shyu, 2019), although the specific mechanisms by which physical education facilitates these results are not well comprehended. This gap prompts the current review to concentrate on the mediating functions of self-regulation and motivation.

Among university students specifically, research identifies several predictors of psychological well-being, including spiritual well-being and stress (Leung & Pong, 2021; Motevalli et al., 2022; Yusof et al., 2019), mindfulness-based interventions (Seppälä et al., 2020), personality traits such as agreeableness and conscientiousness (Osamika et al., 2021), as well as factors like learning styles and perceived social isolation (Liu et al., 2021; Morales-Rodríguez et al., 2020). These findings collectively highlight the multifaceted nature of student well-being and justify the examination of physical education in conjunction with motivational and self-regulatory processes.

A significant number of the studies featured in this review were carried out in Chinese university contexts, highlighting both the extensive recent research output from China and the specific challenges encountered by Chinese university students, such as elevated academic expectations, competitive atmospheres, and swift societal transformations. The contextual circumstances render the Chinese university population significant for analysing the relationship among physical education, self-regulation, motivation, and psychological well-being. Recent research conducted at Chinese institutions has underscored this significance: Yang et al. (2024) discovered a correlation between physical literacy and health-related quality of life among medical students at Shanxi Medical University, with physical exercise and subjective well-being acting as mediators. Kan et al. (2024) similarly established a favourable correlation between physical literacy, physical exercise, and psychological well-being among Chinese university students, highlighting the significance of physical education in fostering psychological resilience. These findings support the broader argument that structured physical education programs can effectively enhance student mental health, especially in high-stress academic settings.

Physical Literacy and Well-being

Physical literacy includes the movement skills, confidence, motivation, and knowledge essential for promoting lifelong engagement in physical activity (Dudley et al., 2019; Killough

et al., 2020; Roetert et al., 2018). Although health promotion policy emphasises its significance, the lack of a universally accepted definition hinders the creation of integrated programs (Bailey, 2020). Nevertheless, standardised assessment instruments, including the Physical Literacy Knowledge Questionnaire, are being formulated to bridge this gap (Longmuir et al., 2018).

A recent study has highlighted the importance of physical literacy in improving overall well-being, particularly among children and adolescents. Britton et al. (2023) and Blain et al. (2020) reported positive associations between physical literacy and well-being. In addition, Blain et al. (2020) found that higher levels of physical literacy were associated with greater participation in physical education and leisure-time physical activity. Urbano-Mairena et al.'s (2023) bibliometric study supports these findings by indicating a substantial relationship between physical literacy and health outcomes. Yi et al. (2020) dives into the complexities of physical literacy, discovering gender discrepancies and mitigating factors that influence children's physical literacy skills. Furthermore, Ahmad et al. (2020) and Roetert et al. (2019) emphasises the need for a multifaceted approach to literacy, including health literacy, in promoting overall well-being and physical exercise. Their findings highlight the significance of communicating a consistent message to improve health outcomes and build a culture of physical activity among people of all ages. These findings highlight the importance of physical literacy in promoting overall well-being and the need for coordinated efforts to include physical literacy in educational and health promotion strategies.

Although the beneficial correlation between physical literacy and student well-being is widely acknowledged, a significant gap remains in our comprehension of the fundamental causative mechanisms. A multitude of research utilises correlational designs, complicating the differentiation of causation and effect, while neglecting the impact of confounding variables. The specific elements of physical literacy—movement skills, knowledge, or confidence—that most profoundly influence well-being are ambiguous, obstructing the creation of successful tailored treatments. The absence of longitudinal research constrains our comprehension of the enduring impacts of physical literacy on well-being. A more sophisticated strategy is required, integrating varied approaches and improved measurement instruments to address these significant constraints. The reciprocal link between physical literacy and other well-being criteria requires more research to identify the most effective techniques for promoting positive and lasting effects.

Physical Education and psychological well-being

Physical education is a multifaceted educational domain that promotes physical activity, sports, and exercise and is central to holistic individuals' development (Živanović et al., 2021). Its benefits encompass not just physical health but also cognitive function, academic performance, and psychological well-being (Bailey et al., 2013; Salian & Kumar, 2022). Moreover, physical education significantly contributes to alleviating mental strain and stress (Burlui & Moisescu, 2021), and there is an increasing acknowledgement of the necessity to modernise curricula to maintain student involvement (Liu, 2020; Tison et al., 2020).

Numerous studies have looked at the relationship between physical education and psychological well-being, with consistent favourable results. According to Piñeiro-Cossio et al. (2021) and Sun et al. (2024), physical education can improve psychological well-being, especially through health education and sports participation. Du and Liu (2022) emphasises the importance of physical activity in improving psychological well-being, especially during the transition to college. Furthermore, Erturan-Ilker (2014) and Nopiyanto et al. (2022) provide a more nuanced viewpoint, emphasising the importance of meeting fundamental psychological requirements and motivating rules within the context of physical education in developing psychological well-being. Physical education and psychological well-being lay the

groundwork for understanding motivation and its critical role in increasing physical activity, improving physical literacy, and determining educational results (see Figure 1).

Despite the frequent reporting of a positive link between physical education (PE) and psychological well-being, the current literature has numerous significant limitations. A multitude of research utilises cross-sectional designs, which exclude conclusive findings regarding causation and insufficiently address the role of confounding variables. The precise components of physical education—activity types, intensity, duration, or social context—that most successfully enhance psychological well-being are generally unspecified, hindering the development of evidence-based, focused programs. Moreover, the long-term implications of physical education engagement on psychological well-being are frequently underexplored, constraining our comprehension of enduring repercussions. A more comprehensive research agenda is necessary, integrating longitudinal studies, varied techniques, and improved assessment instruments to address these critical gaps and fully harness the promise of physical education to increase student mental health. The intricate relationship between physical education, other elements of school life, and wider societal surroundings requires additional examination to comprehensively understand its varied impact on psychological well-being.

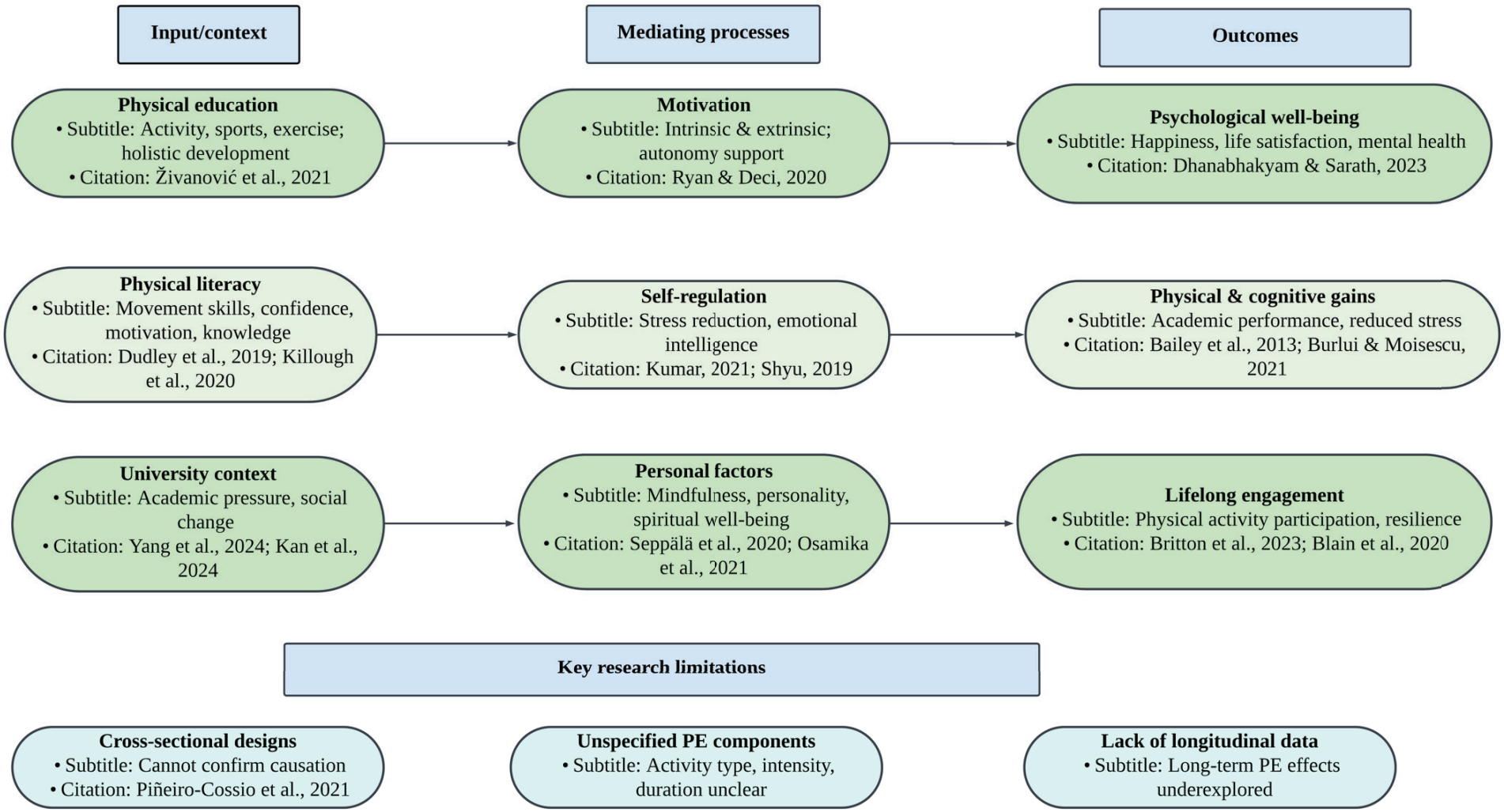

Figure 1. Physical education and psychological well-being.

Note: Adapted from Živanović et al. (2021); Dhanabhakyam & Sarath (2023); Bailey et al. (2013); Ryan & Deci (2020); Kumar (2021); Britton et al. (2023); Yang et al. (2024).

Role of motivation in physical education and psychological well-being

Motivation refers to the initiation, direction, intensity, and persistence of behaviour (Dörnyei, 2018; Ryan & Deci, 2000; Sulaiman et al., 2021), a construct recognised as dynamic and multifaceted, varying across developmental stages, environments, and tasks (Wright et al., 2019). According to Self-Determination Theory (Ryan & Deci, 2020), motivation encompasses both the intrinsic forms driven by internal goals and satisfaction and extrinsic forms, driven by external incentives or demands. In the context of education, motivation is essential for sustained learning and can be influenced by factors such as self-efficacy, goal orientation, and task difficulty (Salajegheh & Hoseinyshavoun, 2018). In physical education, motivation is a crucial factor influencing students' engagement, physical activity levels, and long-term well-being, rendering it a significant theme in this analysis.

Several studies have underlined the importance of motivation in physical activity, physical literacy, and education. Van Doren et al. (2021) and Leo et al. (2022) discovered that students' opinions of their physical education instructors' motivational style significantly impacted their motivation and physical activity levels. Hutmacher et al. (2020) and Kalajas-Tilga et al. (2020) emphasised the importance of autonomy support and intrinsic motivation in physical education, with the former demonstrating a positive impact on out-of-school physical activity and the latter identifying intrinsic motivation as a significant predictor of daily physical activity. Choi et al. (2021) and Rojo-Ramos et al. (2022) both highlighted the beneficial impacts of certain educational interventions, such as sport education, on physical literacy, motivation, and physical activity levels. These studies collectively indicate that when physical education programs emphasise skill development and collaborative learning, student motivation rises, hence enhancing both in-school engagement and physical activity outside of school environments. Motivation is crucial for the advancement of physical literacy; increased motivation cultivates a more favourable attitude towards physical activity, prompting students to develop skills that facilitate lifetime engagement in exercise (Choi et al., 2021). It is essential to recognise that motivational effects are contingent upon context and may be influenced by teaching methods, social dynamics inside the classroom, and cultural influences. Pereira et al. (2021) and Baena-Extremera et al. (2021) presented practical applications and insights from self-determination theory and neuroeducation, respectively, to improve motivation and physical activity in physical education. These findings pave the way for understanding how self-regulation, as a complementary construct, interacts with desire to influence behaviour and accomplishment in a variety of circumstances.

Motivation has a significant role in psychological outcomes, especially in educational contexts, where it profoundly affects students' mental health and academic achievement. Perez-Ordas et al. (2022) assert that intrinsic motivation, derived from personal interest and enjoyment in activities, correlates with improved psychological well-being. Their study suggests that genuinely driven students are more inclined to engage profoundly in learning experiences, resulting in enhanced emotional regulation and resilience. This inherent motivation not only cultivates a constructive learning atmosphere but also enhances life satisfaction and general mental well-being. Within the realm of physical education, this differentiation is notably pertinent: intrinsic motivation forecasts enduring participation in physical activities and psychological wellness, whereas extrinsic motivation, though effective in the short term, is less consistently linked to long-term results (Perez-Ordas et al., 2022).

Evidence from Chinese educational settings further corroborates these tendencies. Zheng et al. (2023) discovered that motivation significantly impacts both physical activity levels and reported well-being among Chinese adolescents during physical education. Specifically, higher motivation was linked to increased enjoyment of physical activities, which was positively correlated with adolescents' overall well-being, indicating that motivationally enriched

physical education environments can significantly improve both physical engagement and psychological outcomes (see Figure 2).

While motivation clearly influences the association between physical education and well-being (Papaioannou & Krommidas, 2021; Perez-Ordas et al., 2022), the unique and interactive effects of intrinsic and extrinsic motivation on psychological well-being require further research. Innovative pedagogical methods, including cross-disciplinary integration in physical education (Gobbi et al., 2020), show potential but need to be assessed in broader and more varied contexts. Qualitative methodologies, for example, could provide deeper insights into students' motivated experiences, enhancing the mostly quantitative database.

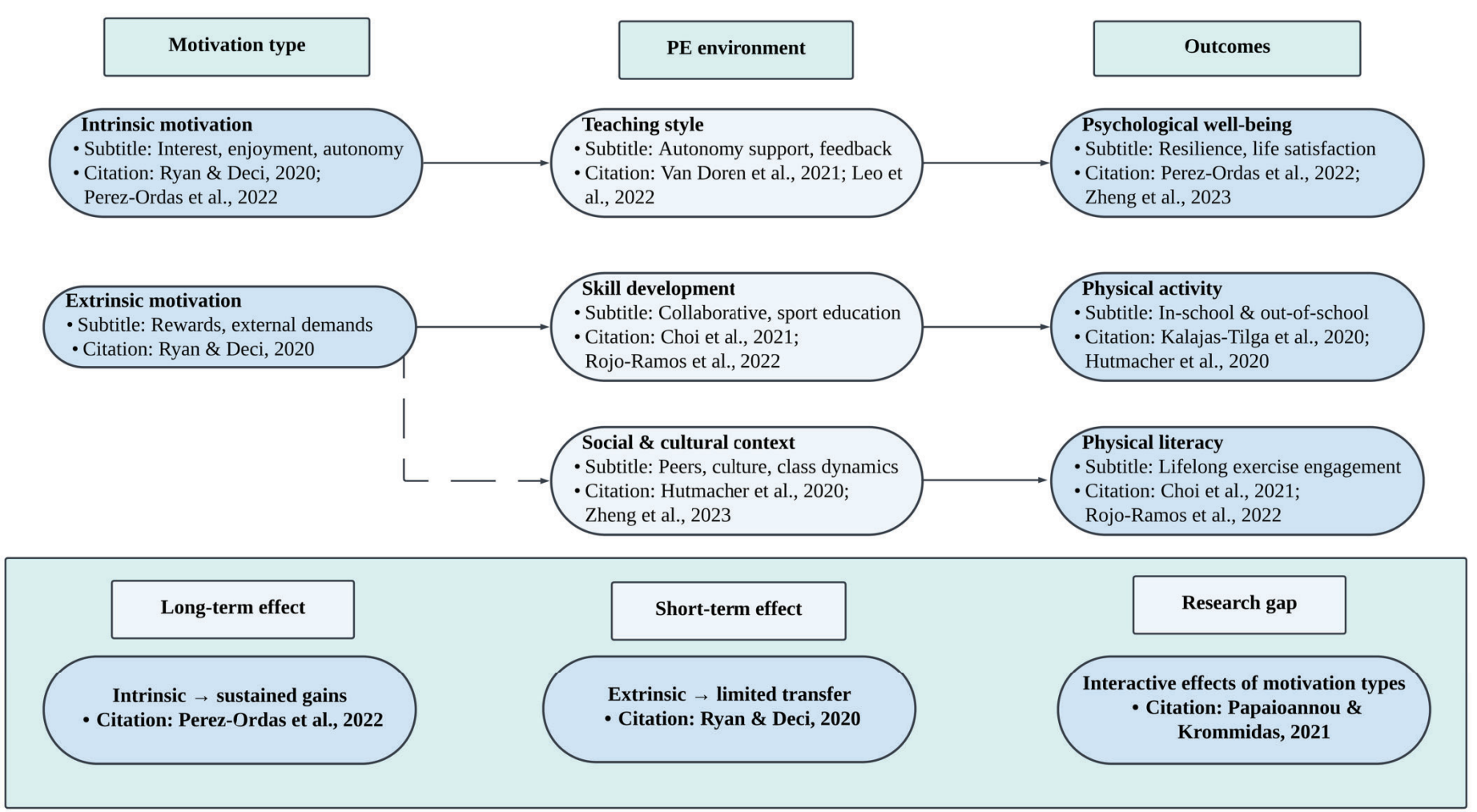

Figure 2. The role of motivation in physical education and psychological well-being.

Note: Adapted from Ryan & Deci (2020); Perez-Ordas et al. (2022); Zheng et al. (2023); Choi et al. (2021); Kalajas-Tilga et al. (2020); Van Doren et al. (2021); Leo et al. (2022).

The role of self-regulation in physical education and psychological well-being

Self-regulation is the process by which individuals actively monitor, control, and regulate their thoughts, emotions, and behaviours to achieve desired goals and outcomes (Boekaerts et al., 1999; Zimmerman, 2000, 2008). This process encompasses cognitive, emotional, and behavioural strategies including goal-setting, planning, progress monitoring, self-reflection, and adaptive adjustment as well as avoiding distractions, deferring gratification, and persevering in the face of obstacles or disappointments. Generally, these capacities make self-regulation an important predictor of adaptive functioning across academic, social, and psychological domains (Boekaerts et al., 1999; Zimmerman, 2008).

Self-regulation is a multidimensional construct that is essential to human functioning across a range of domains. In educational contexts, promoting self-regulation enhances children's academic performance and psychological health (Merritt et al., 2022), with its theoretical underpinnings derived from the synthesis of social psychology, personality psychology, and cognitive neuroscience (Inzlicht et al., 2021). In physical and athletic contexts, self-regulation influences training, competition, and recovery: effective recovery self-regulation necessitates individuals to recognise the disparity between their current and desired states and to implement cognitive, emotional, and behavioural strategies to bridge this gap, thereby improving long-term health and athletic performance (Balk & Englert, 2020). Kermarrec et al. (2022) discovered that self-regulation significantly enhances learning processes in physical education, augmenting students' abilities to establish goals, track progress, and modify strategies, which results in improved performance and increased engagement in physical activities. These findings establish self-regulation as not only an academic skill but also a fundamental competency for physical and psychological well-being across various contexts.

Evidence consistently associates self-regulation with favourable academic performance and well-being results throughout various educational levels. In early childhood, self-regulation correlates with academic preparedness and prosocial behaviour (Savina, 2021). In teenagers, psychological and academic subjective well-being are intricately linked to self-regulatory abilities, with educators significantly influencing the development of students' self-efficacy and self-regulation skills (Gökteke & Ocak, 2024). Rodríguez et al. (2022) correlated self-regulation with student happiness and school engagement at the university level, whereas Šteh and Šarić (2020) evidenced that fostering self-regulated learning processes enhances meaningful and effective learning in higher education. Nieva and Prudente (2022) discovered that academic achievement did not moderate the association between online self-regulated learning and well-being, indicating that self-regulation provides a direct psychological advantage irrespective of performance results. These findings collectively highlight the necessity of further investigation into the function of self-regulation in physical education and physical literacy.

In the context of physical education, self-regulation is shaped by multiple factors, including teacher learning support and the motivational climate of the classroom (Laxdal, 2020), as well as the cognitive and metacognitive strategies employed by physical education instructors (Liu et al., 2020). Structured interventions targeting self-regulated learning, such as dedicated self-regulation teaching units, have demonstrated improvements in students' physical performance calibration, goal accomplishment, and attributions patterns (Kolovelonis et al., 2022). Beyond the classroom, research indicates that self-regulation plays a crucial mediating role in the association between physical activity and cognitive school readiness in preschool-age children (Bai et al., 2021). Specifically, moderate-to-vigorous physical activity (MVPA) was positively correlated with self-regulation and cognitive school readiness scores, with self-regulation partially mediating the association between MVPA and cognitive school readiness -

indicating both direct and indirect pathways through which physical activity supports early cognitive development. Collectively, these findings underscore the imperative of developing physical education treatments that specifically aim to enhance self-regulatory abilities to improve both physical and cognitive outcomes.

A converging body of studies has indicated significant links between self-regulation, physical literacy, and psychological well-being. Bai et al. (2021) and Gea-García et al. (2020) found that self-regulation mediates the association between physical exercise and cognitive school readiness, while also improving students' time management and goal-setting capabilities. Furthermore, effective self-regulation boosts fitness levels by promoting regular participation in physical activities, so creating a positive feedback loop that supports both physical and cognitive achievement. She et al. (2023) elucidated that physical literacy mediates the correlation between self-esteem and participation in physical activity: by enhancing individuals' confidence and competence in movement, physical literacy fosters continued engagement in exercise, subsequently improving self-esteem and overall well-being. These findings underscore the importance of including physical literacy development into educational curriculum as a means to enhance both self-regulatory capacity and psychological well-being.

Erturan et al. (2020) and Blain et al. (2020) underscored the complementary roles of self-efficacy and self-regulation in enhancing leisure-time physical activity and engagement in physical education. Enhanced self-efficacy cultivates individuals' confidence in their capacity to participate in physical activities, whereas proficient self-regulation allows them to establish objectives, track advancement, and surmount challenges. Collectively, these constructs significantly improve participation rates and motivation in both recreational and formal educational contexts, supporting the case of targeted interventions that develop both capacities in students. Building on this, Vasilopoulos and Ellefson (2021) and Wang et al. (2022) demonstrated positive associations between physical activity, self-regulation, and emotional regulation, as well as the mediating role of self-efficacy and emotional intelligence in the relationship between physical exercise and subjective well-being. These findings collectively highlight the complex, mutually reinforcing links among self-regulation, physical education, and psychological well-being.

Several recent studies have investigated these linkages among Chinese university students, a demographic marked by unique academic constraints and an increasing state focus on physical education reform. Yang et al. (2024) discovered at Shanxi Medical University that physical literacy had a positive correlation with health-related quality of life among medical students, with physical exercise and subjective well-being acting as mediators.

In a separate study of 798 university students in Chongqing, Zhang et al. (2022) found that higher physical fitness was correlated with higher physical activity and physical literacy, which in turn predicted improved psychological well-being. Furthermore, Zhong (2024) found that students intrinsically motivated to participate in physical activities reported higher levels of personal development and general well-being, suggesting that physical education programs which cultivate intrinsic motivation may yield substantial psychological benefits. Collectively, these studies illustrate that the pathway from physical education and psychological well-being in Chinese university students functions through various mechanisms—physical literacy, fitness, and intrinsic motivation—reinforcing the need for comprehensive program design that addresses all three.

Additional evidence substantiates the mediating function of self-regulation in this area. Leo et al. (2022) identified that a need-supportive teaching environment in physical education correlated with enhanced student intentions for physical activity, whereas Aleksovska-Velickovska et al. (2019) established that self-determined regulation of exercise behaviour forecasted elevated physical activity levels. Wang et al. (2022) and Shang and Xie (2021) further confirmed positive correlations between physical exercise and subjective well-being,

with the latter identifying body image and self-esteem as mediating variables. Despite this increasing evidence, the mediating roles of self-regulation and motivation in the association between physical education and well-being remain inadequately comprehended. In particular, existing research rarely distinguishes between the independent and interactive effects of these two dimensions, resulting in an inadequate specification of the mechanisms by which they influence psychological consequences. Further research utilising robust methodologies — such as mediation and moderation analyses — is essential to elucidate how self-regulation and various forms of motivation (intrinsic versus extrinsic) collectively impact the association between physical education participation and psychological well-being. This paper proposes a conceptual framework that incorporates the suggested variables in physical education and psychological well-being, while also considering the mediating roles of self-regulation and motivation (see Figure 3).

Conclusion

This study examined the intricate relationship between physical literacy, physical education, and psychological well-being, focusing on three primary research issues. The results illuminate the beneficial impacts of physical literacy and physical education on students' psychological well-being (RQ1), elucidating the crucial influence of motivation in fostering participation in physical education and improving psychological well-being (RQ2). The study investigated the mediating effects of self-regulation and motivation on the link between physical education and psychological well-being (RQ3), highlighting the significant interaction of these elements in fostering beneficial results. The research offers a refined comprehension of the interrelation between physical exercise, psychological aspects, and well-being, guiding the creation of more effective treatments for holistic student development.

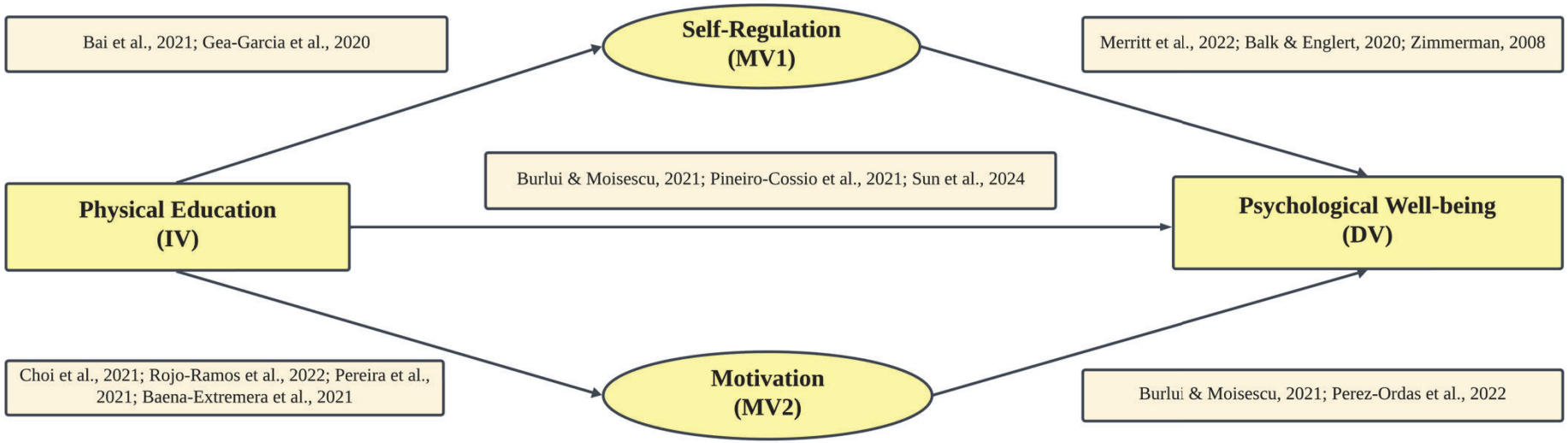

Figure 3. Proposed conceptual mediating roles of self-regulation and motivation in physical education and psychological well-being

Funding
This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Disclosure statement
All authors declare that there are no conflicts of interest regarding the publication of this paper.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process
During the preparation of this manuscript, the author(s) used ChatGPT to assist with improving language clarity, grammar, and phrasing. The author(s) carefully reviewed and revised the output to ensure accuracy and take(s) full responsibility for the content of the final manuscript.

Notes on Contributors
Xihang Miao is an ideological and political education researcher and university practitioner with more than nine years of experience in psychology, education, and clinical practice. He holds a Bachelor's degree in Management, a Master's degree in Pedagogy, as well as a PhD in Educational Psychology. His academic background reflects solid training in both theoretical and applied aspects of pedagogy and psychological science. Email : miaoxihang1821@163.com

Saeid Motevalli is an educational psychologist, researcher, and practitioner with more than 20 years of experience in psychology, education, and clinical practice. He holds a Bachelor's degree and a Master's degree in General Psychology, as well as a PhD in Educational Psychology. His academic background reflects strong training in both theoretical and applied aspects of psychological science. Email: saeid@ucsiuniversity.edu.my

Rui Song holds a Ph.D. in Education from UCSI University, Malaysia. She received her Bachelor's degree from the Sichuan Conservatory of Music, China, and her Master's degree from Shandong Sport University, China. Her primary research interests lie at the intersection of music education, educational psychology, and physical education, with a particular focus on the psychophysiological regulatory effects of music on exercise motivation, attention, emotion, and athletic performance. Email: songrui@sdpei.edu.cn

Nadia Samsudin's research focuses on public health, educational psychology, mental health, and health promotion, with particular emphasis on well-being, behavioural health, physical activity, and health-related educational contexts. Her work applies quantitative and interdisciplinary approaches, including structural equation modelling, systematic reviews, and applied health and education research. Email: nadia.samsudin@ucsiuniversity.edu.my

References

Abdullahi, A. A., Ntozini, A., & Oguntayo, R. (2021). Socio-contextual factors as determinants of psychological wellbeing of selected aged in South Africa: A moderating approach. *Pertanika Journal of Social Sciences and Humanities*, *29*(1), 349–366. https://doi.org/10.47836/pjssh.29.1.20

Ahmad, F. N., Tl, R., Tirth, A., & Rawat, P. (2020). Health literacy: Addressing well-being: A review. *International Healthcare Research Journal*, *4*(5), 105–112. https://doi.org/10.26440/IHRJ/0405.08355

Aleksovska-Velickovska, L., Gontarev, S., & Ruzdija, K. (2019). Students motivation for engaging in physical activity: Theory for self-determination. *Journal of Human Sport and Exercise*, *14*(2), 325–334. https://doi.org/10.14198/jhse.2019.142.06

Baena-Extremera, A., Ruiz-Montero, P. J., & Hortigüela-Alcalá, D. (2021). Neuroeducation, motivation, and physical activity in students of physical education. *International Journal of Environmental Research and Public Health*, *18*(5), 2622. https://doi.org/10.3390/ijerph18052622

Bai, P., Johnson, S., Trost, S. G., Lester, L., Nathan, A., & Christian, H. (2021). The relationship between physical activity, self-regulation and cognitive school readiness in preschool children. *International Journal of Environmental Research and Public Health*, *18*(22), 11797. https://doi.org/10.3390/ijerph182211797

Bailey, R. (2020). Defining physical literacy: Making sense of a promiscuous concept. *Sport in Society*, *25*(1), 163–180. https://doi.org/10.1080/17430437.2020.1777104

Bailey, R., Hillman, C., Arent, S., & Petitpas, A. (2013). Physical activity: An underestimated investment in human capital? *Journal of Physical Activity and Health*, *10*(3), 289–308. https://doi.org/10.1123/jpah.10.3.289

Balk, Y. A., & Englert, C. (2020). Recovery self-regulation in sport: Theory, research, and practice. *International Journal of Sports Science & Coaching*, *15*(2), 273–281. https://doi.org/10.1177/1747954119897528

Blain, D. O., Curran, T., & Standage, M. (2020). Psychological and behavioral correlates of early adolescents' physical literacy. *Journal of Teaching in Physical Education*, *40*(1), 157–165. https://doi.org/10.1123/jtpe.2019-0131

Boekaerts, M., Zeidner, M., & Pintrich, P. R. (1999). *Handbook of self-regulation*. Elsevier.

Britton, Ú., Onibonoje, O., Belton, S., Behan, S., Peers, C., Issartel, J., & Roantree, M. (2023). Moving well-being well: Using machine learning to explore the relationship between physical literacy and well-being in children. *Applied Psychology: Health and Well-Being*, *15*(3), 1110–1129. https://doi.org/10.1111/aphw.12429

Burlui, R. M., & Moisescu, P.-C. (2021). The role of physical education in well-being and school performance of pupils. *Ştiinţa Culturii Fizice*, *2*(38), 149–157. https://doi.org/10.52449/1857-4114.2020.38-2.09

Choi, S. M., Sum, K. W. R., Leung, F. L. E., Wallhead, T., Morgan, K., Milton, D., Ha, S. C. A., & Sit, H. P. C. (2021). Effect of sport education on students' perceived physical literacy, motivation, and physical activity levels in university required physical education: a cluster-randomized trial. *Higher Education*, *81*, 1137–1155. https://doi.org/10.1007/s10734-020-00603-5

Coventry, P. (2023). Psychological well-being is aligned to the ethical theory of flourishing. *Environment and Social Psychology*, *8*(2). https://doi.org/10.54517/esp.v8i2.1603

Dhanabhakyam, M., & Sarath, M. (2023). Psychological wellbeing: A systematic literature review. *International journal of advanced research in science, communication and technology*, *3*(1), 603–607. https://doi.org/10.48175/IJARSCT-8345

Dörnyei, Z. (2018). Motivating students and teachers. *The TESOL encyclopedia of English language teaching*, 1–6. https://doi.org/10.1002/9781118784235.eelt0128

Du, X., & Liu, Z. (2022). Influence of physical education on the mental health of college students. *Revista Brasileira de Medicina do Esporte*, *28*(4), 311–314. https://doi.org/10.1590/1517-8692202228042021_0062

Dudley, D., Cairney, J., & Goodway, J. (2019). Special issue on physical literacy: Evidence and intervention. *Journal of Teaching in Physical Education*, *38*(2), 77–78. https://doi.org/10.1123/jtpe.2019-0020

Erturan-Ilker, G. (2014). Psychological well-being and motivation in a Turkish physical education context. *Educational Psychology in Practice*, *30*(4), 365–379. https://doi.org/10.1080/02667363.2014.949374

Erturan, G., McBride, R., & Agbuga, B. (2020). Self-regulation and self-efficacy as mediators of achievement goals and leisure time physical activity: A proposed model. *Pedagogy of Physical Culture and Sports*, *24*(1), 12–20. https://doi.org/10.15561/26649837.2020.0102

Gea-García, G. M., González-Gálvez, N., Espeso-García, A., Marcos-Pardo, P. J., González-Fernández, F. T., & Martínez-Aranda, L. M. (2020). Relationship between the practice of physical activity and physical fitness in physical education students: the integrated regulation as a mediating variable. *Frontiers in psychology*, *11*, 558971. https://doi.org/10.3389/fpsyg.2020.01910

Gobbi, E., Maltagliati, S., Sarrazin, P., Di Fronso, S., Colangelo, A., Cheval, B., Escriva-Boulley, G., Tessier, D., Demirhan, G., & Erturan, G. (2020). Promoting physical activity during school closures imposed by the first wave of the COVID-19 pandemic: Physical education teachers' behaviors in France, Italy and Turkey. *International Journal of Environmental Research and Public Health*, *17*(24), 9431. https://doi.org/10.3390/ijerph17249431

Gökteke, Z., & Ocak, G. (2024). The concept of self-regulation and its place and importance in educational sciences. *European Journal of Education Studies*, *11*(1), 159–168. https://doi.org/10.46827/ejes.v11i1.5160

Hutmacher, D., Eckelt, M., Bund, A., & Steffgen, G. (2020). Does motivation in physical education have an impact on out-of-school physical activity over time? A longitudinal approach. *International Journal of Environmental Research and Public Health*, *17*(19), 7258. https://doi.org/10.3390/ijerph17197258

Inzlicht, M., Werner, K. M., Briskin, J. L., & Roberts, B. W. (2021). Integrating models of self-regulation. *Annual review of psychology*, *72*, 319–345. https://doi.org/10.1146/annurev-psych-061020-105721

Kalajas-Tilga, H., Koka, A., Hein, V., Tilga, H., & Raudsepp, L. (2020). Motivational processes in physical education and objectively measured physical activity among adolescents. *Journal of sport and health science*, *9*(5), 462–471. https://doi.org/10.1016/j.jshs.2019.06.001

Kan, W., Huang, F., Xu, M., Shi, X., Yan, Z., & Türegün, M. (2024). Exploring the mediating roles of physical literacy and mindfulness on psychological distress and life satisfaction among college students. *PeerJ*, *12*, e17741. https://doi.org/10.7717/peerj.17741

Kermarrec, G., Regaieg, G., & Clayton, R. (2022). Mixed-methods approaches to learning strategies and self-regulation in Physical Education: a literature review. *Physical Education and Sport Pedagogy*, *27*(2), 172–185. https://doi.org/10.1080/17408989.2021.1999916

Killough, B. P., Sluder, J. B., Howard-Shaughnessy, C., & Rhodes, A. C. (2020). Physical literacy and practical applications for physical educators. *Journal of Physical*

Education, Recreation & Dance, *92*(2), 30–39. https://doi.org/10.1080/07303084.2020.1853633

Kolovelonis, A., Goudas, M., & Samara, E. (2022). The effects of a self-regulated learning teaching unit on students' performance calibration, goal attainment, and attributions in physical education. *The Journal of Experimental Education*, *90*(1), 112–129. https://doi.org/10.1080/00220973.2020.1724852

Kumar, U. (2021). Positive emotions at workplace. In *Emotion, Well-Being, and Resilience* (1st ed., pp. 283–296). Apple Academic Press.

Laxdal, A. G. (2020). *The learning environment in upper secondary school physical education: The student perspective* [PhD, University of Stavanger]. https://hdl.handle.net/11250/2657854

Leo, F. M., Mouratidis, A., Pulido, J., López-Gajardo, M., & Sánchez-Oliva, D. (2022). Perceived teachers' behavior and students' engagement in physical education: The mediating role of basic psychological needs and self-determined motivation. *Physical Education and Sport Pedagogy*, *27*(1), 59–76. https://doi.org/10.1080/17408989.2020.1850667

Leung, C. H., & Pong, H. K. (2021). Cross-sectional study of the relationship between the spiritual wellbeing and psychological health among university Students. *PloS one*, *16*(4), e0249702. https://doi.org/10.1371/journal.pone.0249702

Liu, C., McCabe, M., Dawson, A., Cyrzon, C., Shankar, S., Gerges, N., Kellett-Renzella, S., Chye, Y., & Cornish, K. (2021). Identifying predictors of university students' wellbeing during the COVID-19 pandemic—a data-driven approach. *International Journal of Environmental Research and Public Health*, *18*(13), 6730. https://doi.org/10.3390/ijerph18136730

Liu, G. (2020). Research on the status quo of the curriculum of public physical education in high schools. *Journal of Contemporary Educational Research*, *4*(2), 50–53. https://doi.org/10.26689/jcer.v4i2.1009

Liu, J., Xiang, P., McBride, R. E., & Chen, H. (2020). Self-regulated learning strategies and achievement goals among preservice physical education teachers. *European Physical Education Review*, *26*(2), 375–391. https://doi.org/10.1177/1356336X19859602

Longmuir, P. E., Woodruff, S. J., Boyer, C., Lloyd, M., & Tremblay, M. S. (2018). Physical Literacy Knowledge Questionnaire: feasibility, validity, and reliability for Canadian children aged 8 to 12 years. *BMC public health*, *18*, 1–11. https://doi.org/10.1186/s12889-018-5890-y

Lubans, D., Richards, J., Hillman, C., Faulkner, G., Beauchamp, M., Nilsson, M., Kelly, P., Smith, J., Raine, L., & Biddle, S. (2016). Physical activity for cognitive and mental health in youth: a systematic review of mechanisms. *Pediatrics*, *138*(3), e20161642. https://doi.org/10.1542/peds.2016-1642

Mead, J., Fisher, Z., & Kemp, A. H. (2021). Moving beyond disciplinary silos towards a transdisciplinary model of wellbeing: An invited review. *Frontiers in psychology*, *12*, 642093. https://doi.org/10.3389/fpsyg.2021.642093

Merritt, J., Kernot, J., Dizon, J., & Boshoff, K. (2022). Facilitating practices to support children's self-regulation in classrooms: a scoping review protocol. *JBI evidence synthesis*, *20*(3), 882–889. https://doi.org/10.11124/JBIES-21-00067

Morales-Rodríguez, F. M., Espigares-López, I., Brown, T., & Pérez-Mármol, J. M. (2020). The relationship between psychological well-being and psychosocial factors in university students. *International Journal of Environmental Research and Public Health*, *17*(13), 4778. https://doi.org/10.3390/ijerph17134778

Moroz, V., & Shtepa, O. (2021). Motivation as a determinant factor in performance. *Scientific Journal of Polonia University*, *44*(1), 284–289.

Motevalli, S., Sulaiman, T., Wong, K. Y., & Jaafar, W. M. W. (2022). Athletes' psycho-physical training and cognitive restructuring module to enhance university-athlete students' well-being. *The Open Psychology Journal*, *15*(1). https://doi.org/10.2174/18743501-v15-e221018-2022-13

Nieva, A. M., & Prudente, J. E. (2022). Online self-regulated learning, academic performance, and well-being of Senior High School Students in the NCR: A mediation analysis. *Bedan Research Journal*, *7*(1), 48–62. https://doi.org/10.58870/berj.v7i1.32

Nopiyanto, Y. E., Raibowo, S., Prabowo, A., & Ibrahim, I. (2022). Psychological well-being: A study of physical education students. *Altius: Jurnal Ilmu Olahraga dan Kesehatan*, *11*(2), 160–166. https://doi.org/10.36706/altius.v11i2.130

Osamika, B. E., Lawal, T., Osamika, A. E., Hounhanou, A. J. V., & Laleye, M. (2021). Personality characteristics, psychological wellbeing and academic success among university students. *International Journal of Research in Education and Science*, *7*(3), 805–821. https://doi.org/10.46328/ijres.1898

Papaioannou, A. G., & Krommidas, C. (2021). Self-transcendence achievement goals and well-being. *International Journal of Sport and Exercise Psychology*, *19*(2), 215–245. https://doi.org/10.1080/1612197X.2020.1830826

Pereira, P., Marinho, D. A., & Santos, F. (2021). Positive motivational climates, physical activity and sport participation through self-determination theory: Striving for quality physical education. *Journal of Physical Education, Recreation & Dance*, *92*(6), 42–47. https://doi.org/10.1080/07303084.2021.1936307

Perez-Ordas, R., Pineiro-Cossio, J., Diaz-Chica, O., & Ayllon-Negrillo, E. (2022). Relevant variables in the stimulation of psychological well-being in physical education: A systematic review. *Sustainability*, *14*(15), 9231. https://doi.org/10.3390/su14159231

Piñeiro-Cossio, J., Fernández-Martínez, A., Nuviala, A., & Pérez-Ordás, R. (2021). Psychological wellbeing in physical education and school sports: A systematic review. *International Journal of Environmental Research and Public Health*, *18*(3), 864. https://doi.org/10.3390/ijerph18030864

Rodríguez, S., González-Suárez, R., Vieites, T., Piñeiro, I., & Díaz-Freire, F. M. (2022). Self-regulation and students well-being: A systematic review 2010–2020. *Sustainability*, *14*(4), 2346. https://doi.org/10.3390/su14042346

Roetert, E. P., Ellenbecker, T. S., & Kriellaars, D. (2018). Physical literacy: Why should we embrace this construct? *British Journal of Sports Medicine, 52*(20), 1291–1292. https://doi.org/10.1136/bjsports-2017-098465

Roetert, E. P., Hainline, B., & Shell, D. (2019). A complementary perspective of wellness-related literacies. *Translational Journal of the American College of Sports Medicine*, *4*(9), 61–63. https://doi.org/10.1249/TJX.0000000000000084

Rojo-Ramos, J., González-Becerra, M. J., Gómez-Paniagua, S., Merellano-Navarro, E., & Adsuar, J. C. (2022). Analysis of the motivation of students of the last cycle of primary school in the subject of physical education. *International Journal of Environmental Research and Public Health*, *19*(3), 1332. https://doi.org/10.3390/ijerph19031332

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary educational psychology*, *25*(1), 54–67. https://doi.org/10.1006/ceps.1999.1020

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary educational psychology*, *61*, 101860. https://doi.org/10.1016/j.cedpsych.2020.101860

Salajegheh, M., & Hoseinyshavoun, A. (2018). The Role of motivation in learning. *The Journal of Medical Education and Development*, *13*(2), 172–174.

Salian, P., & Kumar, A. (2022). Changing your new focus on physical education and sports sciences. *Asian Journal of Multidimensional Research*, *11*(10), 49–56. https://doi.org/10.5958/2278-4853.2022.00239.7

Savina, E. (2021). Self-regulation in preschool and early elementary classrooms: Why it is important and how to promote it. *Early Childhood Education Journal*, *49*(3), 493–501. https://doi.org/10.1007/s10643-020-01094-w

Seppälä, E. M., Bradley, C., Moeller, J., Harouni, L., & Nandamudi, D. (2020). Promoting mental health and psychological thriving in university students: a randomized controlled trial of three well-being interventions. *Frontiers in psychiatry*, *11*, 534776. https://doi.org/10.3389/fpsyt.2020.00590

Shang, Y., & Xie, H.-D. (2021). The relationship between physical exercise and subjective well-being in college students: The mediating effect of body image and self-esteem. *Frontiers in psychology*, *12*, 658935. https://doi.org/10.3389/fpsyg.2021.658935

She, X., Gao, T.-Y., Ma, R.-S., Tang, D., Zhong, H., & Dong, H.-L. (2023). Relationship among positive self-esteem, physical literacy, and physical activity in college students: a study of a mediation model. *Frontiers in psychology*, *14*, 1097335. https://doi.org/10.3389/fpsyg.2023.1097335

Shyu, Y.-I. L. (2019). Maintaining and improving psychological well-being. *Journal of Nursing Research*, *27*(3), e19. https://doi.org/10.1097/jnr.0000000000000333

Šteh, B., & Šarić, M. (2020). Enhancing self-regulated learning in higher education. *Journal of Elementary Education*, *13*(Spec. Iss.), 129–150. https://doi.org/10.18690/rei.13.Special.129-150.2020

Sulaiman, T., Ibrahim, A., Motevalli, S., Wong, K. Y., & Hakim, M. N. (2021). Effect of e-evaluation on work motivation among teachers during the movement control order in COVID-19: The mediating role of stress. *Interactive Technology and Smart Education*, *18*(3), 435–449. https://doi.org/10.1108/ITSE-05-2020-0066

Sun, H., Du, C.-R., & Wei, Z.-F. (2024). Physical education and student well-being: Promoting health and fitness in schools. *PloS one*, *19*(1), e0296817. https://doi.org/10.1371/journal.pone.0296817

Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC medical research methodology*, *8*(1), 45. https://doi.org/10.1186/1471-2288-8-45

Tison, G. H., Avram, R., Kuhar, P., Abreau, S., Marcus, G. M., Pletcher, M. J., & Olgin, J. E. (2020). Worldwide effect of COVID-19 on physical activity: A descriptive study. *Annals of internal medicine*, *173*(9), 767–770. https://doi.org/10.7326/M20-2665

Urbano-Mairena, J., Castillo-Paredes, A., Muñoz-Bermejo, L., Denche-Zamorano, Á., Rojo-Ramos, J., Pastor-Cisneros, R., & Mendoza-Muñoz, M. (2023). A bibliometric analysis of physical literacy studies in relation to health of children and adolescents. *Children*, *10*(4), 660. https://doi.org/10.3390/children10040660

Van Doren, N., De Cocker, K., De Clerck, T., Vangilbergen, A., Vanderlinde, R., & Haerens, L. (2021). The relation between physical education teachers'(de-) motivating style, students' motivation, and students' physical activity: A multilevel approach. *International Journal of Environmental Research and Public Health*, *18*(14), 7457. https://doi.org/10.3390/ijerph18147457

Vasilopoulos, F., & Ellefson, M. R. (2021). Investigation of the associations between physical activity, self-regulation and educational outcomes in childhood. *PloS one*, *16*(5), e0250984. https://doi.org/10.1371/journal.pone.0250984

Wang, K., Li, Y., Zhang, T., & Luo, J. (2022). The relationship among college students' physical exercise, self-efficacy, emotional intelligence, and subjective well-being.

International Journal of Environmental Research and Public Health, *19*(18), 11596. https://doi.org/10.3390/ijerph191811596

Wright, K. L., Hodges, T. S., & McTigue, E. M. (2019). A validation program for the Self-Beliefs, Writing-Beliefs, and Attitude Survey: A measure of adolescents' motivation toward writing. *Assessing Writing*, *39*, 64–78. https://doi.org/10.1016/j.asw.2018.12.004

Yang, X., Wang, M., Wang, J., Zhang, S., Yang, X., & Zhao, L. (2024). Physical literacy and health of Chinese medical students: the chain mediating role of physical activity and subjective well-being. *Frontiers in Public Health*, *12*, 1348743. https://doi.org/10.3389/fpubh.2024.1348743

Yi, K. J., Cameron, E., Patey, M., Loucks-Atkinson, A., Loeffler, T., Sullivan, A.-M., Mcgowan, E., Borduas, C., & Buote, R. (2020). Future directions for physical literacy education: Community perspectives. *Journal of Physical Education and Sport*, *20*(1), 123–130. https://doi.org/10.7752/jpes.2020.01016

Yusof, H. M., Rahman, R. H. A., Noordin, N. F. M., Patah, S., Yunus, W., & Fei, G. (2019). Does University Students' Stress Have an Impact on their Psychological Well-Being? *Indian Journal of Public Health Research & Development*, *10*(6), 1290–1294. https://doi.org/10.5958/0976-5506.2019.01473.6

Zhang, C., Liu, Y., Xu, S., Sum, R. K.-W., Ma, R., Zhong, P., Liu, S., & Li, M. (2022). Exploring the level of physical fitness on physical activity and physical literacy among Chinese university students: a cross-sectional study. *Frontiers in psychology*, *13*, 833461. https://doi.org/10.3389/fpsyg.2022.833461

Zheng, W., Shen, H., Belhaidas, M. B., Zhao, Y., Wang, L., & Yan, J. (2023). The relationship between physical fitness and perceived well-being, motivation, and enjoyment in Chinese adolescents during physical education: a preliminary cross-sectional study. *Children*, *10*(1), 111. https://doi.org/10.3390/children10010111

Zhong, T. (2024). Physical activity motivations and psychological well-being among university students: a canonical correlation analysis. *Frontiers in Public Health*, *12*, 1442632. https://doi.org/10.3389/fpubh.2024.1442632

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In *Handbook of self-regulation* (pp. 13–39). Elsevier. https://doi.org/10.1016/B978-012109890-2/50031-7

Zimmerman, B. J. (2008). Investigating self-regulation and motivation: Historical background, methodological developments, and future prospects. *American educational research journal*, *45*(1), 166–183. https://doi.org/10.3102/0002831207312909

Živanović, N., Milošević, Z., Stanković, V., Ranđelović, N., & Pantelić, B. K. (2021). Physical education and healthy lifestyle. *Fizičko vaspitanje i sport kroz vekove*, *8*(1), 1–10. https://doi.org/10.5937/spes2101001Z

Table S1. Thomas and Harden (2008) Thematic Coding — Motivation, Self-Regulation, Physical Education, and Psychological Well-Being

Theme 1: Physical Education, Physical Literacy, and Psychological Well-Being			
1a. Psychological well-being among university students			
Happiness, life satisfaction, and mental health as core components of well-being	Multidimensional nature of psychological well-being	Physical education supports holistic well-being through multiple psychological pathways	Dhanabhakyam & Sarath (2023); Abdullahi et al. (2021)
Stress, spiritual well-being, and personality traits predict student well-being	Individual predictors of university student well-being	Physical education supports holistic well-being through multiple psychological pathways	Leung & Pong (2021); Osamika et al. (2021); Seppälä et al. (2020)
Chinese university students face elevated academic pressure and social change	Contextual constraints on student well-being in China	Physical education supports holistic well-being through multiple psychological pathways	Yang et al. (2024); Kan et al. (2024)
Physical literacy correlates with health-related quality of life in medical students	Physical literacy as a mediator of well-being in high-stress contexts	Physical education supports holistic well-being through multiple psychological pathways	Yang et al. (2024); Kan et al. (2024)
1b. Physical literacy and well-being			
Movement skills, confidence, motivation, and knowledge define physical literacy	Physical literacy as a multidimensional construct	Physical literacy is a foundational pathway linking PE participation to long-term well-being	Dudley et al. (2019); Killough et al. (2020); Roetert et al. (2018)
Physical literacy positively linked to well-being and leisure-time activity participation	Physical literacy predicts well-being and activity engagement	Physical literacy is a foundational pathway linking PE participation to long-term well-being	Britton et al. (2023); Blain et al. (2020)
Gender differences and mitigating factors shape physical literacy development	Variability in physical literacy acquisition	Physical literacy is a foundational pathway linking PE participation to long-term well-being	Yi et al. (2020)
Lack of universal definition hinders integrated program development	Definitional and methodological gaps in physical literacy research	Physical literacy is a foundational pathway linking PE participation to long-term well-being	Bailey (2020); Longmuir et al. (2018)
Correlational designs limit causal conclusions about physical literacy and well-being	Research design limitations in physical literacy studies	Physical literacy is a foundational pathway linking PE participation to long-term well-being	Urbano-Mairena et al. (2023)
1c. Physical education and psychological well-being			
PE improves psychological well-being through sports participation and health education	Direct positive effects of PE on psychological outcomes	Structured PE programs produce consistent psychological benefits, though mechanisms remain underspecified	Piñeiro-Cossio et al. (2021); Sun et al. (2024)
PE alleviates mental strain and contributes to stress reduction	PE as a stress-reduction tool	Structured PE programs produce consistent psychological benefits, though mechanisms remain underspecified	Burlui & Moisescu (2021); Du & Liu (2022)

Meeting basic psychological needs in PE fosters well-being	Psychological need satisfaction as a PE mechanism	Structured PE programs produce consistent psychological benefits, though mechanisms remain underspecified	Erturan-Ilker (2014); Nopiyanto et al. (2022)
Cross-sectional designs dominate; causal conclusions are limited	Methodological limitations of PE and well-being research	Structured PE programs produce consistent psychological benefits, though mechanisms remain underspecified	Piñeiro-Cossio et al. (2021)
Specific PE components (intensity, duration, context) remain underspecified	Lack of specificity about effective PE components	Structured PE programs produce consistent psychological benefits, though mechanisms remain underspecified	Liu (2020); Tison et al. (2020)
Theme 2: Motivation as a Mediating Mechanism in Physical Education and Well-Being			
2a. Nature and types of motivation in PE			
Motivation is dynamic, multifaceted, and varies across contexts and developmental stages	Motivation as a context-dependent construct	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Ryan & Deci (2020); Dörnyei (2018)
Intrinsic motivation driven by internal goals; extrinsic by external incentives	Intrinsic vs. extrinsic motivation in PE (SDT)	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Ryan & Deci (2020); Ryan & Deci (2000)
Self-efficacy, goal orientation, and task difficulty influence motivation in education	Cognitive antecedents of motivation	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Salajegheh & Hoseinyshavoun (2018)
2b. Motivational influences on physical activity and physical literacy			
Teacher motivational style significantly impacts student motivation and PA levels	Teacher behaviour as a motivational determinant	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Van Doren et al. (2021); Leo et al. (2022)
Autonomy support and intrinsic motivation predict out-of-school physical activity	Autonomy support as a driver of PA beyond school	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Hutmacher et al. (2020); Kalajas-Tilga et al. (2020)
Sport education and collaborative PE interventions increase motivation and physical literacy	Pedagogical interventions that enhance motivation	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Choi et al. (2021); Rojo-Ramos et al. (2022)
SDT and neuroeducation-based approaches improve motivation and PA in PE	Theory-based motivational interventions in PE	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Pereira et al. (2021); Baena-Extremera et al. (2021)

2c. Motivation and psychological outcomes			
Intrinsic motivation correlates with emotional regulation, resilience, and life satisfaction	Intrinsic motivation predicts psychological well-being	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Perez-Ordas et al. (2022)
Higher motivation linked to enjoyment of PA and overall well-being in Chinese adolescents	Motivation, enjoyment, and well-being in Chinese PE contexts	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Zheng et al. (2023)
Intrinsic motivation predicts long-term PA and well-being; extrinsic is effective short-term only	Differential long-term effects of intrinsic vs. extrinsic motivation	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Perez-Ordas et al. (2022); Papaioannou & Krommidas (2021)
Interactive effects of intrinsic and extrinsic motivation on well-being remain underexplored	Research gap: interactive motivational effects	Motivation mediates the relationship between PE and psychological well-being, with intrinsic motivation producing the most sustained effects	Gobbi et al. (2020)
Theme 3: Self-Regulation as a Mediating Mechanism Between Physical Education and Well-Being			
3a. Nature and dimensions of self-regulation			
Self-regulation involves monitoring and controlling thoughts, emotions, and behaviours towards goals	Self-regulation as a goal-directed, multi-strategy process	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Zimmerman (2000, 2008); Boekaerts et al. (1999)
Self-regulation draws on social psychology, personality psychology, and cognitive neuroscience	Multidisciplinary theoretical foundations of self-regulation	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Inzlicht et al. (2021)
Self-regulation influences training, competition, and recovery in athletic contexts	Self-regulation in sport and physical performance	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Balk & Englert (2020)
3b. Self-regulation across educational levels			
Self-regulation correlates with academic readiness and prosocial behaviour in early childhood	Developmental role of self-regulation in early education	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Savina (2021)
Self-regulatory abilities linked to academic and psychological well-being in adolescents	Self-regulation predicts adolescent academic and psychological outcomes	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Gökteke & Ocak (2024)

Self-regulation correlates with university student happiness and school engagement	Self-regulation as a predictor of university student well-being	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Rodríguez et al. (2022); Šteh & Šarić (2020)
Self-regulation provides direct psychological benefit regardless of academic performance	Self-regulation's independent effect on well-being	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Nieva & Prudente (2022)
3c. Self-regulation in the PE context			
Teacher support and motivational climate shape self-regulation in PE	PE environment as an antecedent of self-regulation	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Laxdal (2020); Liu et al. (2020)
Self-regulation teaching units improve PE performance calibration and goal attainment	Structured SR interventions improve PE outcomes	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Kolovelonis et al. (2022)
Kermarrec et al. found SR enhances goal-setting, progress tracking, and strategy use in PE	SR as an active learning tool in PE	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Kermarrec et al. (2022)
MVPA positively correlated with self-regulation and cognitive school readiness in preschoolers	Physical activity → self-regulation → cognitive readiness pathway	Self-regulation bridges PE participation and psychological well-being through cognitive, emotional, and behavioural pathways	Bai et al. (2021)
3d. Self-regulation, physical literacy, and well-being interactions			
Self-regulation mediates the link between physical exercise and cognitive school readiness	SR as mediator: PA → cognitive outcomes	Self-regulation and physical literacy jointly mediate the pathway from PE to psychological well-being, creating a positive feedback loop	Bai et al. (2021); Gea-García et al. (2020)
Physical literacy mediates the relationship between self-esteem and PA participation	Physical literacy as mediator: self-esteem → PA engagement	Self-regulation and physical literacy jointly mediate the pathway from PE to psychological well-being, creating a positive feedback loop	She et al. (2023)
Self-efficacy and SR jointly enhance leisure-time PA and PE engagement	Self-efficacy and SR as complementary regulatory mechanisms	Self-regulation and physical literacy jointly mediate the pathway from PE to psychological well-being, creating a positive feedback loop	Erturan et al. (2020); Blain et al. (2020)
Physical exercise → self-efficacy/emotional intelligence →	Emotional intelligence as mediator between PE and well-being	Self-regulation and physical literacy jointly mediate the pathway from PE to psychological well-being,	Vasilopoulos & Ellefson (2021); Wang et al. (2022)

subjective well-being pathway confirmed		creating a positive feedback loop	
Body image and self-esteem mediate physical exercise and well-being in Chinese students	Body image and self-esteem as mediating variables	Self-regulation and physical literacy jointly mediate the pathway from PE to psychological well-being, creating a positive feedback loop	Shang & Xie (2021); Zhang et al. (2022)
Physical literacy, fitness, and intrinsic motivation all mediate PE and well-being in Chinese universities	Multiple mediating pathways in Chinese university PE research	Self-regulation and physical literacy jointly mediate the pathway from PE to psychological well-being, creating a positive feedback loop	Yang et al. (2024); Zhong (2024)
Independent and interactive effects of SR and motivation on well-being remain underspecified	Critical research gap: SR and motivation interaction	Self-regulation and physical literacy jointly mediate the pathway from PE to psychological well-being, creating a positive feedback loop	Leo et al. (2022); Aleksovska-Velickovska et al. (2019)

Note. Coding follows the three-phase Thomas and Harden (2008) framework: (1) initial codes derived from individual source findings; (2) descriptive themes grouped by conceptual similarity; (3) analytical themes addressing the review's guiding questions. Sources cited reflect those discussed within each coded finding.