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Pedagogical Model for Teaching the Spinning Dragon Jump in Chinese Dance

Zhang Zexi, Muhammad Fazli Taib Saearani

Universiti Pendidikan Sultan Idris, Malaysia

Email: 2499324591@qq.com

Corresponding Author Email: fazli@fmsp.upsi.edu.my

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Abstract

Chinese Classical Dance is an artistic practice that places high physical and neuromotor demands on performers, particularly in complex jumping techniques such as the *Spinning Dragon Jump*, which involves axial rotation and precise landing control. Although the biomechanical risks associated with this technique have been widely documented, dance pedagogy in higher education remains largely dominated by traditional approaches based on imitation and aesthetic correction, with limited integration of injury prevention principles. This study aims to develop and examine a developmentally structured crossover pedagogical model that progressively integrates traditional teaching methods with biomechanical principles in the instruction of the *Spinning Dragon Jump*. The study employs a mixed methods design within a quasi-experimental framework involving crossover and control groups. Participants consisted of 15 dance instructors and 30 dance students from various arts education institutions in China. Analysed variables included biomechanical performance indicators (*jump height* and *knee valgus angle*), clinical–pedagogical indicators (*pain score* and *injury risk index*), and performative variables encompassing artistic expression and centre-of-gravity control during landing. The results indicate that the crossover group demonstrated improved jump performance and a significant reduction in injury risk indicators without any deterioration in artistic quality. These findings confirm that a developmentally structured pedagogical approach effectively enhances technical performance and bodily safety in Chinese Classical Dance education.

Keywords: Chinese Classical Dance, Spinning Dragon Jump, Developmentally Structured Pedagogy, Dance Biomechanics, Injury Prevention, Artistic Performance

Introduction

Chinese Classical Dance has historically been positioned as a refined performative art that emphasises continuity of movement, expressive subtlety, and deep cultural symbolism. While its aesthetic orientation foregrounds grace and embodied meaning, its performative execution entails substantial physical demands. Techniques involving repeated jumping, rotation, and controlled landing expose dancers to high ground reaction forces, complex segmental coordination, and advanced neuromuscular control. In this respect, dancers may be understood not only as cultural performers but also as performing athletes whose

physiological and biomechanical demands parallel those observed in high-risk sports contexts (Koutedakis & Jamurtas, 2004; Mattiussi et al., 2021).

Within this broader physical–aesthetic framework, jumping techniques occupy a particularly critical position. Among them, the Spinning Dragon Jump stands out as one of the most technically and physically demanding elements in Chinese Classical Dance. The movement integrates explosive vertical take-off, axial rotation during the airborne phase, and precise landing that requires strict regulation of the centre of gravity. Biomechanically, successful execution depends on coordinated neuromuscular activation, axial stability, spatial awareness, and effective attenuation of landing forces to prevent excessive loading of the lower-extremity joints (Winter, 2009; Yeadon & Pain, 2023). This convergence of artistry, physical control, and injury risk positions the technique as a crucial pedagogical site where performance quality and bodily safety intersect.

Empirical evidence underscores the risks embedded in such demanding techniques. Studies report a relatively high prevalence of musculoskeletal injuries among dancers in China, particularly affecting the knee, ankle, and lower extremities. These risks are intensified by high training loads, repetitive jumping, and performance pressure within higher education and competitive training environments (Dang et al., 2020). During the COVID-19 pandemic, altered training conditions and reduced pedagogical supervision further exacerbated these vulnerabilities (Dang et al., 2021). Collectively, these findings indicate that injury risk in dance is not merely incidental but structurally linked to pedagogical conditions and instructional approaches.

Despite growing biomechanical insights into dance-related injury mechanisms, pedagogical practice in Chinese Classical Dance remains predominantly traditional. Instruction typically relies on imitation, visual demonstration, and aesthetic correction, with teachers functioning as the primary movement models (Go, 2024; Liu, 2024). While such approaches are effective in transmitting stylistic norms, cultural values, and embodied traditions, they offer limited explicit engagement with the biomechanical principles underlying movement stability, force regulation, and safe landing strategies.

The limitations of purely traditional pedagogy become especially evident in physically intensive techniques such as the Spinning Dragon Jump. In the absence of explicit biomechanical framing, pedagogical correction tends to prioritise visual outcomes over internal processes such as load distribution, joint alignment, and neuromuscular timing. Research in dance biomechanics suggests that visually oriented instruction alone is not consistently effective in reducing injury risk or improving landing stability, particularly under high-intensity or fatigued conditions (Fotaki et al., 2021). This reveals a persistent gap between dancers' safety needs and prevailing pedagogical practices.

Contemporary perspectives increasingly conceptualise dance as a complex physical activity that requires advanced neuromotor coordination, strength, balance, and postural control. From this viewpoint, dancers are not only expressive subjects but also performers executing demanding movement tasks comparable to those undertaken by elite athletes (Hamill et al., 2021; Winter, 2009). In Chinese Classical Dance, these demands are particularly pronounced

in jumping and rotational techniques that require the integration of rhythmic timing, spatial perception, and bodily control during both airborne and landing phases.

Dance performance is further supported by neurocognitive processes such as motor empathy, predictive processing, and attentional regulation, which influence how dancers perceive, memorise, and adapt complex techniques (Bläsing et al., 2012). However, these dimensions remain underrepresented in formal pedagogical design, which continues to privilege visual aesthetics over embodied understanding. Biomechanically, jumping movements involve critical kinematic and kinetic parameters—such as joint angles, jump height, and ground reaction forces—that directly affect both performance quality and injury risk (Mattiussi et al., 2021; Hansberger et al., 2018). The landing phase, in particular, is consistently associated with elevated injury risk, with dynamic knee valgus identified as a key mechanism linked to ligament injury and chronic musculoskeletal pain, especially under fatigue (Abbasi et al., 2025; Abergel et al., 2021).

While traditional dance pedagogy plays a vital role in transmitting cultural identity and stylistic coherence within developmentally progressive curricula (Kassing & Jay, 2020), its limited engagement with biomechanical mechanisms constrains its capacity for injury prevention. Although teacher behaviour can influence kinaesthetic awareness and technical execution (Minton & McGill, 1998), reliance on traditional methods alone has proven insufficient for addressing the physical risks associated with complex jumping techniques.

In contrast, research in sport science demonstrates that neuromuscular training, progressive skill structuring, and biomechanical feedback can significantly enhance movement control and reduce injury risk (Chen et al., 2025; Diekfuss et al., 2020; Cofré-Fernández et al., 2023). Within dance studies, biomechanics has increasingly been framed not as a replacement for tradition but as a reflective tool that enriches bodily awareness and supports safer performance practices (Cantergi et al., 2021; Medeiros, 2021). Nevertheless, systematic empirical integration of biomechanical principles into Chinese Classical Dance pedagogy—particularly for complex techniques such as the Spinning Dragon Jump—remains limited.

Responding to this gap, the present study develops and evaluates a developmentally structured crossover pedagogical model for teaching the Spinning Dragon Jump in Chinese Classical Dance. The model integrates traditional, aesthetics-based instruction with biomechanically informed pedagogical strategies in a gradual and contextualised manner aligned with students' developmental stages and physical readiness. Rather than displacing traditional pedagogy, biomechanical principles are introduced as pedagogical enhancers that support bodily awareness, movement control, and injury prevention while preserving artistic integrity.

The study examines the effects of this model across four domains: (1) technical performance of the Spinning Dragon Jump, (2) biomechanical control during jumping and landing, (3) injury risk and perceived pain, and (4) artistic expressiveness. Through this multidimensional framework, the study seeks to provide empirical evidence for a pedagogical approach that reconciles safety, performance quality, and aesthetic tradition.

The novelty of this study lies in its developmentally structured integration of biomechanics into traditional Chinese Classical Dance pedagogy. Unlike previous studies that tend to treat biomechanical analysis and traditional dance instruction as parallel or separate domains, this research positions pedagogy itself as a mediating social mechanism that links cultural transmission, bodily discipline, and performer wellbeing. By empirically demonstrating that biomechanically informed instruction can enhance—rather than constrain—artistic expression, this study contributes to the social sciences by advancing pedagogical theory in dance education, strengthening interdisciplinary dialogue between performance studies and movement science, and offering a culturally grounded yet physically sustainable model for training complex dance techniques.

Methodology

This study employed a mixed methods design combining quantitative and qualitative approaches to obtain a comprehensive evaluation of the proposed pedagogical model. The mixed methods approach was selected to enable simultaneous analysis of measurable performance outcomes alongside pedagogical processes and dancers' learning experiences (Creswell & Clark, 2017).

Quantitatively, the study adopted a quasi-experimental framework using a crossover and control group design to compare traditional teaching methods with a developmentally structured pedagogical model integrating biomechanical interventions. A quasi-experimental design was deemed appropriate because full randomisation is not feasible within formal dance education contexts without disrupting institutional teaching structures (Shadish et al., 2002). Qualitative support data were collected through pedagogical observations and documentation of the learning process to strengthen interpretation of quantitative findings.
Participants comprised two groups: instructors and students. The instructor group (n = 15) was drawn from multiple arts education institutions across China and represented diverse disciplinary backgrounds, including dance pedagogy, choreography, sport science, ballet, and martial arts. This diversity provided a strong basis for analysing variation in pedagogical orientations toward teaching the Spinning Dragon Jump.

The student group (n = 30) consisted of dance majors with heterogeneous training backgrounds, including Chinese Classical Dance, ballet, gymnastics, and martial arts. Variation in prior training and performance experience was central to the implementation of developmentally structured pedagogy. All participants participated voluntarily and followed learning procedures aligned with their institutional curricula.

The pedagogical intervention was implemented in two phases reflecting crossover pedagogy principles. The initial phase emphasised traditional instruction, including imitative learning, direct visual correction, and attention to aesthetic quality and stylistic continuity, with the aim of establishing a solid technical and artistic foundation.

In the subsequent phase, biomechanical pedagogy was progressively integrated, focusing on landing stability, knee control, force efficiency, and awareness of the body's centre of gravity. This integration was contextual and gradual to preserve aesthetic continuity while enhancing technical safety and control.

Outcome measures included biomechanical variables (jump height, landing force, knee valgus angle), clinical–pedagogical indicators (pain score, injury risk index), and performative variables (action standardisation, emotional expressiveness, stylefulness, and centre-of-gravity control during landing). These measures formed the basis for comparative analysis between the crossover and control groups

Results

Pedagogical Profiles of Instructors and Differentiation of Teaching Approaches

The results indicate that the participating instructors possessed diverse pedagogical backgrounds and professional experiences. This variation encompassed institutional affiliations, the types of student cohorts taught, levels of teaching experience, and areas of technical specialisation in dance. Such diversity provides an important contextual basis for understanding the differences in instructional approaches to the *Spinning Dragon Jump* implemented during the study. The demographic profiles of the instructors and their teaching contexts are presented in Table 1, while their training histories, professional experience, and pedagogical emphases are summarised in Table 2.

Table 1

Demographic Profiles and Teaching Contexts of Instructors

Teacher	Institution	Teaching Experience
T01	Shandong Normal University, Dance Department	Upper-intermediate male students
T02	Shandong Arts College, Dance Academy	Undergraduates and graduates
T03	Shandong Youth Politics College, Dance Academy	Freshmen and sophomore
T04	Shandong University of Arts, School of Dance	Intermediate and advanced undergraduates
T05	Qingdao University, Department of Dance	First- and second-year students
T06	Shanghai Theater Academy, Department of Chinese Dance	Undergraduates and professionals in workshops
T07	Beijing Dance Academy, School of Performance	Competition-level students
T08	Tianjin Conservatory of Music, Department of Dance	General undergraduate dance students
T09	Sichuan University of Arts, Faculty of Dance	Undergraduates with rhythm focus
T10	Guangdong Dance Academy	First- and second-year students
T11	Hebei Academy of Fine Arts	General undergraduates
T12	Nanjing University of the Arts, Department of Dance	Creative undergraduate students
T13	Central Conservatory of Music, Department of Dance Education	Beginners to advanced undergraduates
T14	Zhejiang University of Media Communications, Department of Dance	Advanced undergraduates, competition preparation
T15	Xinjiang Arts University, Dance Department	Beginners to professional dancers

Table 2
Training Backgrounds and Pedagogical Specialisations of Instructors

Teacher	Training / Education	Teaching Experience	Years in Classical Dance	Specialty / Focus
T01	Beijing Dance Academy; 10 years at Shandong Opera & Dance Drama Theatre	>6 years teaching Spinning Dragon Jump	±10 years	Men's tumbling & jumping
T02	Master in Classical Dance Style & Technique	12 years teaching; ±10 years Spinning Dragon Jump	12 years	Landing stability & jump explosiveness
T03	BA & MA in pedagogy & body rhythm	4 years teaching	4 years	Fundamentals & body awareness
T04	Central Univ. for Nationalities; choreographer	18 years teaching; 12 years Spinning Dragon Jump	15 years	Expressive jumps
T05	Classical & contemporary dance	9 years teaching	6 years	Foundational movement
T06	PhD in Dance Pedagogy	20 years teaching	20 years	Theatrical jumps
T07	Performance & choreography	7 years teaching	7 years	Acrobatics integration
T08	Classical, ballet, martial arts	11 years teaching	11 years	Axis & spine control
T09	Classical & stage choreography	14 years teaching	14 years	Rhythm synchronization
T10	Dance & gymnastics	6 years teaching	6 years	Strength-based training
T11	Classical & folk dance	13 years teaching	13 years	Breathing & rhythm
T12	Chinese dance & improvisation	5 years teaching	5 years	Emotional expression
T13	Dance pedagogy & sports science	16 years teaching	16 years	Muscular balance
T14	Expressive performance	10 years teaching	10 years	Acting in jumps
T15	Classical & ethnic dance	19 years teaching	19 years	Stamina training

Based on the data presented in both tables, instructors with backgrounds primarily grounded in traditional pedagogy and choreography tended to emphasise artistic expression, stylistic continuity, and the visual quality of movement in teaching the *Spinning Dragon Jump*. This orientation was particularly evident among instructors with extensive experience in stage choreography and formal Chinese Classical Dance education. In contrast, instructors with additional backgrounds in sport science, ballet, gymnastics, or martial arts demonstrated a stronger emphasis on bodily stability, efficiency of force application, and landing control.

These differences in pedagogical focus reflect variations in instructors' epistemological frameworks and teaching orientations in conceptualising the dancer's body—either predominantly as a medium of artistic expression or as a biomechanical system requiring safe and efficient control. This differentiation constitutes an empirical foundation for the implementation of the developmentally structured pedagogical model, which integrates

traditional methods and biomechanical approaches progressively within the learning process of the *Spinning Dragon Jump*.

Comparison of Outcomes Between the Crossover and Control Groups

Comparative analysis between the crossover and control groups revealed consistent differences across most biomechanical and clinical–pedagogical variables. Quantitative pre- and post-intervention data for both groups are summarised in Table 3.

Table 3

Comparison of Mean Values for Biomechanical and Injury Risk Variables Between the Crossover and Control Groups

Variabel	Fase	Crossover	Control
Jump Height	Pre	29.94	30.27
	Post	33.74	30.49
Landing Force	Pre	3.49	3.46
	Post	3.13	3.50
Crossword Puzzle Score*	Pre	1.20	1.22
	Post	0.96	1.20
Knee Valgus Angle	Pre	10.69	9.96
	Post	8.15	10.14
Pain Score	Pre	2.61	2.95
	Post	0.48	3.13
Injury Risk Index	Pre	7.03	6.95
	Post	4.54	6.93

* *Note: This variable is reported using the terminology applied in the research instrument.*

With respect to biomechanical variables, the crossover group demonstrated a clear increase in jump height following the biomechanical pedagogical intervention, whereas the control group showed no meaningful change. In addition, knee valgus angle in the crossover group decreased consistently in the post-intervention phase, indicating improved landing stability. By contrast, the control group tended to maintain or exhibit an increase in knee valgus angle. From a clinical–pedagogical perspective, both pain score and injury risk index decreased markedly in the crossover group following the intervention. In the control group, these indicators remained largely unchanged or showed a slight increase in the post-intervention phase. Overall, this pattern of results suggests that implementation of the crossover pedagogical model is associated with improved bodily control and a reduced risk of injury when compared with a purely traditional instructional approach.

Impact on Artistic Performativity

Analysis of the performativity of the *Spinning Dragon Jump* in the crossover group indicates that improvements in biomechanical control were not accompanied by a decline in artistic quality. Performativity scores encompassing action standardisation, emotional expressiveness, stylefulness, and centre-of-gravity control during landing are presented in Table 4.

Table 4
Performativity Scores of the Spinning Dragon Jump in the Crossover Group

Student ID	Action Standardization	Emotional Expressiveness	Stylefulness	Landing Center of Gravity Control
S21	8.05	7.80	8.10	8.40
S22	8.10	8.05	8.05	8.50
S23	8.00	7.85	8.20	8.40
S24	7.90	7.95	8.40	8.30
S25	8.25	8.10	7.90	8.25
S26	8.15	8.20	8.15	8.10
S27	8.25	7.85	8.35	8.15
S28	8.10	7.90	8.05	8.25
S29	7.75	7.85	7.85	8.05
S30	8.30	7.95	8.00	8.40
Overall Mean	**8.09**	**7.95**	**8.11**	**8.28**

The results shown in Table 4 indicate that all performative indicators remained within a high-performance range following implementation of the crossover pedagogical model. The highest mean score was observed in centre-of-gravity control during landing, suggesting an enhanced ability of dancers to maintain postural stability after the airborne phase. To further clarify differences in performative patterns, Figure 1 presents a radar diagram comparing overall performance scores of the *Spinning Dragon Jump* between the crossover and control groups.

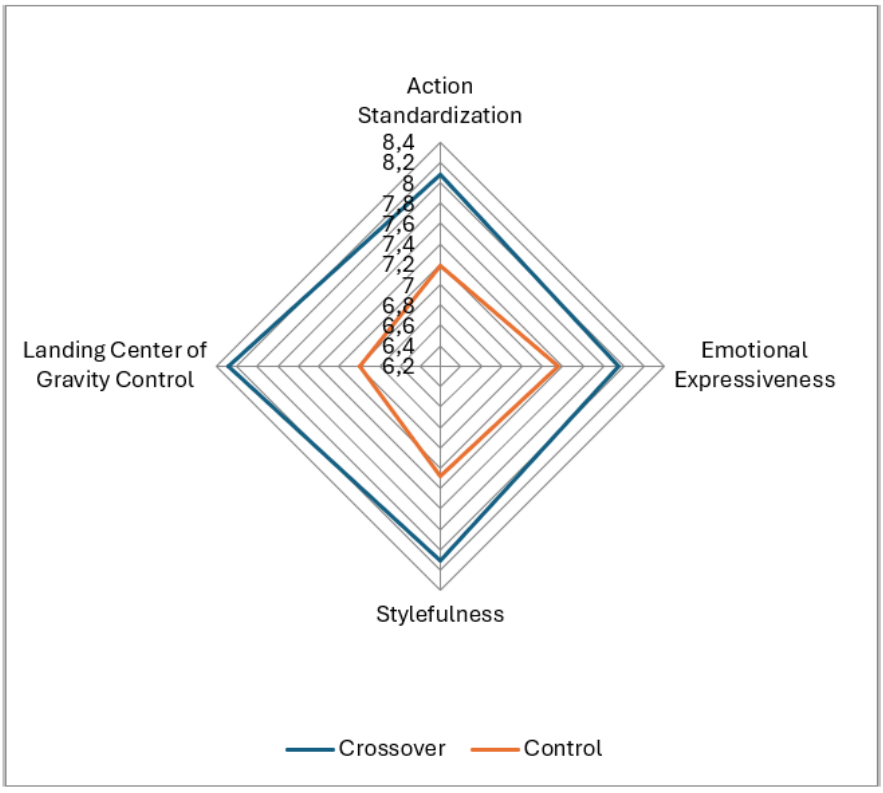

Figure 1. Radar Diagram of Overall Performativity Scores for the Spinning Dragon Jump in the Crossover and Control Groups

Visually, the radar diagram demonstrates that the crossover group outperformed the control group across all performative dimensions, with the most pronounced difference observed in centre-of-gravity control during landing. This visual pattern is consistent with the quantitative findings for biomechanical and clinical–pedagogical variables, particularly the reductions in knee valgus angle and injury risk index observed in the same group.

Overall, these performative results indicate that enhanced bodily stability and biomechanical awareness can be achieved without compromising artistic expression. On the contrary, improved bodily control appears to be associated with the maintenance—and in certain aspects, the strengthening—of artistic quality in the execution of the *Spinning Dragon Jump*.

Discussion

Effectiveness of Developmentally Structured Pedagogy

The findings of this study demonstrate that the implementation of a developmentally structured pedagogical approach produced consistent positive effects on technical performance, biomechanical control, and dancer safety in mastering the *Spinning Dragon Jump*. Increases in jump height, reductions in knee valgus angle, and decreases in pain score and injury risk index in the crossover group indicate that learning organised in a progressive and contextualised manner is more effective than a purely traditional approach. These findings reinforce the principle that the acquisition of complex motor skills requires adjustment of task difficulty in accordance with learners' neuromotor readiness.

Pedagogically, the developmentally structured model applied in this study reflects the principle of scaffolding, whereby technical complexity and physical demands are introduced gradually as dancers' bodily control capacities develop. This approach enables students to establish a technical foundation and embodied awareness before being exposed to higher biomechanical demands, particularly during high-risk landing phases. This principle aligns with Knudson's (2021) assertion that effective motor skill instruction must account for neuromotor readiness and individual adaptive capacity to mechanical loading. Empirical support for this approach is evident in the consistent differences observed between the crossover and control groups, as shown in Tables 3 and 4.

The improvement in landing stability, as reflected by reductions in knee valgus angle in the crossover group, can be understood as the outcome of a learning process that does not prioritise immediate technical correction, but instead allows dancers to develop internal movement control progressively. This contrasts with the direct corrective approach commonly employed in traditional pedagogy, which—although visually effective—does not always afford sufficient time for neuromuscular systems to adapt to complex technical demands.

Furthermore, the effectiveness of developmentally structured pedagogy is underscored by the absence of any degradation in performative quality within the crossover group. Scores for action standardisation, emotional expressiveness, and stylefulness remained within a high-performance range following the intervention. These findings suggest that progressive learning does not constrain artistic expression; rather, it creates a more stable and secure bodily condition that enables dancers to express artistic qualities with greater consistency. In

this sense, neuromotor readiness cultivated through developmentally structured pedagogy serves to expand, rather than restrict, the space for artistic expression.

Taken together, these findings reinforce the argument that the effectiveness of dance pedagogy cannot be evaluated solely on the basis of visual aesthetic outcomes. Equally important is the capacity of pedagogical approaches to prepare dancers' bodies to meet technical demands sustainably. Within the context of Chinese Classical Dance—where techniques such as the *Spinning Dragon Jump* carry substantial symbolic and technical significance—developmentally structured pedagogy offers an adaptive learning framework that accommodates diversity in students' backgrounds and variations in physical readiness. Accordingly, the effectiveness of this model lies in its ability to simultaneously reconcile technical demands, bodily safety, and artistic quality.

Integration of Tradition and Biomechanics

The findings of this study indicate that integrating biomechanical principles into Chinese Classical Dance pedagogy does not function as a replacement for tradition, but rather as a *pedagogical enhancer* that supports the sustainability of aesthetic values and technical quality. This integration allows traditional teaching practices to be preserved while being complemented by scientific understanding of bodily control and dancer safety. This perspective aligns with Rowe et al. (2020), who emphasise that pedagogical innovation in dance education in China emerges through negotiation between traditional norms, institutional structures, and contemporary pedagogical demands.

Within the context of this study, biomechanics was not introduced as a normative framework dictating movement form, but as a reflective tool enabling dancers and instructors to understand principles of efficiency and bodily stability during the execution of complex techniques such as the *Spinning Dragon Jump*. This approach promotes technical correction at an internal level through enhanced bodily awareness and neuromuscular control, rather than relying solely on external visual correction. Such an integrative model is consistent with the work of Markula and Frantsi (2024), who conceptualise reflective and collaborative pedagogy as a process in which scientific knowledge and artistic experience function in a complementary relationship within learning environments.

The alignment between tradition and biomechanics is empirically evident in the crossover group, which demonstrated improved biomechanical stability without a decline in performative quality. Reductions in knee valgus angle, pain score, and injury risk index (Table 3) occurred alongside consistently high scores in action standardisation, emotional expressiveness, and stylefulness (Table 4), as well as the visual patterns illustrated in Figure 1. These findings suggest that biomechanical principles, when applied contextually, support both technical consistency and artistic expression, particularly through enhanced control of the centre of gravity during landing.

Furthermore, the results demonstrate that biomechanical integration is adaptable to the diversity of instructors' and students' backgrounds. The differentiated teaching approaches identified in the Results section indicate that the crossover pedagogical model accommodates both traditional aesthetic orientations and science-based technical perspectives. Consequently, this integration does not necessitate homogenisation of teaching methods;

rather, it provides a flexible framework within which multiple pedagogical perspectives can operate coherently within a unified learning system.

Conceptually, these findings reinforce the argument that preserving tradition in dance education does not require resistance to modern scientific knowledge. On the contrary, culturally sensitive integration of biomechanics can function as an effective pedagogical strategy for maintaining technical integrity and dancer safety without compromising aesthetic values or the symbolic meanings of movement. In the context of Chinese Classical Dance, the integration of tradition and biomechanics through a crossover pedagogical model offers a culturally sustainable approach that responds to the physical demands placed on contemporary dancers.

Safety Pedagogy as an Educational Issue

The findings of this study underscore that safety in dance instruction should not be positioned solely as a medical or rehabilitative concern, but rather as a pedagogical and curricular issue intrinsic to the teaching and learning of technique. The reductions in pain score and injury risk index observed in the crossover group (Table 3) indicate that systematically designed, developmentally structured teaching strategies play a significant role in mitigating injury risk. These results suggest that injury prevention can be effectively embedded within pedagogical practice, rather than addressed only through clinical intervention after injury has occurred.

In Chinese Classical Dance, techniques such as the *Spinning Dragon Jump* impose substantial mechanical loads on dancers, particularly during the landing phase. The findings demonstrate that integrating biomechanical principles into the learning process is associated with improved landing stability and knee control, as reflected by the reduction in knee valgus angle in the crossover group. This outcome is consistent with existing literature emphasising the importance of biomechanically informed preventive approaches in injury prevention strategies for dancers and movement-based athletes (Fotaki et al., 2021; Pavlasová et al., 2025).

Importantly, the results also show that safety pedagogy need not be positioned as a constraint on artistic freedom. On the contrary, improvements in biomechanical control and reductions in injury risk in the crossover group occurred alongside the maintenance of high performative quality, as evidenced by scores for action standardisation, emotional expressiveness, and stylefulness (Table 4). This indicates that appropriately integrated safety pedagogy creates safer and more stable bodily conditions, enabling dancers to perform with greater confidence and consistency.

From an educational perspective, these findings imply that dancer safety constitutes an institutional responsibility that must be articulated within curriculum design and teaching practice. Pedagogical approaches that neglect safety considerations risk reproducing high-risk training cultures in which injury is perceived as an inevitable consequence of artistic achievement. In contrast, the crossover pedagogical model demonstrated in this study shows that safety can be established as a learning principle without diminishing technical demands or aesthetic values.

Conceptually, the findings reinforce the view that safety pedagogy should be understood as an integral component of contemporary dance education. Integrating biomechanical principles and neuromuscular training into the learning process supports the development of more sustainable skills, both in terms of performance quality and dancers' physical health. In this sense, safety pedagogy functions not merely as an injury-prevention strategy, but as an educational foundation that underpins the long-term sustainability of Chinese Classical Dance practice in relation to the physical demands placed on modern dancers.

Cultural and Educational Implications for Dance Education in China

The findings of this study carry significant cultural and educational implications for the institutional development of Chinese Classical Dance education. The evidence that the crossover pedagogical model enhances technical performance and bodily safety without diminishing artistic quality demonstrates that pedagogical innovation need not be interpreted as a threat to traditional values. Rather, pedagogical innovation designed with cultural sensitivity can strengthen the sustainability of classical dance practice in response to the physical demands placed on contemporary dancers. This perspective aligns with Li and Tan (2022), who argue that the reinvention of traditional culture in modern contexts is not inherently disruptive, but can function as an adaptive strategy to broaden participation and ensure the long-term viability of artistic practices.

Within the context of higher education in China, the findings indicate that Chinese Classical Dance pedagogy operates at the intersection of preserving traditional aesthetic values and addressing increasingly complex demands related to physical performance and safety. The reduction in injury risk index and pain score in the crossover group (Table 3), occurring alongside the maintenance of high performative scores (Table 4), suggests that these demands are not mutually exclusive. This finding indicates that dance education institutions possess pedagogical space to integrate movement science–based approaches without compromising the artistic identity of Chinese Classical Dance.

Furthermore, the differentiation in instructors' backgrounds identified in the Results section (Tables 1 and 2) reflects the epistemological plurality characterising dance education in China. In this context, the crossover pedagogical model functions as a connective framework that facilitates dialogue between imitation-based, aesthetic pedagogical traditions and biomechanically informed, safety-oriented approaches. Such a framework resonates with Go's (2024) call for reform in higher dance education in China, advocating for greater responsiveness to social change, professional demands, and students' physical conditions.

Culturally, the findings also suggest that the preservation of aesthetic values in Chinese Classical Dance depends not only on the reproduction of movement forms, but also on the sustainability of dancers' bodies as cultural media of expression. When pedagogy neglects safety and physical readiness, dance practice risks perpetuating unsustainable training cultures that may undermine dancers' long-term participation. Conversely, pedagogical approaches that integrate bodily safety into the learning process enable dancers to sustain high-quality artistic expression over extended periods.

Accordingly, the central implication of this study is that Chinese Classical Dance education should move towards a more holistic pedagogical model—one that not only emphasises the

transmission of aesthetic and symbolic values, but also accounts for the biomechanical demands and bodily safety of modern dancers. The developmentally structured crossover pedagogical model examined in this study offers a relevant framework for bridging the preservation of tradition with the transformation of dance education in contemporary institutional contexts.

Implications and Limitations

The findings indicate that integrating movement science and biomechanical principles into Chinese Classical Dance education has clear implications for curriculum design at the tertiary level. Improvements in technical performance, biomechanical stability, and reductions in injury risk observed in the crossover group suggest that developmentally structured pedagogy offers a curricular framework that is more responsive to students' diverse physical readiness and training backgrounds.

From a curricular perspective, these results support a shift away from instructional models that prioritise aesthetic outcomes alone towards approaches that balance artistic quality, bodily control, and safety. The gradual incorporation of biomechanical concepts—such as landing stability, knee alignment, and force efficiency—can be embedded within core technique modules rather than introduced as stand-alone courses that risk separating movement science from dance practice. Furthermore, the crossover model implies that classical dance curricula should be designed progressively, allowing a structured transition from imitation-based traditional methods to reflective approaches that foster neuromotor awareness, particularly for complex techniques such as the *Spinning Dragon Jump*.

Several practical recommendations emerge from these findings. First, interdisciplinary pedagogical training is recommended for dance instructors to strengthen their understanding of basic biomechanics and injury prevention, without compromising their artistic identities. Second, simple biomechanical observations—such as monitoring landing mechanics, knee control, and balance—can be used as reflective pedagogical tools rather than punitive assessments, supporting students' independent development of bodily awareness. Third, dance institutions are encouraged to embed safety pedagogy within academic policies, positioning injury prevention as an educational responsibility rather than a purely medical concern.

This study also has limitations. The relatively small sample size restricts generalisability across broader educational contexts. The focus on formal higher education limits applicability to non-formal or pre-tertiary training settings. Biomechanical analysis was confined to selected indicators and did not include detailed measures such as muscle activation or rotational dynamics. Finally, the short intervention period precludes conclusions about long-term adaptation and injury prevention. Future research should employ larger samples, diverse contexts, and longitudinal designs to further evaluate developmentally structured pedagogy in Chinese Classical Dance.

Conclusion

This study demonstrates that a developmentally structured crossover pedagogical model is an effective and contextually relevant approach for teaching the *Spinning Dragon Jump* within Chinese Classical Dance education. Through the gradual integration of traditional

instructional methods with biomechanical principles, the model improves technical performance while enhancing biomechanical control and dancers' bodily safety.

Empirical results indicate that the crossover group achieved significant gains in jump height alongside marked reductions in knee valgus angle, pain score, and injury risk index, without any decline in artistic quality. These findings confirm that enhanced landing stability and neuromotor awareness do not compromise aesthetic achievement; instead, they create safer and more consistent bodily conditions that support artistic expression in performance.

Pedagogically, the study highlights the importance of staged learning aligned with dancers' neuromotor readiness. The developmentally structured approach enables learners to progressively establish technical foundations and bodily awareness before engaging with more demanding biomechanical tasks. The model also accommodates diversity in students' training backgrounds and instructors' pedagogical orientations.

Importantly, this research reframes safety pedagogy as an educational responsibility rather than a purely medical concern. By embedding injury prevention within curricular practice, the crossover model supports a sustainable and professional model of Chinese Classical Dance education that responds to contemporary physical demands.

Overall, this study offers conceptual and practical contributions by proposing a pedagogical framework that integrates tradition, movement science, and artistic expression. Rather than replacing tradition, the crossover model strengthens Chinese Classical Dance through a safer, reflective, and performance-sustainable approach.

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