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Comparison of the Effectiveness of a Gymnastics Training Program and Teaching Games for Understanding on Improving Gross Motor Skills in Children Aged 4 to 11 Years

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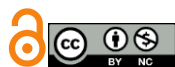
Article Info	ABSTRACT
Article type: *Original Research* **How to cite this article:** 	**Objective:** This study aimed to compare the effectiveness of a gymnastics training program and the Teaching Games for Understanding (TGfU) approach in enhancing gross motor skills among children aged 4 to 11 years. **Methods and Materials:** A quasi-experimental design with a pre-test and post-test structure was employed. Sixty girls aged 4 to 11 years from Mashhad, who had no prior experience in gymnastics, were recruited using convenience sampling. Participants were randomly assigned to either the gymnastics training group or the TGfU group, each further divided into two age-based subgroups (4–7 years and 8–11 years). Gross motor skills were assessed using the Bruininks-Oseretsky Test of Motor Proficiency (BOT-2). Data were analyzed using descriptive statistics and a one-way multivariate analysis of covariance (MANCOVA) to determine differences between the groups. **Findings:** Both the gymnastics training program and TGfU approach significantly improved gross motor skills. However, the TGfU group showed a greater increase in mean post-test scores compared to the gymnastics group. ANCOVA results confirmed a statistically significant difference in motor skill improvement between the two interventions, with TGfU exhibiting a stronger overall effect. These findings highlight TGfU's ability to integrate cognitive engagement and contextual learning, resulting in greater enhancements in motor skill development. **Conclusion:** The TGfU approach demonstrated superior effectiveness in enhancing gross motor skills compared to gymnastics training. While gymnastics promotes strength and balance through structured routines, TGfU fosters intrinsic motivation and cognitive understanding. **Keywords:** *Teaching Games for Understanding (TGfU), gymnastics training, gross motor skills, children, physical education, motor skill development.*

1. Introduction

Gross motor skills are fundamental to children's physical development, as they form the basis for more complex movements and contribute significantly to physical activity participation, social interaction, and overall well-being (1-5). Enhancing these skills during childhood not only supports physical literacy but also fosters long-term engagement in physical activities. Among various interventions, gymnastics and Teaching Games for Understanding (TGfU) have emerged as effective strategies for improving motor skills and fostering intrinsic motivation in physical education settings (6-8). However, limited studies have compared the relative effectiveness of these methods on gross motor skill development, particularly in younger populations.

Gymnastics is widely recognized as a discipline that enhances strength, flexibility, balance, and coordination. Research highlights its benefits for children's motor skill development and physical fitness, making it a popular choice in physical education curricula (9, 10). Gymnastics emphasizes controlled movements, which help develop proprioception and improve balance, agility, and spatial awareness (11). Additionally, it offers opportunities for skill progression, enabling children to master increasingly complex movements over time (12). This progression aligns with theories of motor learning, which suggest that repeated practice and gradual skill advancement foster neural adaptations and enhance motor competence (13).

Educational gymnastics also promotes creativity and self-expression, allowing children to explore movement patterns in a supportive environment. This aligns with modern pedagogical approaches, such as Nonlinear Pedagogy, which emphasize individualized learning experiences and adaptability in skill acquisition (14). Moreover, the aesthetic and artistic components of gymnastics contribute to its appeal, motivating children to participate and excel (15).

TGfU is an innovative instructional model that prioritizes game-based learning to enhance motor skills, cognitive understanding, and decision-making abilities (16). Unlike traditional skill-focused methods, TGfU emphasizes the context and purpose of movements within games, encouraging children to develop strategic thinking alongside motor proficiency (7). The model's focus on active participation and problem-solving fosters intrinsic motivation, making it particularly effective for engaging children in physical education (17).

Research has demonstrated the effectiveness of TGfU in improving motor skills, particularly through its emphasis on meaningful play and the integration of tactical concepts (6). The approach aligns with Self-Determination Theory, which posits that autonomy, competence, and relatedness are essential for fostering intrinsic motivation (18, 19). By allowing children to take ownership of their learning and experience the joy of play, TGfU enhances both physical and psychological outcomes (1-4).

Hybrid models that combine TGfU with other pedagogical frameworks, such as Sport Education, have further demonstrated the potential to enhance motivation, enjoyment, and perceived competence (2, 4, 20). These findings underscore the versatility and adaptability of TGfU in diverse educational contexts.

While both gymnastics and TGfU have proven benefits, they differ in their instructional approaches and focus areas. Gymnastics emphasizes precision, repetition, and progression through structured routines, fostering physical attributes such as strength and balance (21). In contrast, TGfU adopts a holistic approach, integrating motor skills with cognitive and social learning through game-based activities (1-3, 22).

The comparative effectiveness of these methods on gross motor skill development remains underexplored, particularly in younger children. Existing studies suggest that gymnastics may excel in enhancing balance and coordination, while TGfU promotes decision-making, game performance, and motivation (23, 24). By investigating these approaches within the same population, this study aims to identify their relative strengths and contributions to motor skill development.

This study is grounded in Achievement Goal Theory and Self-Determination Theory, which provide a comprehensive framework for understanding motivation in physical education (19). Achievement Goal Theory posits that task-oriented goals, such as skill mastery, enhance intrinsic motivation and promote persistence in physical activities. Meanwhile, Self-Determination Theory highlights the importance of satisfying basic psychological needs—autonomy, competence, and relatedness—to foster sustained engagement and enjoyment (18, 20).

Building on these theoretical foundations, the present study seeks to achieve the following objective:

To compare the relative contributions of gymnastics and TGfU to overall motor skill enhancement, considering factors such as motivation, enjoyment, and perceived competence.

2. Methods and Materials

2.1 Study Design and Participants

This study is a quasi-experimental design with a pre-test and post-test structure. The research focuses on a sample of girls from the city of Mashhad, aged 4 to 11 years, who have not previously participated in gymnastics. Due to the large population, a convenience sampling method was used to select participants. A total of 60 children were selected after completing a personal information questionnaire and obtaining sports insurance coverage. These children were randomly assigned to two intervention groups: one group engaged in gymnastics skills training (with subgroups for ages 4–7 and 8–11 years), and the other participated in Teaching Games for Understanding (TGfU), also with age-based subgroups. The study aimed to assess the impact of these interventions on the development of gross motor skills.

2.2 Measures

The primary tool for data collection was the Bruininks-Oseretsky Test of Motor Proficiency (BOT-2), a standardized reference test designed to assess motor performance in children aged 4.5 to 14.5 years. This test consists of eight subtests, which together evaluate both fine and gross motor skills. The subtests include running speed and agility, balance, bilateral coordination, and strength for gross motor skills, as well as reaction speed, visual-motor control, and upper limb speed and agility for fine motor skills. The BOT-2 is a comprehensive tool, widely recognized for its reliability and validity. The test has been validated across diverse populations, including children from various racial, ethnic, and geographical backgrounds. Test-retest reliability for the long form of the BOT-2 is reported at 78%, and for the short form, it is 86%.

2.3 Interventions

The gymnastics training protocol includes a series of movements designed to improve strength, flexibility, and balance in young children. The training sessions begin with basic exercises such as standing and walking, which serve as the foundation for more complex movements. These exercises are followed by activities that focus on body coordination and strength development, such as the "bunny hop," "bear walk," and "kangaroo hop." Children are also introduced to various jumps, like the "double jump," "leap," and "frog jump," which help enhance leg strength and agility. Additional movements such as "crab walk" and "angel stretch" focus on developing overall body coordination. These activities are progressively organized from simple to complex, including more challenging actions like "forward rolls," "backward rolls," "balance on three legs," and "cartwheels." The protocol incorporates exercises to enhance balance and control, including "balance on one leg" and "jumping and landing exercises," along with drills designed to improve body posture and agility, such as "jumping into a tuck position" and "backward tumbling." Throughout these exercises, emphasis is placed on body awareness, control, and flexibility, with an emphasis on performing movements with precision and fluidity. By targeting core strength, flexibility, and balance, the gymnastics program is designed to promote motor skill development and physical fitness in children (11, 12, 21).

The TGfU protocol focuses on teaching games to improve understanding of motor skills and strategic thinking. The intervention begins with physical and mental preparation, including warm-up exercises that prevent injury and enhance flexibility. The first phase introduces simple movements such as standing and walking, which form the basic skills for more complex actions. After mastering basic movements, the children are taught to break down more complicated movements into smaller parts, which helps them master each individual step before progressing. Visual aids are used, including video demonstrations or live modeling, to provide a clear understanding of the movements. Feedback is given continuously to correct errors and encourage improvement, with teachers providing positive reinforcement and constructive suggestions. The intervention also incorporates balance and strength exercises, using tools such as mats and balance beams to support safety. Progressively more difficult movements are introduced to challenge the children while maintaining their interest and engagement. Finally, regular assessments track individual progress, adjusting the intervention plan to meet the needs of each child and ensuring the development of both cognitive and motor skills (6, 23-25).

2.4 Data Analysis

Data analysis was performed using both descriptive and inferential statistics. Descriptive statistics, including means and standard deviations, were used to summarize the data. For inferential analysis, the Shapiro-Wilk test was employed to assess the normality of the data distribution. If the data followed a normal distribution, a one-way multivariate analysis of covariance (MANCOVA) was used to analyze

the differences between the groups. Statistical calculations were carried out using the SPSS software package.

3. Results

Table 1. Descriptive Statistics

Group	Pre-test (Mean ± SD)	Post-test (Mean ± SD)
Teaching Games for Understanding (TGfU)	6.74 ± 0.86	7.86 ± 0.85
Gymnastics Training Program	5.80 ± 0.66	6.67 ± 0.23

As shown in Table 1, the descriptive statistics indicate the mean scores of gross motor skills for both groups in the pre-test and post-test phases. For the group receiving Teaching Games for Understanding (TGfU), the mean score for gross motor skills in the pre-test was 6.74 with a standard deviation of 0.86, and in the post-test, it improved to 7.86 with a standard deviation of 0.85. In the gymnastics training group, the pre-test mean score was 5.80 with a standard

Table 1 presents the descriptive findings of the gross motor skills in children aged 4 to 11 years before and after the intervention in both groups.

deviation of 0.66, and the post-test mean score increased to 6.67 with a standard deviation of 0.23. This suggests an improvement in gross motor skills in both groups, with the TGfU group showing a greater increase in mean scores than the gymnastics training group.

Table 2 displays the results of the analysis of covariance (ANCOVA) for comparing the gross motor skills scores between the two groups (gymnastics training and TGfU).

Table 2. Reporting ANCOVA

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Sig
Group	49.469	1	49.469	31.45	0.0001
Gross Motor Skills	11.927	1	17.927	210.97	0.0001
Group * Gross Motor Skills	3.692	1	3.692	43.48	0.0001
Error	4.928	58	0.085		
Total	70.016	61			
Adjusted Total	71.023	59			

As shown in Table 2, the ANCOVA results indicate that there is a statistically significant difference in the improvement of gross motor skills between the two groups (F = 31.45, p = 0.0001), suggesting that the type of intervention has a substantial effect on the development of gross motor skills in children aged 4 to 11 years. Additionally, the interaction between group and gross motor skills is also significant (F = 43.48, p = 0.0001), indicating that the effect of the interventions is not uniform across all motor skills. Therefore, Hypothesis 1 is confirmed, as there is a significant difference between the gymnastics training program and the Teaching Games for Understanding (TGfU) program in enhancing gross motor skills among the children in the study.

4. Discussion and Conclusion

The results of this study demonstrate significant improvements in gross motor skills in children aged 4 to 11 years for both the gymnastics training program and the Teaching Games for Understanding (TGfU) approach. The

descriptive statistics indicate that while both groups improved, the TGfU group exhibited a greater increase in mean post-test scores compared to the gymnastics group. The analysis of covariance (ANCOVA) results further confirm a statistically significant difference in motor skill enhancement between the two interventions, with the TGfU approach showing a stronger overall impact.

The superior performance of the TGfU group aligns with previous studies highlighting its effectiveness in engaging students through contextual learning and problem-solving (1). TGfU emphasizes autonomy and enjoyment, both critical components for intrinsic motivation as outlined by Self-Determination Theory (18). The interactive and game-based nature of TGfU likely provided a more engaging and relatable environment, fostering better participation and understanding of gross motor skills (7, 20).

On the other hand, the gymnastics training program, while effective, focuses on structured, repetitive movements to enhance physical attributes such as strength and balance (9). The improvement observed in the gymnastics group supports findings that controlled and progressive skill

training is beneficial for developing specific motor competencies (12). However, the lack of emphasis on contextual or cognitive engagement in gymnastics may explain its comparatively lower impact on overall gross motor skill improvement (21).

The findings corroborate the results of Pan et al. (2023), who observed that TGfU fosters greater improvements in motivation and motor skills compared to traditional methods (24). The approach\u2019s integration of cognitive and physical learning through game scenarios likely mirrors real-world applications, enhancing skill transferability and retention (6). Furthermore, studies by Gustian (2024) and López-Lemus (2023) highlight TGfU\u2019s effectiveness in promoting tactical understanding alongside physical development, which aligns with this study\u2019s results (22, 23).

In contrast, the gymnastics program\u2019s structured methodology aligns with the work of Baumgarten and Pagnano-Richardson (2010), emphasizing physical literacy through repetition and precision. While effective for physical attributes like balance and coordination, it lacks the interactive and motivational elements of TGfU (10). This dichotomy underscores the importance of selecting appropriate pedagogical approaches based on desired outcomes.

Despite its contributions, this study has limitations that must be acknowledged. First, the sample size of 60 participants, though sufficient for statistical analysis, may limit the generalizability of the findings to broader populations. Additionally, the study was conducted within a single geographic region, potentially introducing cultural or environmental biases that may not reflect diverse educational settings (26). Another limitation is the relatively short duration of the interventions, which may not fully capture long-term effects on gross motor skill development. Finally, the reliance on a single assessment tool (BOT-2) might not encompass the multifaceted nature of motor skill development, such as psychosocial and cognitive aspects (2-4).

Future studies should expand the sample size and include participants from diverse cultural and socioeconomic backgrounds to enhance generalizability. Longitudinal designs are recommended to evaluate the sustained effects of gymnastics and TGfU on gross motor skills over time. Incorporating additional assessment tools that measure cognitive and motivational outcomes would provide a more holistic understanding of these interventions (8). Furthermore, exploring hybrid models that integrate gymnastics and TGfU could uncover synergistic effects, potentially maximizing benefits for children\u2019s physical and cognitive development (1-4, 7, 20).

Educators and physical education practitioners can leverage these findings to optimize curricula by incorporating TGfU\u2019s game-based approach for engaging and motivating students. For younger children, TGfU offers a dynamic and interactive platform that fosters both physical and cognitive skills, making it ideal for introductory motor skill programs (7). Gymnastics training, on the other hand, remains valuable for enhancing balance, strength, and coordination, suggesting its integration as a supplementary activity to TGfU. Teachers should consider combining elements of both approaches to address diverse learning needs and maximize skill development (24). Additionally, regular assessment and feedback mechanisms should be implemented to monitor progress and tailor interventions accordingly.\n\nIn conclusion, this study underscores the relative strengths of gymnastics and TGfU in enhancing gross motor skills in children. By adopting evidence-based practices, educators can design inclusive and effective physical education programs that support lifelong physical literacy and well-being.

Authors' Contributions

S. S. conceptualized the study, designed the methodology, and contributed to data collection and manuscript drafting. K. H. S. assisted with participant recruitment, conducted data analysis, and critically revised the manuscript. M. R. contributed to the development of training programs, oversaw the implementation of interventions, and provided final approval for publication. All authors reviewed and approved the final version of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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