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Pedagogical Effectiveness of Competency-Based Acrobatic Training For 5–6-Year-Old Rhythmic Gymnasts

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Abstract: This article examines the pedagogical content and effectiveness of competency-based acrobatic training for 5–6-year-old rhythmic gymnasts. It draws on group-level data from a controlled pedagogical experiment conducted at the Nafis Specialized Sports School for Rhythmic Gymnastics in Bukhara, Uzbekistan. The proposed model integrates motor-technical, health-and-safety, communicative-cooperative, self-regulatory, and cultural-expressive competencies within one age-appropriate training process. For the 5–6-year-old cohort, training time was allocated to general physical preparation (17%), special physical preparation (18%), special motor preparation (28%), and special technical preparation (37%). A secondary descriptive analysis of the means reported in the underlying study showed that the experimental group improved by 33.8% in dynamic strength, 32.8% in speed-strength, 31.4% in static strength, and 13.9% in flexibility and joint mobility. Corresponding changes in the control group were 25.8%, 20.9%, 24.6%, and 14.5%. The additional advantage of the experimental programme was therefore most evident for speed-strength, dynamic strength, and static strength, whereas flexibility improved to a similar extent in both groups. The findings support competency-based training as a practical framework for designing progressive, safe, and child-centred acrobatic instruction. Because the available record contains aggregate rather than participant-level data and does not provide a separate sample size for each age stratum, the results are interpreted descriptively and should be confirmed through a prospectively registered trial with complete reporting.

Keywords: Competency-based approach, rhythmic gymnastics, acrobatic exercises, children aged 5–6, physical preparation, motor competence, safety, pedagogical experimen.

Introduction: Early childhood is a period in which movement experience, postural control, coordination, strength, flexibility, and confidence interact to shape later participation in physical activity. Motor competence does not emerge through maturation alone; it is facilitated by varied, well-structured, and developmentally appropriate practice. Systematic reviews and developmental models link motor competence with physical activity, fitness, perceived competence, and longer-term health trajectories (Barnett et al., 2016; Robinson et al., 2015; Stodden et al., 2008). For this reason, organised gymnastics can be considered not merely an early route to technical specialisation, but also a pedagogical environment for building physical literacy, self-regulation, communication, and safe movement behaviour.

Gymnastics presents a distinctive educational challenge. Its content includes body positions, balances, rolls, supports, jumps, landings, rotations, and choreographic transitions that require precision and gradual progression. At the same time, children aged 5–6 have limited attention spans, uneven neuromuscular control, and a strong need for play, emotional security, and comprehensible feedback. When early training is dominated by repeated technical drills or accelerated performance demands, the child's learning process may become fragmented and unnecessarily stressful. International gymnastics guidance therefore emphasises age-appropriate progressions, athlete-centred coaching, technical quality, health, ethics, and safeguarding (Fédération Internationale de Gymnastique [FIG], 2023; FIG, n.d.).

A competency-based approach offers a pedagogical response to this challenge. Competence is understood as the capacity to mobilise knowledge, skills, attitudes, and values in a meaningful context rather than as the mechanical reproduction of isolated movements. Contemporary educational frameworks similarly treat competence as the integrated and adaptive application of learning (Council of the European Union, 2018). Applied to gymnastics, this means that a child should not only reproduce an acrobatic element, but also understand the sequence, follow safety rules, communicate discomfort or uncertainty, cooperate with the coach and peers, regulate effort, and transfer learned habits to new tasks.

The underlying study was designed in response to a local methodological problem: initial gymnastics programmes often assessed technical or normative outcomes while giving insufficient attention to the child's communicative, safety-related, cultural, and self-development competencies. The present article reformulates the study in the field of pedagogical sciences, particularly 13.00.04, and analyses the available results through an international educational lens.

The purpose of the article is to evaluate the pedagogical effectiveness of a competency-based model of acrobatic training for 5–6-year-old rhythmic gymnasts. Three objectives are pursued: to operationalise the competence structure of the programme; to compare descriptive changes in selected physical-quality scores between experimental and control groups; and to formulate evidence-informed recommendations for age-appropriate gymnastics pedagogy.

LITERATURE REVIEW

1. Competency-based pedagogy and physical literacy

Competency-based education shifts the focus from the amount of content delivered to the learner's ability to act effectively in context. The European Reference Framework defines key competences through combinations of knowledge, skills, and attitudes that support personal development, social participation, learning, and responsible action (Council of the European Union, 2018). In physical education and sport, this perspective is compatible with the concept of physical literacy, which combines physical competence with motivation, confidence, knowledge, understanding, and responsibility for engagement in movement (Whitehead, 2010). UNESCO's Quality Physical Education guidelines likewise call for inclusive, developmentally appropriate learning that addresses physical, cognitive, social, and affective outcomes rather than performance alone (UNESCO, 2015).

Within the Uzbek pedagogical tradition, competence is also treated as the practical mobilisation of knowledge, skills, experience, and personal qualities. Muslimov et al. (2015) emphasise that pedagogical competence is inseparable from the ability to select methods, solve professional problems, and organise learner activity. In the context of gymnastics, this principle requires the coach to create tasks in which movement technique, safe conduct, verbal understanding, cooperation, and reflection are assessed together.

2. Gymnastics, motor competence, and age-appropriate development

Evidence supports the educational value of structured gymnastics for young children. Anderson, Button, and Lamb (2022) found that educational gymnastics enabled children of approximately six years of age to improve postural performance and control more rapidly than peers following typical physical education. Biino et al. (2023) reported that children with gymnastics experience outperformed several sport and control groups on gross motor coordination tasks, particularly walking backwards and moving sideways. A recent controlled study of children aged 3–6 also reported improvements in static and dynamic balance following a systematic gymnastics intervention (Yu et al., 2025). These findings are consistent with the broader evidence that organised movement interventions can improve preschool motor competence when the programme is purposeful, sufficiently frequent, and developmentally appropriate.

However, the positive effects of gymnastics depend on programme design. Young athletes need broad foundational movement experiences, not only early repetition of competition-specific elements. The FIG Age Group Programme therefore promotes gradual and safe progressions and the alignment of technical content with growth, maturation, and long-term development (FIG, n.d.). Similarly, youth strength-training guidance supports supervised, technique-driven, age-appropriate exercise rather than maximal loading (Faigenbaum et al., 2009). For 5–6-year-old gymnasts, strength work is most appropriately embedded in body-weight supports, hangs, jumps, locomotor tasks, controlled landings, and playful circuits.

3. Safety, communication, and the changing role of the coach

Acrobatic learning contains inherent risk because it involves inversion, flight, rotation, landing, and reliance on equipment or spotting. Injury reviews therefore highlight supervision, suitable equipment, progressive skill acquisition, balanced conditioning, and correct landing as central preventive measures (Caine & Nassar, 2005). Safety in a competency-based model is not restricted to the coach's control of the environment. It also becomes a learning outcome: the child recognises a rule, waits for a signal, checks space, reports pain or fear, maintains an appropriate starting position, and applies a safe landing response.

This approach changes the coach's role from transmitter of commands to organiser of purposeful learning. Demonstration and clear instructions remain essential, but they are complemented by short questions, guided discovery, age-appropriate choices, peer observation, feedback, and reflection. Such methods strengthen the child's understanding and make communication part of technical accuracy. The source study therefore combined direct teaching with play, circuit training, progressive exercises, assisted practice, and individual feedback.

METHODOLOGY

Research design. The study used a controlled pedagogical experiment with experimental and control training groups. The available research record does not document random allocation; the design is therefore treated as quasi-experimental. The experiment was conducted in the training process of young female gymnasts at the Nafis Specialized Sports School for Rhythmic Gymnastics in Bukhara, Uzbekistan.

Participants and reporting scope. The broader longitudinal record indicates that 25 children entered each group at the beginning of the observation. However, the source table containing the 5–6-year-old pre- and post-training outcomes does not specify the exact number of children contributing to each age-stratified mean. Consequently, the present article uses group-level descriptive evidence and does not reconstruct inferential statistics. This decision prevents unsupported p-values or effect estimates from being introduced into the manuscript.

Training organisation. Training sessions lasted 90 minutes and were conducted three to four times per week. Each session consisted of a preparatory part, a main part, and a concluding part. The preparatory part combined organisation, warm-up, general developmental movements, and coordination games. The main part included age-appropriate acrobatic technique, special physical preparation, assisted and lead-up exercises, circuit tasks, play, and controlled repetitions. The concluding part used low-intensity activity, relaxation, brief feedback, and home or self-monitoring tasks.

Training-content allocation. For the 5–6-year-old experimental group, the programme allocated 17% of total training time to general physical preparation, 18% to special physical preparation, 28% to special motor preparation, and 37% to special technical preparation. The distribution was intended to prevent premature dominance of narrow technical work while still maintaining sufficient exposure to foundational gymnastics skills.

Pedagogical methods. The programme used explanation, demonstration, precise age-appropriate terminology, segmentation of complex skills, lead-up exercises, assisted performance, repeated practice, games, relays, circuit stations, guided questioning, and individual feedback. Particular attention was given to safe landing, rolling, supports, hangs, body alignment, flexibility, coordination, and the child's ability to understand and verbalise basic safety cues.

Outcome measures. The research record reports composite score values for dynamic strength, speed-strength, static strength, and flexibility/joint mobility as means and standard deviations before and after the training cycle. These outcomes represent the physical component of the broader competence model; no validated scale of communicative or self-regulatory competence was reported.

Data analysis. Absolute gain was calculated as post-test minus pre-test. Relative change was calculated as the absolute gain divided by the pre-test mean and multiplied by 100. Difference-in-gains was calculated as the experimental-group gain minus the control-group gain. Coefficients of variation reported in the source were used to examine changes in group homogeneity. Because participant-level observations, age-specific sample sizes, allocation procedures, and test-retest correlations were unavailable, no new t-tests, confidence intervals, or standardised effect sizes were calculated.

1. Operational structure of the competency-based model

Competence domain	Observable child outcomes	Teaching methods	Assessment evidence
Motor-technical competence	Performs body positions and acrobatic sequences in the correct order; coordinates support, balance, jump, roll, and landing actions.	Demonstration, segmentation, lead-up exercises, repeated practice, individual correction.	Accuracy, sequence, control, and transfer to a slightly modified task.
Health-and-safety competence	Follows warm-up and hygiene rules; uses equipment correctly; waits for the coach's signal; applies safe landing and falling actions; reports discomfort.	Safety briefing, equipment check, spotting, model landing, protective rolling, stop-signal routines.	Observable compliance, correct response to a safety scenario, and timely communication of pain or fear.
Communicative-cooperative competence	Listens to short instructions, asks for clarification, uses key movement terms, and cooperates during pair or group tasks.	Guided questions, verbal cueing, peer observation, turn-taking, short reflection.	Comprehension of instructions, appropriate questions, respectful interaction, and joint task performance.

Competence domain	Observable child outcomes	Teaching methods	Assessment evidence
Self-regulation and learning competence	Maintains attention, regulates effort, persists after an error, compares performance with a model, and accepts feedback.	Goal setting, small achievable steps, performance diary, praise for effort, self-assessment prompts.	Task completion, effort regulation, response to feedback, and age-appropriate self-evaluation.
Cultural-expressive competence	Coordinates movement with music, displays posture and expressiveness, respects training norms, and values collective participation.	Music-based exercises, choreography, imagery, etiquette, and culturally meaningful movement tasks.	Rhythm, expression, discipline, aesthetic quality, and respectful behaviour.

Table 1. Competence domains operationalised from the pedagogical content of the underlying study.

RESULTS

1. Training-content balance

The experimental programme deliberately balanced general, special physical, special motor, and special technical preparation. This structure is pedagogically important because a 5–6-year-old child requires broad movement experience before high-volume repetition of complex elements. The 37% technical component remained the largest single share, but 63% of the programme was devoted to general, physical, and motor foundations that supported safe technical acquisition.

Training component	Share of total time	Primary pedagogical purpose
General physical preparation	17%	General mobility, posture, locomotion, playful conditioning, and whole-body development.
Special physical preparation	18%	Strength, speed-strength, static control, flexibility, and body-weight conditioning relevant to gymnastics.
Special motor preparation	28%	Coordination, balance, spatial orientation, swings, supports, landings, and lead-up acrobatic actions.
Special technical preparation	37%	Age-appropriate acrobatic and rhythmic-gymnastics elements, combinations, and technical refinement.

Training component	Share of total time	Primary pedagogical purpose
Total	100%	Integrated preparation for safe and progressive movement learning.

Table 2. Experimental training-time allocation for the 5–6-year-old group.

2. Descriptive changes in physical-quality scores

Baseline differences between the groups were small: 0.20 score units for dynamic strength, no difference for speed-strength, 0.35 for static strength, and 0.30 for flexibility. Both groups improved after the training cycle, which is expected in a period of rapid development and regular practice. The pedagogically relevant comparison is therefore the magnitude and pattern of change rather than the presence of improvement alone.

Outcome	EG pre	EG post	EG gain	CG pre	CG post	CG gain	Gain advantage
Dynamic strength	6.80 ± 1.20	9.10 ± 0.50	+2.30 (33.8%)	6.60 ± 1.10	8.30 ± 0.90	+1.70 (25.8%)	+0.60
Speed-strength	6.70 ± 1.40	8.90 ± 0.50	+2.20 (32.8%)	6.70 ± 1.10	8.10 ± 0.90	+1.40 (20.9%)	+0.80
Static strength	6.85 ± 1.50	9.00 ± 0.40	+2.15 (31.4%)	6.50 ± 1.30	8.10 ± 0.90	+1.60 (24.6%)	+0.55
Flexibility / joint mobility	7.90 ± 1.10	9.00 ± 0.50	+1.10 (13.9%)	7.60 ± 0.70	8.70 ± 0.60	+1.10 (14.5%)	0.00

Table 3. Group-level descriptive results for 5–6-year-old gymnasts. Values are mean ± SD. EG = experimental group; CG = control group. The "gain advantage" is EG gain minus CG gain. No new inferential statistics were calculated because age-stratum sample sizes and participant-level data were unavailable.

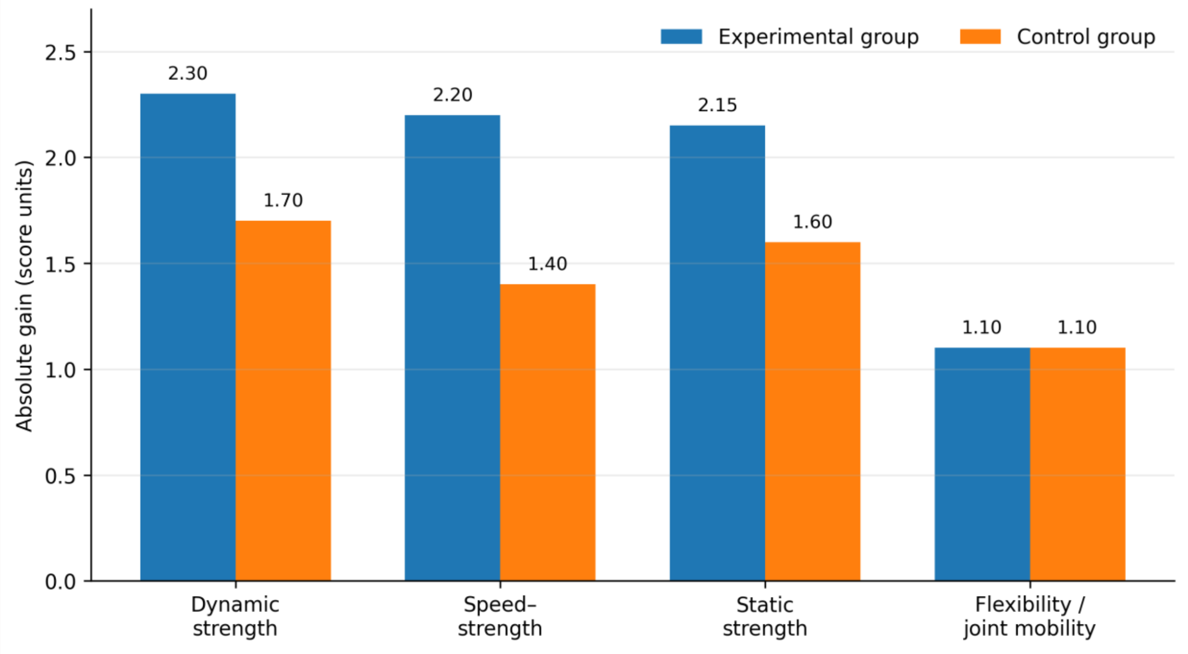

Figure 1. Absolute change in physical-quality scores by group, calculated from the reported means.

The largest difference-in-gains occurred in speed-strength (+0.80 score units in favour of the experimental group). Dynamic strength showed a +0.60 advantage, and static strength a +0.55 advantage. These three outcomes correspond closely to the programme's use of body-weight supports, hangs, jumps, short acceleration tasks, controlled transitions, and repeated low-complexity acrobatic sequences.

Flexibility and joint mobility improved by 1.10 score units in both groups. The experimental group began and ended with slightly higher mean values, but the training model did not produce an additional gain relative to the control condition. This finding is important because it prevents an overly general conclusion. The programme's distinctive effect appears to concern strength-related motor qualities more than flexibility, which was already a prominent component of both groups' rhythmic-gymnastics practice.

Variation within the experimental group also decreased. The reported coefficient of variation fell from 17.6% to 5.5% for dynamic strength, from 20.9% to 5.6% for speed-strength, from 21.9% to 4.4% for static strength, and from 13.9% to 5.5% for flexibility. Corresponding control-group reductions were smaller for the three strength-related outcomes. Descriptively, the programme therefore improved not only average performance but also the consistency of learning across children. This interpretation remains provisional because individual trajectories were not available.

3. Complementary longitudinal indicators

The broader 5–8-year longitudinal record provides additional, although not age-specific, evidence of programme productivity. Across three years, the experimental group mastered 270 gymnastics and special-motor units compared with 184 in the control group, a descriptive difference of 86 units (46.7%). The largest contrast concerned special motor preparation: 187 units in the experimental group versus 108 in the control group, a difference of 79 units (73.1%). The reported mean technical-preparation score was 39.8 ± 1.17 in the experimental group and 33.8 ± 2.77 in the control group. These data support the interpretation that a broad motor foundation can facilitate rather than delay technical development. Because the source's significance notation is internally inconsistent and participant-level data are unavailable, these complementary outcomes are reported without reconstructed p-values.

DISCUSSION

The results are consistent with the view that gymnastics learning improves when technical practice is embedded in a broader pedagogical system.

Anderson et al. (2022) demonstrated that educational gymnastics can accelerate changes in postural control, while Biino et al. (2023) found that gymnastics experience is associated with superior gross motor coordination. The present data add a competence-oriented interpretation: physical gains were obtained within a programme that also explicitly addressed safety, communication, self-regulation, and cultural expression.

The strength-related pattern is plausible. Dynamic and speed-strength tasks were repeatedly practised through jumps, relays, body-weight actions, supports, and short acrobatic sequences. Static strength was supported by hangs, support positions, body alignment, and controlled holds. These tasks were linked to clear movement cues and progressive difficulty, thereby combining physical conditioning with cognitive organisation of action. The absence of an additional flexibility advantage suggests that flexibility work was not unique to the experimental programme and that future interventions should specify dose, technique, and individual adaptation if flexibility is a primary outcome.

From a pedagogical standpoint, the programme's principal contribution is the integration of what is learned, how it is learned, and how it is assessed. A child's successful performance is not defined solely by the final shape of an element. It also includes readiness, rule-following, safe use of space and equipment, communication of uncertainty, persistence, and the ability to repeat the movement under slightly changed conditions. This operationalisation is compatible with competence frameworks and physical-literacy theory, both of which reject a narrow separation of knowledge, skills, motivation, and responsibility.

The study also highlights the importance of the coach's professional competence. Young gymnasts need concise explanations, technically accurate demonstrations, appropriate spotting, emotional support, and immediate correction without humiliation or excessive pressure. The FIG Academy's athlete-centred and safeguarding principles are therefore not external administrative requirements; they are part of the pedagogy of effective motor learning (FIG, 2023).

Several limitations must be recognised. The available record contains aggregate data, incomplete reporting of age-specific sample sizes, no documented randomisation, no validated instrument for the non-motor competence domains, and no detailed fidelity or injury-monitoring data. The age range also broadens in parts of the longitudinal analysis. These limitations prevent causal claims and meta-analytic comparison. Nevertheless, the descriptive pattern is sufficiently coherent to justify a more rigorous prospective study.

CONCLUSION

The competency-based model provided a coherent pedagogical structure for acrobatic training in 5–6-year-old rhythmic gymnasts. It combined physical and technical preparation with safety, communication, self-regulation, cooperation, and cultural expression. The 17:18:28:37 allocation across general physical, special physical, special motor, and special technical preparation preserved a substantial technical component while giving priority to the broad foundations required for safe learning.

Descriptively, the experimental group showed larger gains than the control group in dynamic strength, speed-strength, and static strength. Flexibility improved similarly in both groups, indicating that the programme's additional effect was outcome-specific rather than universal. Complementary longitudinal data also suggested greater accumulation of special-motor and technical units in the experimental programme.

For practice, coaches should: (1) formulate each acrobatic task as a competence outcome that includes technique, understanding, safety, and communication; (2) use progressive and assisted exercises before whole-skill performance; (3) preserve game-based and circuit activities to maintain motivation and develop coordination; (4) teach landing, falling, equipment use, and pain reporting as observable child competencies; (5) assess individual progress rather than relying only on group norms; and (6) involve parents in consistent safety, recovery, and attendance routines.

For future research, the programme should be tested in a prospectively registered controlled trial with clearly reported sample sizes, allocation procedures, intervention duration, attendance, fidelity, adverse events, and parental consent. Validated measures should be added for communication, self-regulation, perceived competence, enjoyment, and safety knowledge. Participant-level data would allow mixed-model analysis, confidence intervals, and effect-size estimation.

Within the field of pedagogical sciences, the study supports competency-based acrobatic training as a promising framework for child-centred initial sports preparation. Its value lies not only in improving movement scores, but in organising the conditions under which young children learn to move accurately, safely, consciously, and confidently.

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