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REVIEW ARTICLE

Gymnastics Education Teaching Learning: A Review of the Literature

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ABSTRACTS

Purpose This study examines the development of teaching and learning practices in gymnastics education within physical education by identifying pedagogical approaches, technology integration, teacher competence, and implementation challenges. Unlike previous reviews focusing mainly on performance aspects, this study provides a multidimensional synthesis of pedagogical, psychological, technological, and cognitive perspectives.

Materials and Methods This study employed a systematic literature review following PRISMA guidelines, including identification, screening, eligibility, and inclusion stages. Data were collected from the Scopus database using structured keywords within the publication range of 2015–2025. A total of 88 records were identified, and 17 articles met the inclusion criteria for final analysis. The selected studies were analyzed thematically to classify key themes related to pedagogy, technology integration, teacher competence, psychological aspects, and learning outcomes.

Result The findings revealed five major themes: pedagogical approaches, technology integration, teacher competence, psychological and inclusivity aspects, and physiological and cognitive impacts. Innovative methods such as Teaching Personal and Social Responsibility (TPSR) and cooperative learning improved students' motor skills, knowledge, and social attitudes. Technology integration through Android-based media, 3D simulations, and artificial intelligence increased engagement and movement understanding. However, challenges remain, including limited teacher readiness, inadequate facilities, and students' fear and low confidence. Gymnastics education also contributes to cognitive development, particularly critical thinking skills.

Conclusion Gymnastics education has evolved into a multidimensional and student-centered learning process integrating pedagogy and technology to optimize physical and cognitive learning outcomes.

Keywords Gymnastics education; Physical education; Teaching learning; Pedagogy; Technology integration.

INTRODUCTION

Gymnastics education is an important component of physical education because it contributes to the development of students' motor, cognitive, social, and emotional skills (Larsson et al., 2026). Gymnastics learning is not only oriented toward the mastery of movement techniques, but also plays an important role in developing students' self-confidence, discipline, teamwork, and critical

thinking skills (Ameen et al., 2015; Sojourner et al., 2018; Widowati et al., 2025). Therefore, gymnastics holds a strategic position in supporting the holistic goals of physical education, which emphasize the comprehensive development of students.

Nevertheless, the implementation of gymnastics learning in schools continues to face various challenges (Lopes & Carbinatto, 2023). Previous studies have shown that many physical education teachers still experience limitations in pedagogical competence, curriculum adaptation, and the use of innovative instructional strategies (Ávalos-Ramos et al., 2025; Hao & Zhao, 2024). In addition, gymnastics learning is often constrained by limited facilities, low technological readiness, and students' psychological factors such as fear and low self-confidence (Sepúlveda et al., 2024; McVeigh et al., 2025). These conditions cause gymnastics learning processes to continue relying on traditional approaches that focus primarily on technical demonstrations and error correction, thereby providing limited support for active student participation and meaningful learning experiences (Yang et al., 2026).

In recent years, research on gymnastics learning has increasingly shifted toward more innovative and student-centered approaches. Instructional models such as cooperative learning and Teaching Personal and Social Responsibility (TPSR) have been shown to improve students' motor skills, motivation, and engagement more effectively than conventional methods (Yuwono et al., 2022; Khataybeh et al., 2024). On the other hand, the integration of technologies such as Android-based media, 3D simulations, and artificial intelligence has also demonstrated significant potential in improving movement understanding and learning effectiveness (Handayani et al., 2025; Almulla, 2020; Gallardo-fuentes et al., 2025). However, existing studies remain fragmented and tend to focus only on specific aspects, such as technical performance, technology integration, or physiological impacts.

Based on the existing literature, a clear research gap remains. Previous studies have rarely integrated pedagogical aspects, technology, teacher competence, and students' psychological factors into a comprehensive framework of gymnastics learning. Most studies have also placed greater emphasis on physical performance outcomes rather than students' learning experiences, inclusivity, and the overall quality of the instructional process. Furthermore, previous literature reviews have generally focused only on specific dimensions of gymnastics education without providing a multidimensional synthesis of the development of gymnastics learning in physical education.

Therefore, this study conducts a systematic literature review to analyze the development of teaching and learning practices in gymnastics education within the context of physical education. Unlike previous studies that primarily focused on technical or physiological aspects, this review integrates pedagogical, technological, psychological, and cognitive perspectives to provide a more comprehensive understanding of gymnastics learning. The novelty of this study lies in its multidimensional synthesis of major themes, methodological trends, implementation challenges, and future directions in gymnastics education. Accordingly, the findings of this review are expected to contribute to the development of evidence-based instructional practices, the improvement of teacher competence, and the advancement of more innovative, inclusive, and student-centered gymnastics education.

METHODS

Research Design

This study employed a systematic literature review (SLR) method (Cabrera et al., 2023) to analyze the development of gymnastics teaching and learning within the context of physical education based

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on internationally reputable scientific articles. The review process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure that the identification, selection, evaluation, and synthesis of the literature were conducted systematically, transparently, and reproducibly (Cabrera et al., 2023).

Data Collection and Search Strategy

The primary data source was obtained from the Scopus database, which was selected as the main database due to its broad coverage of internationally indexed scientific publications. To enhance the comprehensiveness of the search process, additional relevant references cited within related articles were also considered during the identification stage. The search strategy employed structured keywords: TITLE-ABS-KEY (gymnastics AND education AND teaching AND learning). The search was limited to articles published between 2015 and 2025, categorized as journal articles, written in English, and available in open access format. Furthermore, the articles were restricted to the fields of health sciences, social sciences, and physical education to ensure relevance to the focus of the study.

Inclusion and Exclusion Criteria

The inclusion criteria in this study were: (1) empirical research articles discussing gymnastics learning in physical education; (2) participants consisting of students, university students, or physical education teachers; (3) studies conducted in school or formal educational contexts; (4) articles published in reputable international journals; and (5) articles available in full text. Meanwhile, the exclusion criteria included: (1) articles focusing solely on competitive sports performance without a learning context; (2) proceedings, editorials, and non-research articles; (3) duplicate articles; and (4) articles lacking direct relevance to gymnastics teaching and learning.

Study Selection and Quality Assessment

The article selection process was conducted through the four PRISMA stages: identification, screening, eligibility, and final inclusion (Page et al., 2021). At the identification stage, 88 initial articles were found. Duplicate articles were then removed, followed by screening based on titles and abstracts. Articles that passed the screening stage were subsequently analyzed through a full-text review to ensure their relevance to the focus of the study. The selection process was conducted systematically by the researchers by considering thematic relevance and publication quality. After all stages were completed, a total of 17 articles met all inclusion criteria and were used as the primary data sources for the study.

To enhance methodological rigor, this study also conducted a descriptive quality assessment of the selected articles based on the clarity of research objectives, research design, participant characteristics, instructional procedures, and the relevance of findings to the focus of the review. Articles with incomplete methodological information or limited relevance were excluded during the eligibility stage.

Data Analysis and Synthesis

Data from the selected articles were analyzed using thematic analysis techniques. The analysis process was conducted through several stages: (1) reading and understanding all selected articles; (2) coding the main findings; (3) grouping the codes into major themes; and (4) interpreting the relationships among themes to produce a conceptual synthesis. Through this process, several major themes were identified, including pedagogical approaches, technology integration, teacher

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competence, psychological and inclusivity aspects, as well as physiological and cognitive impacts in gymnastics learning. Thus, this method provided a systematic analytical framework for understanding the development of research on gymnastics teaching and learning in physical education more comprehensively.

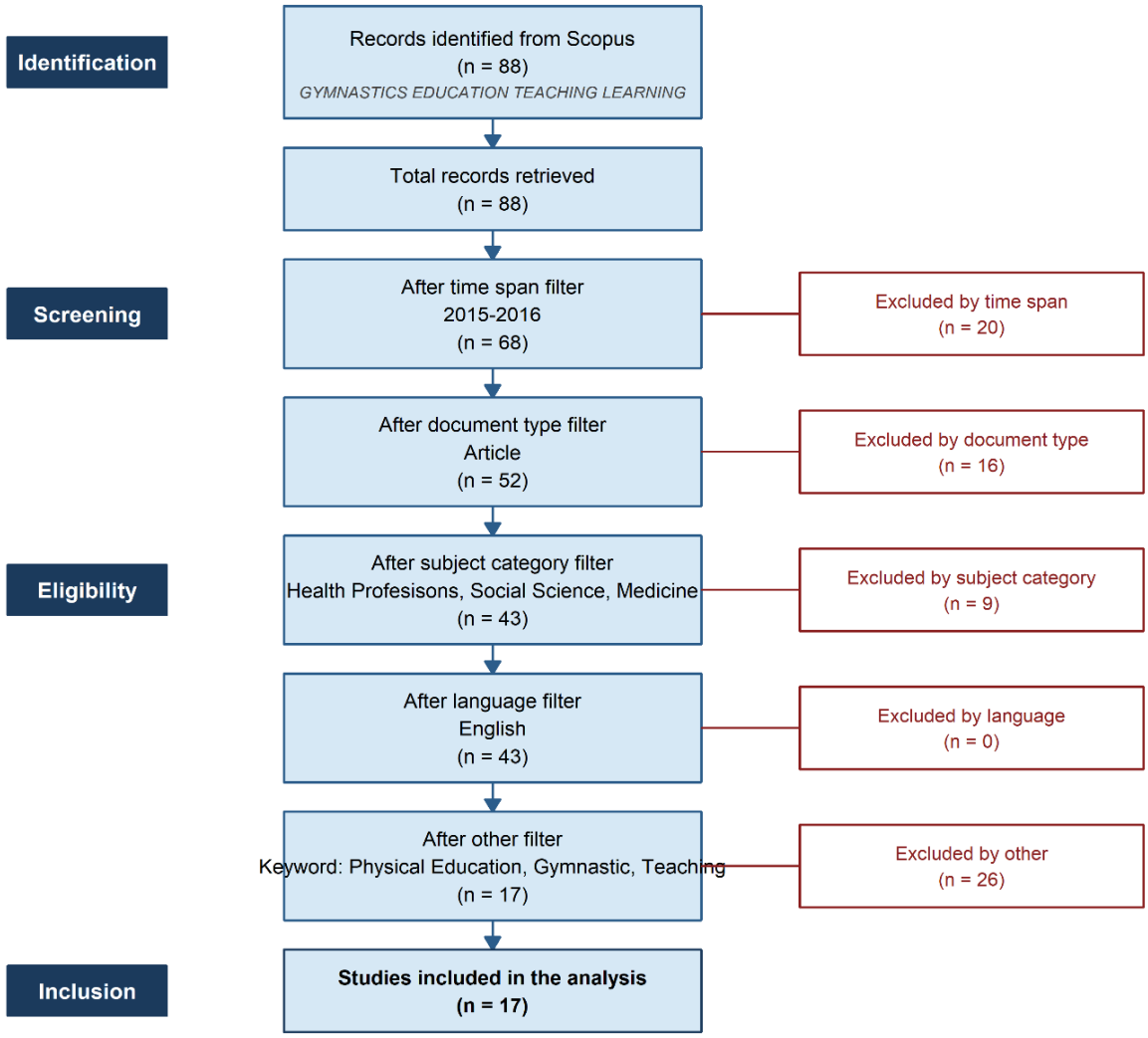

Figure 1. PRISMA research flow diagram

The article selection process was executed systematically in accordance with the PRISMA guidelines to ensure transparency and reproducibility. The initial identification stage yielded 88 records from the Scopus database using the structured keyword query 'GYMNASTICS EDUCATION TEACHING LEARNING'. During the screening phase, the dataset was refined by applying a temporal filter covering the years 2015 to 2025, which resulted in the exclusion of 20 records, and a document type filter, which removed a further 16 records, leaving 52 articles. Subsequently, in the eligibility phase, the articles underwent subject category screening including Health Professions, Social Science, and Medicine, leading to the removal of 9 records. While no articles were excluded based on language criteria, the application of specific inclusion filters focusing on physical education, gymnastics, and teaching keywords necessitated the removal of an additional 26 records. Consequently, the final synthesis and analysis comprised 17 studies that fully met the established inclusion criteria.

RESULT

Table 1. Synthesis of Literature Gymnastics Education Teaching Learning

No	Author/Year	Study Focus	Research Gap	Key Findings
1	Ameen et al., 2015	Biomechanics in gymnastics	Students struggle to understand biomechanical concepts in practice	Biomechanical theory significantly improves jumping skills
2	Handayani, 2023	Android-based media (handstand)	Lack of gymnastics-specific digital media	Media effectively improves skills (↑ significant score increase)
3	Yuwono et. al., 2022	TPSR model	Teaching materials not aligned with standards	TPSR improves attitudes, knowledge, and skills
4	Handayani et al., 2023	Android-based media (cartwheel)	Limited research on technology-based media	Significant improvement in cartwheel skills
5	Khataybeh et al., 2024	Cooperative learning	Lack of systematic studies on cooperative learning	Improves gymnastics performance by >50%
6	Wu & Liu, 2021	Multimedia simulation	Unrealistic human body modeling	Effective for analyzing movement techniques
7	Ávalos-Ramos et al., 2025	Pre-service teacher competence	Limited studies on perceived competence in teaching gymnastics	Moderate competence, weak in curriculum adaptation
8	Zhou, 2016	Choreography software	Manual methods are inefficient	Multimedia improves understanding and interest
9	McVeigh et al., 2025	Inclusivity (disability)	Limited disability perspective in PE	Need for anti-ableist pedagogy
10	Hao & Zhao, 2024	Early childhood teacher competence	Evaluation model not yet comprehensive	Instructional design has the greatest influence
11	Zhao, 2024	3D simulation	Limitations in movement visualization	Improves performance and student satisfaction
12	Dong, 2022	Gymnastics e-learning	Lack of teaching materials & technological support	Online systems improve learning quality
13	William, 1895	Historical gymnastics	Lack of historical pedagogical analysis	Gymnastics influenced by global context
14	Sepúlveda et al., 2024	Student experience	Lack of formal teaching & evaluation	Emotions (fear) affect learning
15	Ren & Ma, 2025	AI & simulation	Technology impact not yet optimal	AI improves learning effectiveness
16	Widowati et al., 2025	Gymnastics & cognition	PE focus still physical	Gymnastics improves critical thinking
17	La et al., 2023	Gymnastics physiology	Variation in training response	Gymnastics improves muscle function & recovery

A total of 88 records were initially identified through the Scopus database search. After duplicate removal and screening based on titles and abstracts, 26 articles remained for full-text assessment. Following the eligibility process, 17 articles met all inclusion criteria and were included in the final synthesis. The PRISMA process consisted of four stages: identification, screening, eligibility, and inclusion. The included studies focused specifically on gymnastics teaching and

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learning in physical education contexts, while studies primarily discussing unrelated social, media, or purely competitive sport issues were excluded to maintain thematic relevance.

The selected studies were categorized into five major themes based on thematic analysis: (1) pedagogical approaches, (2) technology integration, (3) teacher competence, (4) psychological and inclusivity aspects, and (5) physiological and cognitive impacts. These themes were developed through a coding process that identified recurring concepts, research objectives, and learning outcomes across studies. This categorization enabled a clearer analytical comparison between studies rather than a purely descriptive summary.

Studies examining pedagogical approaches consistently demonstrated that student-centered learning models were more effective than traditional teacher-centered instruction. Cooperative learning (Khataybeh et al., 2024) and the TPSR model (Yuwono et al., 2022) improved not only motor performance but also students' attitudes, responsibility, and participation. However, methodological quality varied across studies. Some studies used controlled experimental designs with pretest–posttest procedures, while others relied on smaller samples and short-term interventions, limiting the generalizability of findings.

Technology integration emerged as another dominant theme. Android-based media, multimedia simulations, e-learning systems, and artificial intelligence applications generally improved movement understanding, engagement, and learning effectiveness (Almulla, 2020; Gallardo-fuentes et al., 2025; Ren & Ma, 2025). Nevertheless, findings across studies were not entirely consistent. Studies using well-structured instructional designs reported stronger learning outcomes than studies focusing primarily on technological innovation without sufficient pedagogical integration. This suggests that technology effectiveness depends heavily on instructional design and teacher competence.

Research on teacher competence highlighted moderate preparedness among pre-service and early childhood teachers, particularly regarding curriculum adaptation and instructional design (Ávalos-Ramos et al., 2025; Hao & Zhao, 2024). At the same time, studies addressing psychological and inclusivity dimensions revealed that fear, anxiety, and limited disability inclusion remain important barriers in gymnastics learning (McVeigh et al., 2025; Sepúlveda et al., 2024). Compared with studies on technology and performance, these areas remain underexplored.

Finally, several studies emphasized broader cognitive and physiological impacts of gymnastics education. Widowati et al., (2025) found that gymnastics learning contributes to critical thinking development, while La et al., (2023) demonstrated positive effects on muscle function and recovery. However, interdisciplinary studies integrating pedagogy, psychology, technology, and biomechanics simultaneously remain limited. This indicates the need for more comprehensive and methodologically rigorous research frameworks in future gymnastics education studies.

DISCUSSION

The findings of this review indicate that gymnastics education has gradually shifted from a traditional technique-oriented approach toward a more student-centered and multidimensional learning process. Across the reviewed studies, pedagogical innovation consistently emerged as a critical factor influencing learning effectiveness. Studies examining cooperative learning and the Teaching Personal and Social Responsibility (TPSR) model demonstrated that student-centered approaches improve not only motor performance but also social responsibility, motivation, and participation (Khataybeh et al., 2024; Yuwono et al., 2022). These findings support constructivist learning theory, which emphasizes active participation, collaboration, and experiential learning as

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essential components of effective physical education. In contrast, traditional teacher-centered instruction was frequently associated with passive learning, limited student interaction, and lower engagement. However, the effectiveness of innovative pedagogical approaches varied depending on contextual factors such as teacher competence, class management, and instructional design quality. This suggests that pedagogical innovation alone is insufficient without adequate teacher preparation and supportive learning environments.

The review also demonstrates that technology integration has become a dominant trend in gymnastics education research. Studies involving Android-based media, multimedia simulations, e-learning systems, and artificial intelligence generally reported positive effects on students' understanding of movement, learning motivation, and skill acquisition (Almulla, 2020; Gallardo-fuentes et al., 2025; Ren & Ma, 2025). Nevertheless, the findings across studies were not entirely consistent. Research employing structured pedagogical frameworks and guided feedback mechanisms produced stronger educational outcomes than studies focusing mainly on technological novelty. This comparison highlights an important unresolved issue: technology itself does not automatically improve learning quality. Instead, its effectiveness depends on how technology is pedagogically integrated into instructional practice. From a theoretical perspective, this finding aligns with the Technological Pedagogical Content Knowledge (TPACK) framework, which emphasizes the interaction between technology, pedagogy, and content knowledge in effective teaching. Therefore, the successful implementation of digital learning tools in gymnastics education requires not only technological access but also teachers' pedagogical readiness and instructional competence.

Another important finding concerns teacher competence, which emerged as a persistent challenge across studies. Research involving pre-service teachers and early childhood educators showed moderate competence levels, particularly in curriculum adaptation and instructional planning (Ávalos-Ramos et al., 2025; Hao & Zhao, 2024). Although technological innovation and pedagogical models continue to develop rapidly, teacher professional preparation appears unable to progress at the same pace. This creates a gap between educational innovation and practical implementation in schools. Compared with studies emphasizing technological effectiveness, relatively few studies critically examined how teachers' pedagogical beliefs, professional confidence, and institutional support influence gymnastics instruction. This imbalance suggests that future research should move beyond evaluating learning products or interventions and pay greater attention to teacher development as a central determinant of instructional quality. Practically, these findings imply the need for professional development programs that integrate pedagogical training, technology integration, and inclusive instructional strategies specifically for gymnastics education.

Psychological and inclusivity dimensions remain among the least explored areas in the literature, despite their substantial influence on student participation and learning experiences. Several studies identified fear, anxiety, and low self-confidence as significant barriers preventing students from actively engaging in gymnastics activities (Sepúlveda et al., 2024). Furthermore, McVeigh et al., (2025) emphasized the limited inclusion of disability perspectives and anti-ableist pedagogy in gymnastics learning environments. Compared with the large number of studies focusing on motor performance and technological effectiveness, research addressing emotional experiences and inclusive participation remains limited. This imbalance reflects a broader tendency within physical education research to prioritize measurable performance outcomes over students' psychological well-being and social inclusion. From a theoretical perspective, these findings support humanistic and inclusive education approaches, which argue that meaningful learning occurs when students feel psychologically safe, supported, and valued within the learning environment.

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Consequently, gymnastics education should not only emphasize technical mastery but also create emotionally supportive and inclusive instructional settings.

The review further indicates that gymnastics education has broader educational implications beyond physical skill development. Several studies demonstrated positive cognitive and physiological outcomes, including improvements in critical thinking, muscle function, and recovery (Widowati et al., 2025; La et al., 2023). However, most studies examined these dimensions separately rather than through interdisciplinary frameworks integrating pedagogy, psychology, biomechanics, and technology simultaneously. This fragmentation represents a major unresolved issue in current gymnastics education research. The lack of longitudinal and mixed-method studies also limits understanding of long-term learning impacts, student experiences, and sustainable instructional outcomes. Methodologically, many studies relied on small samples, short intervention periods, and quantitative experimental designs, reducing the external validity and generalizability of findings.

The novelty of this review lies in its multidimensional synthesis of gymnastics education literature by integrating pedagogical, technological, psychological, cognitive, and physiological perspectives within a single analytical framework. Unlike previous reviews that primarily focused on technical performance or isolated interventions, this review highlights the interconnected nature of teaching and learning processes in gymnastics education. The findings suggest that effective gymnastics learning requires a balance between innovative pedagogy, meaningful technology integration, teacher competence, and inclusive educational practices. Therefore, future research should adopt more interdisciplinary and comprehensive approaches, including longitudinal designs, diverse participant populations, and mixed-method methodologies, to better understand the complexity of gymnastics learning in physical education contexts.

CONCLUSION

This systematic literature review shows that gymnastics education in physical education has evolved from a technique-oriented activity into a multidimensional and student-centered learning process. The review identified five interconnected themes: pedagogical approaches, technology integration, teacher competence, psychological and inclusivity aspects, and cognitive-physiological impacts. The findings indicate that innovative instructional models such as cooperative learning and Teaching Personal and Social Responsibility (TPSR), supported by digital technologies and simulation-based learning, can improve students' motor skills, motivation, engagement, and critical thinking. The main contribution of this review lies in integrating pedagogical, technological, psychological, and cognitive perspectives into a single analytical framework, providing a more comprehensive understanding of gymnastics learning compared with previous reviews that focused mainly on technical or physical aspects. However, this review also identified several limitations, including the reliance on Scopus-indexed English-language articles and the dominance of short-term quantitative studies with limited sample sizes. Practically, the findings highlight the importance of strengthening teacher competence, integrating technology meaningfully, and implementing inclusive and student-centered learning approaches in gymnastics education. Future research should employ longitudinal and mixed-method designs, involve more diverse participants, and further explore interdisciplinary approaches integrating pedagogy, biomechanics, psychology, and educational technology.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the research, authorship, or publication of this study.

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