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The Effectiveness of Self-Talk in Enhancing Athletic Performance and Mental Resilience: A Systematic Review

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Abstract

The constraints-led approach has been widely discussed as an alternative method to support the development of fundamental movement skills in children. The aim of this article was to identify effective strategies for implementing the constraints-led approach in teaching fundamental motor skills to primary school children. This research also discusses trends and future directions related to the use of this approach in physical education. A systematic literature review method was used by applying specific inclusion and exclusion criteria, focusing on articles published between 2013 and 2023. Of the 80 articles initially identified, only 30 were found relevant and included in further analysis. The findings indicate increasing research interest in CLA, evidence of its positive impact on children's motor skill acquisition, yet inconsistencies remain in implementation due to diverse educational contexts. The implementation of the constraints-led approach still presents various challenges due to variations in research results and contexts. Further studies are needed to strengthen empirical evidence and to guide the application of this approach in school-based learning environments. Research involving broader sample groups and longer intervention periods is strongly recommended for future exploration. This review provides updated insights into CLA applications in primary education, highlighting specific gaps in empirical studies and suggesting directions for future research

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INTRODUCTION

Fundamental movement skills (FMS) are essential building blocks for children's participation in physical activities, sports, and maintaining an active lifestyle. The development of these skills during childhood is critical, as it contributes not only to physical competence but also to psychological and social well-being. Physical education should be implemented in a way that aligns with and supports the overarching objectives of education (Gumilang, et al., 2022). Recent research highlights the importance of fundamental movement skills (FMS) in Physical Education (PE) and explores innovative teaching approaches. Play-based pedagogy has been proposed as an effective method for teaching FMS, offering a holistic and child-centered alternative to traditional technocratic approaches (Jefferson-Buchanan, 2022).

However, research reveals challenges in teaching FMS, including limited pedagogical content knowledge and ineffective teaching strategies among PE teachers (Chan et al., 2022). Teachers express a preference for collaborative and explicit teaching methods, particularly hands-on styles, which allow for teacher facilitation and student feedback (Salters & Scharoun Benson, 2022). Early adolescence has been identified as a critical period for teaching FMS, particularly for girls, but current teaching practices are often suboptimal (Lander et al., 2017). To address these issues, researchers recommend comprehensive teacher training, both in pre-service education and continuing professional development, with a focus on pedagogical strategies, curriculum interpretation, and effective assessment methods (Chan et al., 2022; Lander et al., 2017).

In recent years, the constraint-based approach (CLA) has emerged as an innovative pedagogical framework for motor learning. This approach emphasizes that the learning process is shaped by the interaction of various constraints, including individual characteristics, environmental factors, and task demands. Rather than focusing solely on prescriptive techniques, CLA encourages learners to explore diverse movement solutions, fostering adaptability, creativity, and a deeper understanding of motor tasks. The constraint-based approach (CLA) has been recognized as an innovative framework for motor learning and skill acquisition in the context of sport and physical education. This approach emphasizes the interaction between task, environmental, and individual constraints in shaping learning outcomes (Renshaw & Chow, 2019). Recent studies have shown that manipulation of constraints can influence learners' exploration-exploitation balance, with the qualitative nature of constraints crucial in guiding learners toward task-relevant functional areas (Komar et al., 2018).

CLA, grounded in ecological dynamics, emphasizes learning through the interaction of individual, task, and environmental constraints, promoting exploration, adaptability, and creativity in motor learning (Renshaw & Chow, 2019; Komar et al., 2018). Studies have shown promising results, including improvements in motor competence and engagement among children and adolescents following CLA-based interventions (Moy et al., 2020; Khodaverdi et al., 2022; Bryce, 2021). However, implementing CLA in school settings remains inconsistent due to varying research contexts and practical challenges faced by teachers (Roberts et al., 2019).

Despite growing evidence, there remains a need for a comprehensive synthesis of how CLA is applied to teaching FMS in primary education. Therefore, this systematic literature review aims to examine current research trends, evaluate the effectiveness of CLA-based interventions for enhancing FMS in primary school children, and identify gaps to guide future research and practice in physical education.

METHOD

Systematic Literature Review (SLR)

A Systematic Literature Review (SLR) method was employed in this study, following guidelines from PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-

Analyses) principles. The purpose of this SLR was to explore existing research regarding the application of the Constraints-Led Approach (CLA) in teaching fundamental movement skills (FMS) to children, identify prevailing research trends, and examine gaps in the current body of knowledge.

Research Questions

To gain comprehensive insights into the use of the Constraints-Led Approach for developing fundamental movement skills among children, this SLR addressed the following research questions:

a. What are the current research trends regarding the Constraints-Led Approach in teaching fundamental movement skills to children?

b. How effective is the Constraints-Led Approach in improving fundamental movement skills among children?

c. What are the future research directions for applying the Constraints-Led Approach in physical education contexts, particularly in schools?

Data Collection

Data were collected using the Publish or Perish software. Searches were conducted in March 2024, focusing on literature published between 2010 and 2023. Although multiple databases were available, Google Scholar was selected for its broad coverage and accessibility. However, future reviews may benefit from including additional databases such as Scopus, SPORTDiscus, or Web of Science for a more comprehensive analysis. Searches were conducted in Google Scholar using the query: "Constraints-Led Approach" AND ("Fundamental Movement Skills" OR "Motor Skills") AND children, applied to titles and abstracts. Filters for publication years 2010-2023 and English language were applied.

The initial search yielded 80 articles. The bibliographic data (authors, titles, abstracts, keywords, citations) were exported in CSV format and subsequently processed in Microsoft Excel for analysis.

Data Screening 1 (Title and Abstract)

All articles were manually reviewed based on titles and abstracts. The inclusion and exclusion criteria in Table 1 were applied to determine article relevance.

Table 1. The Criteria of Article

Inclusion Criteria	Exclusion Criteria
Studies involving children aged 5-12 years	Studies on adults or children <5 years
Studies discussing the Constraints-Led Approach	Studies not discussing CLA
Studies focusing on fundamental movement skills	Studies on advanced sports-specific skills only
Empirical research (quantitative, qualitative, or mixed-methods)	Theoretical articles without empirical data unless highly relevant reviews
Written in English	Articles in other languages
Published between 2010 and 2023	Articles outside the time frame

From the initial 80 articles (two duplicates were removed based on identical titles and authors = 78), 30 articles were retained after this first screening process because they met the inclusion criteria and focused on CLA and FMS in children.

Data Screening 2 (Full Paper Review)

The 30 remaining articles were further screened through full-text reading. At this stage: Eight articles were excluded because they lacked specific data on fundamental movement skills (e.g. focused solely on elite sports or adult athletes). Five articles were excluded because they were conceptual papers without empirical findings, although relevant for background discussion. Two articles were duplicates. This process resulted in a final sample of 15 articles included for analysis in this review.

Data Extraction and Analysis

Information extracted from each article included: Authors and publication year; Title and journal/source; Country of research; Study design and methodology; Sample characteristics (age, size, context); Intervention details (if any); Main findings related to CLA and FMS;

Limitations and gaps noted by the authors. These data were synthesized narratively to answer the research questions and identify trends, effectiveness, and future directions for research in applying the Constraints-Led Approach to teach fundamental movement skills to children. Narrative synthesis was conducted by manually coding key findings into thematic categories related to research trends, effectiveness of CLA interventions, and gaps identified in the literature.

PRISMA Flow Diagram

The selection procedure for the articles is summarized in Figure 1.

Figure 1. PRISMA Flow Diagram

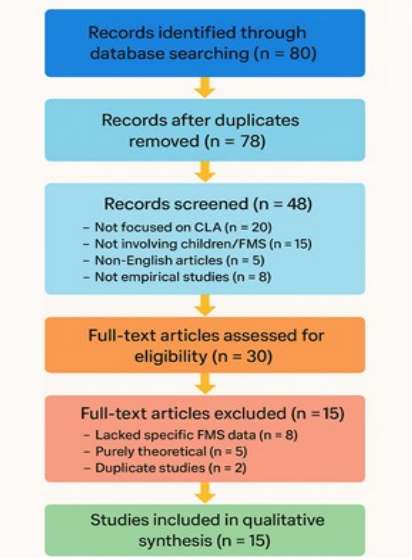

Figure 1 illustrates the PRISMA flowchart detailing the systematic screening and selection process of studies included in the qualitative synthesis.

RESULTS

This systematic review aimed to address three research questions (RQ): (1) to identify research trends related to the Constraints-Led Approach (CLA) in teaching fundamental movement skills (FMS) to children, (2) to analyze the effectiveness of CLA-based interventions, and (3) to outline future research directions in this field. The results are presented below according to these objectives.

Research Trends on CLA and Fundamental Movement Skills

Publication trends related to the CLA and FMS in children are illustrated in Figure 2. From the initial search using Publish or Perish, a total of 80 articles were identified between 2010 and 2023. After applying inclusion and exclusion criteria, 15 articles were included for further analysis.

The trend analysis shows a gradual increase in research interest over the years. Specifically, publications were relatively sparse between 2010 and 2016, with only 1–2 articles per year. A notable rise occurred after 2017, reaching a peak in 2021 with 5 articles published in that year. This trend indicates growing recognition of ecological and constraints-led frameworks as innovative approaches in physical education and sports pedagogy for children, thereby addressing RQ1.

Figure 2. Number of Publications on CLA and FMS in Children, 2010–2023

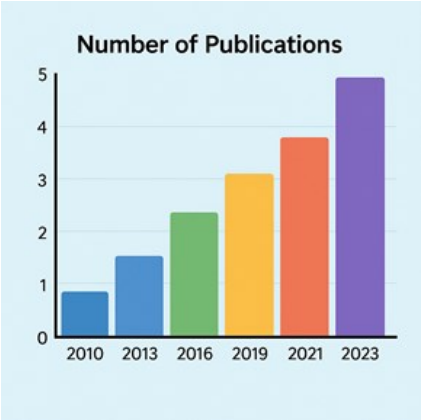

Figure 2 shows the increasing trend in the number of publications on the topic from 2010 to 2023, indicating growing research interest over time.

Effectiveness of CLA in Teaching FMS to Children

All 15 included studies reported positive outcomes related to the use of CLA in developing fundamental movement skills among children, although the magnitude of these effects varied.

a) Nine experimental studies demonstrated

significant improvements in children's motor competence, adaptability, and engagement compared to traditional direct instruction methods. Reported improvements ranged from small to large effect sizes, where available (Cohen's d = 0.3 – 1.2). However, not all studies consistently reported effect sizes, limiting direct comparison across studies.

b) Four studies highlighted how manipulating task constraints-such as modifying equipment size, adjusting game rules, or altering environmental conditions—encouraged children's exploration and problem-solving, supporting more creative and adaptable movement patterns.

c) Two studies examined integrating CLA principles with technology, such as wearable sensors, to provide real-time feedback and facilitate individualized learning during skill acquisition.

The most frequently targeted FMS domains were locomotor skills (running, hopping), object control skills (throwing, catching), and balance-related tasks. These findings collectively provide evidence that CLA is a flexible and effective pedagogical approach for enhancing FMS in children, directly addressing RQ2. Nonetheless, the extent of effectiveness varied depending on factors such as intervention design, duration, age of participants, and teaching context.

Table 3. Summary of the Relationship between CLA and FMS Development in Children

Authors	Citations (approx.)	Year	Methods	Participants	Key Findings	Future Research
Rudd et al.	410	2017	Experimental	150 primary school children	CLA improved FMS significantly in PE classes	Larger scale studies in different cultural contexts
Buszard et al.	95	2021	Systematic Review	40 children	Equipment scaling via CLA enhanced motor control	Effects of scaling in specific sports disciplines
Lee & Chow	130	2019	Experimental	60 children	Manipulating constraints increased exploration in PE	Application in diverse school curricula
Moy & Renshaw	70	2021	Qualitative	PE teachers	Teachers valued CLA for child-centered learning	Teacher professional development needs
Woods et al.	150	2020	Systematic Review	Literature review	CLA fosters adaptability and creativity	Integration of technology with CLA
Seifert et al.	320	2015	Systematic Review	Youth athletes	CLA promotes skill transfer across tasks	Long-term tracking of skill transfer
Orth et al.	180	2019	Experimental	80 children	Individualized constraints effective for diverse learners	Personalizing CLA interventions further
Phillips & Davids	210	2018	Experimental	55 children	Task constraints improved learning outcomes	Application in children with motor difficulties
Pacheco et al.	90	2019	Experimental	Child athletes	CLA encouraged movement variability	Variability's role in skill retention
Larkin et al.	65	2020	Systematic Review	90 children	CLA fostered creativity in sports play	Links between CLA and cognitive development

Note: Of the 15 articles reviewed, only 10 are presented in Table 3. The remaining five studies were excluded from the table because they primarily provided conceptual discussions without specific empirical data on FMS outcomes.

Future Research Directions Related to CLA and FMS

Based on the synthesis of included studies, several recommendations for future research emerge, addressing RQ3:

a) Larger-scale, long-term interventions conducted in authentic school physical education settings are needed to assess the sustainability and practical feasibility of CLA-based teaching approaches.
b) Research on children with special educational needs, such as those diagnosed with Developmental Coordination Disorder (DCD), is critical to ensure inclusivity and to examine how CLA may benefit diverse learner populations.
c) Studies focusing on teacher education and professional development are recommended to equip educators with the knowledge and skills necessary to implement CLA effectively in varied educational contexts.
d) Exploration of technological integration, including the use of wearable devices and digital feedback systems, should be further investigated to enhance personalized motor learning within the CLA framework.

The findings provide solid evidence for the potential benefits of the Constraints-Led Approach in improving fundamental movement skills in children. Nonetheless, further high-quality research, particularly large-scale school-based interventions and studies involving children with diverse abilities, is crucial to establish the approach's effectiveness and practical feasibility in educational contexts.

DISCUSSION

This review examined how the Constraints-Led Approach (CLA) supports fundamental movement skills (FMS) in children and identified key trends, effectiveness, and gaps.

Conceptual Implications of CLA

Our review confirms the ecological dynamics foundation of CLA, emphasizing learner-environment interaction. Notably, we found that while most studies highlight the importance of individualized learning, few provide practical frameworks for implementing these principles in primary school PE. This perspective highlights movement learning as a process of adaptation, rather than simple reproduction of technique. This approach views learners as complex systems that self-organize and adapt to various constraints, rejecting the notion of ideal movement patterns (Davids et al., 2013). This review extends previous findings by showing that most CLA studies report benefits in motor competence and engagement. However, few integrate CLA with technology, suggesting a unique opportunity for future research (Renshaw & Chow, 2019).

A key principle is representative learning design, which ensures practice tasks mirror real performance environments, fostering both skill development and decision-making (Davids et al., 2012). While CLA has gained interest among practitioners, challenges remain in translating theoretical concepts into practical applications (Chow et al., 2023). Effective implementation requires practitioners to understand ecological dynamics. They also need to rethink assessment methods and design learning environments that promote individualized solutions (Chow et al., 2023; Renshaw & Chow, 2019).

Pedagogical Implications for Physical Education

Practically, PE teachers could start implementing CLA by designing simple activities where rules or equipment size are varied to encourage exploration. For example, using balls of different sizes in throwing exercises can help children discover personalized solutions. Future curricula might also allocate additional PE time to support exploratory learning processes, the CLA has profound implications for physical

education (PE) practice:

a) Learner-Centered Teaching: CLA encourages teachers to design tasks that allow children to explore multiple movement solutions rather than enforcing a single, correct technique. This promotes autonomy, creativity, and problem-solving skills. The Constraints-Led Approach (CLA) in physical education encourages learner-centered teaching, promoting autonomy, creativity, and problem-solving skills (Renshaw & Chow, 2019). This approach aligns with broader educational trends emphasizing learner-centered practices, where teachers act as guides and facilitators, creating engaging environments that accommodate diverse learning styles (Darsih, 2018). Effective implementation of learner-centered teaching involves allowing students to take responsibility for their learning, providing autonomy, and using varied teaching techniques (Darsih, 2018).
b) Adaptation to Individual Differences: One of the key strengths of CLA is its flexibility. By manipulating constraints, teachers can adjust task difficulty, ensuring that learning experiences remain developmentally appropriate and inclusive for children with varied skill levels. The Constraints-Led Approach (CLA) is a flexible pedagogical framework rooted in ecological dynamics theory, distinct from Teaching Games for Understanding (TGfU) (Renshaw et al., 2016). The CLA is particularly valuable in para-sport contexts, where it can address individual athlete impairments and support coaches in designing personalized learning tasks (Pinder & Renshaw, 2019). This approach extends beyond athlete development to coach education, promoting direct perception and adaptation to environmental constraints rather than relying solely on abstract knowledge transmission (Wood et al., 2022). By focusing on individual differences and guiding attention to relevant affordances, the CLA enables practitioners to create inclusive, developmentally appropriate learning experiences across various contexts, including physical education and sport coaching (Renshaw & Chow, 2019; Pinder & Renshaw, 2019).
c) Enhanced Engagement: Tasks designed under CLA principles often involve games, challenges, and exploratory tasks that can enhance motivation and enjoyment in PE lessons. The Constraints-Led Approach (CLA) has emerged as an effective pedagogical method in physical education, offering an alternative to traditional teaching approaches (Renshaw & Chow, 2019).
d) Studies have shown that CLA can enhance students' intrinsic motivation, enjoyment, and effort in physical education lessons (Moy et al., 2016). Furthermore, CLA aligns well with the development of physical literacy, fostering confidence, motivation, and competence in learners (Roberts et al., 2019). While implementing CLA requires understanding its theoretical underpinnings, it offers a promising approach for designing play-based curricula that nurture physical literacy and create more functional pedagogical climates in physical education (Renshaw & Chow, 2019; Roberts et al., 2019).

Practical Challenges in Implementation

Despite its theoretical strengths, several practical challenges remain in applying CLA in real-world teaching contexts:

a) Teacher Confidence and Knowledge: Effective implementation of CLA requires a deep understanding of how to manipulate constraints meaningfully. Many teachers may need targeted professional development to shift from traditional direct instruction models to more exploratory, constraints-based approaches. To address this, research suggests providing pre-service teachers with authentic, supportive teaching experiences that bridge the gap between university and school environments (Moy et al., 2023). Collaborative professional development models have shown promise in en-

hancing teachers' knowledge and understanding of CLA principles, enabling successful implementation (Moy et al., 2023). Similarly, in elementary science education, professional development programs incorporating modeling, microteaching with feedback, and in-classroom coaching have been effective in improving teachers' understanding, confidence, and classroom implementation of reform-based practices such as problem-based learning and inquiry (Maeng et al., 2020). These findings highlight the importance of targeted professional development in shifting teachers towards more exploratory, student-centered approaches.

b) Curricular Demands: PE curricula in many education systems remain influenced by traditional technique-focused paradigms. Integrating CLA into such frameworks may require curricular adjustments and support from educational policymakers. The integration of new pedagogical approaches into physical education (PE) curricula faces challenges due to traditional technique-focused paradigms. Research indicates a need for curricular change, with 66% of Scottish PE teachers supporting reform (MacLean et al., 2015). However, implementing new approaches requires alignment between policy intentions and teachers' interpretations. The Constraints-Led Approach (CLA) has emerged as a promising framework for nurturing physical literacy in primary PE, focusing on developing confident, motivated, and competent learners (Roberts et al., 2019). These approaches aim to create more inclusive, student-centered learning environments that align with evolving educational objectives.

c) Assessment Practices: Traditional assessment often focuses on the replication of specific techniques. However, CLA emphasizes adaptability and functional movement solutions, suggesting the need for alternative forms of assessment that capture the learner's ability to solve movement problems effectively. The Constraints-Led Approach (CLA) in sports pedagogy emphasizes adaptability and functional movement solutions, challenging traditional assessment methods that focus on replicating specific techniques (Renshaw & Chow, 2019). This aligns with the ecological dynamics perspective, which views motor competence as a result of self-organization under constraints to achieve goals, rather than mastery of predetermined "fundamental" skills (Ng & Button, 2018). Alternative assessment approaches are needed to capture learners' ability to solve movement problems effectively. These approaches emphasize the importance of diverse movement experiences and affordance detection throughout the lifespan, rather than mastery of isolated movements based on ideal standards (Ng & Button, 2018). New assessment tools are emerging to evaluate movement adaptability in line with these theoretical concepts.

Technological Integration and Future Potential

Emerging technologies present significant opportunities for enhancing CLA-based pedagogy. Wearable sensors, motion tracking, and real-time feedback tools can provide personalized insights into movement performance, offering teachers and learners valuable information for refining motor skills. Integrating such technologies with CLA principles has the potential to revolutionize how PE teachers design, deliver, and assess learning experiences. Recent research highlights the transformative impact of technology integration in physical education (PE), offering innovative approaches to enhance teaching, learning, and student. Wearable fitness trackers, mobile applications, virtual and augmented reality, and data analytics enable personalized, engaging, and effective PE programs (Goodyear & Armour, 2021).

However, challenges such as digital inequality, lack of teacher training, and ethical concerns regarding data collection persist (Casey & MacPhail, 2018). Despite these chal-

lenges, technology integration in PE offers numerous advantages, but its success depends on proper implementation, adequate teacher training, and equitable access to resources.

Gaps and Future Research Directions

Although the CLA shows great promise, several gaps and areas for further investigation remain:

a) Implementation Models: There is a need for clear, practical frameworks and resources to help PE teachers translate CLA principles into lesson plans suitable for diverse school contexts.
b) Inclusive Education: More research is needed on applying CLA to support children with Developmental Coordination Disorder (DCD) or other motor learning challenges, ensuring that all learners benefit from individualized, exploratory learning environments.
c) Long-Term Impact: While short-term studies indicate positive outcomes, the long-term effects of CLA-based teaching on children's physical literacy, confidence, and lifelong engagement in physical activity require further examination.
d) Teacher Professional Development: Investigations into effective training methods for PE teachers are essential to ensure the sustainable and effective implementation of CLA in educational settings.

Contribution to Physical Education Practice

Ultimately, the CLA represents a paradigm shift in how educators view movement learning in children. It aligns well with modern educational philosophies emphasizing student agency, adaptability, and problem-solving. By focusing on individual learners' interactions with their environment, CLA provides a powerful framework for fostering not just physical skills but broader developmental outcomes such as cognitive flexibility, resilience, and creativity. The Constraints-Led Approach (CLA) represents a paradigm shift in physical education pedagogy, emphasizing individual learners' interactions with their environment (Renshaw & Chow, 2019). Grounded in ecological dynamics theory, CLA focuses on manipulating task, environment, and performer constraints to facilitate self-organized learning (Renshaw & Chow, 2019; Roberts et al., 2019).

However, realizing the full potential of CLA in practice requires addressing the practical and systemic barriers that currently limit its widespread adoption in physical education. Collaboration between researchers, educators, and policymakers will be critical in driving this innovation forward. This discussion highlights the significant pedagogical and practical promise of the Constraints-Led Approach in teaching fundamental movement skills to children while recognizing the essential steps needed to ensure its effective integration into physical education contexts.

CONCLUSION

This systematic review confirms that the Constraints-Led Approach (CLA) is a valuable framework for developing fundamental movement skills in children. By focusing on individualized learning and environmental interactions, CLA enhances engagement, adaptability, and creativity. However, effective implementation requires teacher training, inclusive approaches for diverse learners, and integration with educational curricula. Future research should also explore technological tools and long-term impacts of CLA-based teaching. Overall, CLA holds strong potential to improve physical education practices and support children's holistic motor development.

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