

Comparing the Effectiveness of Gymnastics Training and Teaching Games for Understaing (TGfU) for Enhancing Creativity and Motivation in Children Aged 4 to 11

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Article Info

Article type:

Original Research

Section:

Developmental Psychology

How to cite this article:

Shakerian, S., Hosseini Shakib, K., & Rezaee, M. (2025). Comparing the Effectiveness of Gymnastics Training and Teaching Games for Understaing (TGfU) for Enhancing Creativity and Motivation in Children Aged 4 to 11. *KMAN Conseling and Psychology Nexus*, 3, 1-7.

<https://doi.org/10.61838/kman.dp.psynexus.3.2>



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ABSTRACT

This study aimed to compare the effectiveness of gymnastics training and the Teaching Games for Understanding (TGfU) model in improving motivation and creativity among children aged 4 to 11 years. A quasi-experimental design was employed, involving 60 girls aged 4 to 11 years from Mashhad, Iran, who had no prior experience in gymnastics. Participants were randomly assigned to two groups: a gymnastics training group and a TGfU group, each further divided into two age categories (4-7 years and 8-11 years). The interventions were conducted three times a week over eight weeks. Motivation was assessed using the Motivation for Participation in Physical Activities questionnaire, and creativity was evaluated using a coach-assessed Creativity Questionnaire for Children. Data were analyzed using descriptive statistics and one-way multivariate analysis of covariance (MANCOVA) to assess differences between groups. Both interventions significantly improved motivation and creativity, with notable differences in their impacts. The TGfU group exhibited greater improvement in motivation, with a higher post-test mean score (5.63 ± 0.23) compared to the gymnastics group (4.39 ± 0.26). Conversely, the gymnastics training group demonstrated a stronger effect on creativity, with a post-test mean score of 2.30 ± 0.20 compared to 2.35 ± 0.35 in the TGfU group. These findings highlight the distinct strengths of each approach in addressing different developmental domains. TGfU and gymnastics training both offer valuable contributions to physical education, with TGfU excelling in fostering motivation and gymnastics training promoting creativity. Combining these models could optimize their complementary benefits, providing a holistic approach to developing children's physical, cognitive, and emotional skills.

Keywords: Teaching Games for Understanding, gymnastics training, motivation, creativity, physical education, children.

1. Introduction

Physical education plays a vital role in fostering holistic development in children, encompassing physical, cognitive, emotional, and social dimensions. Two prominent pedagogical models in physical education, gymnastics training and Teaching Games for Understanding (TGfU), have gained attention for their effectiveness in promoting essential skills and motivation in young learners (Debien et al., 2022; Gustian, 2024; Hafez, 2017; Li, 2024; Pratama, 2023; Saleh et al., 2021).

The TGfU model is rooted in constructivist learning theory, emphasizing the development of tactical understanding and decision-making skills through modified and contextualized games. According to Chow et al. (2009), TGfU shifts the focus from repetitive skill drills to an integrated approach where learners understand the "why" behind the "how" in gameplay (Chow et al., 2009). This pedagogical framework has shown considerable promise in fostering intrinsic motivation and self-determined engagement in physical activities (Wang & Ha, 2012).

Research underscores the effectiveness of TGfU in enhancing motivation and enjoyment among students. For instance, Arias et al. (2018) found that a hybrid TGfU/Sport Education model significantly improved students' perceived competence and autonomy support, which are critical for sustained participation in physical education (Arias et al., 2018). Furthermore, the model encourages student-centered learning, enabling participants to develop problem-solving and critical thinking skills (Jarrett & Harvey, 2016).

The TGfU framework has been applied across various sports with notable success. Aryanti et al. (2022) demonstrated that TGfU effectively enhanced overhead passing skills in elementary volleyball players (Aryanti et al., 2022), while Pratama (2023) highlighted its applicability in teaching upper passing techniques (Pratama, 2023). Pan et al. (2023) compared TGfU and hybrid TGfU-Sport Education models, reporting superior outcomes in learning motivation and sport enjoyment under the hybrid approach (Pan et al., 2023). Such findings suggest the versatility and effectiveness of TGfU in diverse physical education settings.

Gymnastics is a discipline that combines physical skill development with artistic expression, providing a unique platform for cultivating strength, flexibility, balance, and coordination (Baumgarten & Pagnano-Richardson, 2010). Unlike game-based models, gymnastics emphasizes structured practice and progression through increasingly

complex movements, fostering discipline and perseverance in young learners.

Studies have highlighted the multifaceted benefits of gymnastics training. Saleh et al. (2021) reported significant improvements in static and dynamic balance among children following an eight-week anaerobic gymnastics training program (Saleh et al., 2021). Similarly, Hafez (2017) demonstrated that brain gym exercises positively influenced balance and manipulative skills in beginners (Hafez, 2017). Gymnastics training not only enhances physical capabilities but also contributes to cognitive and emotional growth, as athletes learn to manage challenges and develop resilience (Booth et al., 2015).

Moreover, gymnastics provides an avenue for fostering creativity through movement exploration and expression. As Jae Hwa and Soyeon (2023) note, physical environments that encourage diverse and imaginative activities can significantly enhance creativity (Jae Hwa & Soyeon, 2023). Artistic gymnastics, in particular, offers opportunities for children to experiment with new movement patterns and sequences, promoting cognitive flexibility and originality (Bruijn et al., 2022).

Motivation is a critical determinant of engagement and success in physical education. Self-Determination Theory (SDT) posits that intrinsic motivation—driven by autonomy, competence, and relatedness—is central to sustained participation (Claver et al., 2020). TGfU aligns with SDT principles by providing autonomy-supportive environments, where students are empowered to make decisions and explore strategies during gameplay (Arias et al., 2018; Arias, Diloy-Peña, et al., 2020; Arias et al., 2017; Arias, Harvey, et al., 2020).

Intrinsic motivation is further linked to physical activity outside structured physical education settings. Bagoien et al. (2010) found that self-determined motivation in physical education positively predicted engagement in leisure-time physical activities, highlighting its broader implications for health and well-being. In contrast, motivation derived from external pressures or rewards often leads to short-term compliance rather than long-term commitment (Bagoien et al., 2010).

Creativity, another vital outcome of physical education, is increasingly recognized as a key component of 21st-century skills. Sanjar and Doston (2022) emphasize that creative thinking enhances professional and pedagogical skills, enabling learners to adapt to changing environments (Sanjar & Doston, 2022). Both TGfU and gymnastics provide unique opportunities for fostering creativity—TGfU

through tactical problem-solving and gymnastics through movement exploration (López-Lemus, 2023).

While TGfU and gymnastics training offer distinct pedagogical advantages, their comparative effects on motivation and creativity remain underexplored. Arias et al. (2020) highlighted the potential of a hybrid TGfU-Sport Education model in enhancing self-determined motivation among elementary students, yet the specific mechanisms driving these outcomes warrant further investigation (Arias, Diloy-Peña, et al., 2020). Similarly, research on gymnastics training has predominantly focused on physical outcomes, with limited attention to its cognitive and emotional dimensions (Debien et al., 2022). The present study addresses these gaps by examining the differential impacts of TGfU and gymnastics training on motivation and creativity in children aged 4 to 11 years.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a quasi-experimental design with a pre-test and post-test structure. The target population consisted of girls aged 4 to 11 years, residing in Mashhad, Iran, who had no previous experience in gymnastics. Due to the large size of the population, a convenience sampling method was utilized. A total of 60 participants were selected based on the completion of a personal information questionnaire and obtaining sports insurance. The participants were randomly assigned to two groups based on age: the gymnastics training group and the Teaching Games for Understanding (TGfU) group. Each group included children from two age categories: 4 to 7 years old and 8 to 11 years old.

2.2. Measures

2.2.1. Creativity

Several tools were used for data collection in this study. The Creativity Questionnaire for Children, as assessed by coaches, was one of the primary instruments. This questionnaire is designed to evaluate different aspects of creativity such as fluency, flexibility, originality, and elaboration. Each question was rated using a 3-point scale: 1 for "not at all," 2 for "somewhat," and 3 for "completely." The total score for creativity was calculated by summing the individual scores across all questions and dividing by the number of items. The maximum score obtainable on the test was 90, indicating a high level of creativity, while a score

closer to 30 signified lower creativity (Hamid et al., 2024; Magableh, 2024; Wang et al., 2024).

2.2.2. Motivation

Additionally, the Motivation for Participation in Physical Activities questionnaire, developed by Gill, Gross, and Huddleston (1983), was used. This 30-item questionnaire assesses various motivational factors, including success (achievement), group orientation, fitness, energy release, situational factors, skill improvement, friendship, and fun. The questionnaire employs a 5-point Likert scale, with responses ranging from 1 (completely unimportant) to 5 (completely important). Data derived from this tool were analyzed both by individual subscale and overall score (Arzjani, 2024; Jehanghir et al., 2024; Shahandeh et al., 2024).

2.3. Interventions

2.3.1. Gymnastics Training

The gymnastics training program focused on developing children's basic motor skills, body coordination, balance, and flexibility. The training included a variety of exercises and movements, starting with basic activities like standing in gymnastics position, walking or rhythm exercises, and progressing to more complex movements. Key exercises included the bunny hop, bear crawl, kangaroo jumps, jumping jacks, crab walks, leg stretches, angel jumps, and scissors jumps. Additionally, balance and coordination activities such as the three-point balance, handstands, and cartwheels were incorporated. The protocol included movements that developed core strength, like forward rolls, backward rolls, and various types of jumps and landings, which were fundamental in improving the overall motor control and body awareness of the children. The children also performed activities designed to challenge their balance and flexibility, such as balance exercises, rolling, and different forms of jumps (Baumgarten & Pagnano-Richardson, 2010; Booth et al., 2015; Bressel et al., 2007; Debien et al., 2022; Hafez, 2017; Saleh et al., 2021; Semão et al., 2015).

2.3.2. TGfU

The TGfU program, on the other hand, aimed to enhance cognitive development, creativity, and motivation through structured play activities. The intervention began with physical and mental preparation, starting with warm-up

activities, including stretching and light exercises to prevent injury. After the physical preparation, the focus shifted to improving mental concentration, providing a calm and distraction-free environment to help children focus. Simple movements, such as standing and walking, were introduced initially and repeated until the children mastered them. More complex movements were broken down into smaller, manageable phases to ensure that children could master each stage before progressing. Visual techniques, such as showing videos or live demonstrations of the movements, were used to help children understand and internalize the techniques. Furthermore, balancing and strength exercises were included to support muscle development and stability. Throughout the sessions, children received constructive feedback on their progress, and were encouraged and motivated to achieve small milestones. As children advanced, more complex movements were introduced gradually, ensuring variety to prevent monotony. The children's progress was regularly assessed, and the training program was adjusted based on their development. Short-term and long-term goals were set to maintain their motivation and track improvements (Gustian, 2024; Li, 2024; Pan et al., 2023; Pratama, 2023).

2.4. Data Analysis

Data were analyzed using both descriptive and inferential statistical methods. Descriptive statistics, including means and standard deviations, were calculated for all variables.

Table 1

Descriptive Findings for Motivation and Creativity Scores in Pre-Test and Post-Test for Both Groups

Variable	Group	Pre-Test (Mean \pm SD)	Post-Test (Mean \pm SD)
Motivation	TGfU	4.26 \pm 0.43	5.63 \pm 0.23
	Gymnastics Training	4.14 \pm 0.48	4.39 \pm 0.26
Creativity	TGfU	2.17 \pm 0.27	2.35 \pm 0.35
	Gymnastics Training	2.01 \pm 0.30	2.30 \pm 0.20

The results of the analysis of covariance (ANCOVA) confirmed the significant effect of the intervention on both motivation and creativity. The F-statistic for the group factor was 6.572 ($p = 0.013$) for motivation, and 3510.008 ($p = 0.001$) for creativity. Additionally, the interaction between group and motivation as well as group and creativity was significant, with interaction F-values of 7.333 ($p = 0.009$) for motivation and 27.836 ($p = 0.001$) for creativity (Table 2).

For inferential analysis, the Shapiro-Wilk test was first conducted to assess the normality of the data distribution. If the distribution was found to be normal, a one-way multivariate analysis of covariance (MANCOVA) was employed to compare the effectiveness of the two interventions on motivation and creativity across the different age groups. All analyses were conducted using the SPSS software package.

3. Findings and Results

The descriptive statistics for motivation and creativity scores in the pre-test and post-test for both the gymnastics training and TGfU groups revealed notable differences. For motivation, the TGfU group showed a significant increase in the mean score from 4.26 (SD = 0.43) in the pre-test to 5.63 (SD = 0.23) in the post-test. Similarly, the gymnastics training group demonstrated a modest improvement, with the mean score increasing from 4.14 (SD = 0.48) to 4.39 (SD = 0.26). Regarding creativity, the gymnastics training group exhibited a stronger impact, with the mean score rising from 2.01 (SD = 0.30) in the pre-test to 2.30 (SD = 0.20) in the post-test. In comparison, the TGfU group also showed an improvement, with the mean creativity score increasing from 2.17 (SD = 0.27) to 2.35 (SD = 0.35) in the post-test. These results suggest that while both interventions significantly enhanced motivation and creativity, TGfU was more effective for motivation, whereas gymnastics training had a stronger impact on creativity (Table 1).

For creativity, the ANCOVA results indicated that gymnastics training had a stronger effect on creativity, with a highly significant group effect ($F = 3510.008$, $p = 0.001$) and an interaction between the group and creativity ($F = 27.836$, $p = 0.001$). These results indicate that both interventions led to significant improvements in motivation and creativity, with gymnastics training yielding a greater effect on creativity (Table 2).

Table 2

ANCOVA Results for Motivation and Creativity Scores Between Groups

Variable	Source of Variation	Sum of Squares	df	Mean Square	F	Sig
Motivation	Group	1.744	1	1.744	6.572	0.013
	Motivation	1.793	1	1.793	27.309	0.0001
	Group * Motivation	0.481	1	0.481	7.333	0.009
	Error	3.807	58	0.066		
	Total	7.825	61			
	Corrected Total	8.709	58			
Creativity	Group	549.409	1	549.409	3510.008	0.0001
	Creativity	0.264	1	0.264	35.811	0.0001
	Group * Creativity	0.206	1	0.206	27.836	0.0001
	Error	0.428	58	0.007		
	Total	550.307	61			
	Corrected Total	551.41	59			

4. Discussion and Conclusion

This study compared the effects of gymnastics training and the Teaching Games for Understanding (TGfU) model on motivation and creativity in children aged 4 to 11 years. The findings demonstrated that both interventions led to significant improvements in these outcomes, with notable differences in their impact on motivation and creativity.

The TGfU model significantly enhanced motivation in children, as reflected in the higher mean scores during the post-test. This finding aligns with the principles of Self-Determination Theory (SDT), which emphasize the importance of autonomy, competence, and relatedness in fostering intrinsic motivation (Claver et al., 2020). TGfU creates autonomy-supportive environments, encouraging children to make decisions, solve problems, and engage in meaningful learning experiences (Arias et al., 2018; Arias, Diloy-Peña, et al., 2020; Arias et al., 2017; Arias, Harvey, et al., 2020; Gil-Arias et al., 2021). Studies by Arias et al. (2018) and Pan et al. (2023) support this finding, reporting increased motivation and enjoyment among students participating in TGfU-based activities (Arias et al., 2018; Pan et al., 2023). The interactive and contextually rich nature of TGfU likely contributed to these improvements by making learning engaging and relevant.

Gymnastics training also improved motivation, albeit to a lesser extent than TGfU. The structured and repetitive nature of gymnastics training may have played a role in this more modest increase. While gymnastics emphasizes discipline and skill mastery (Baumgarten & Pagnano-Richardson, 2010), it may lack the immediate feedback and variability inherent in TGfU activities that keep learners motivated.

Bagøien et al. (2010) highlight that activities fostering intrinsic enjoyment are more likely to sustain motivation (Bagøien et al., 2010). However, gymnastics' focus on progression and achievement can still appeal to learners driven by mastery goals (Hafez, 2017).

Regarding creativity, gymnastics training demonstrated a greater impact compared to TGfU. The emphasis on movement exploration, artistic expression, and complex motor skills in gymnastics likely contributed to this outcome (Jae Hwa & Soyeon, 2023). The structured yet flexible framework of gymnastics enables children to experiment with movements, fostering originality and cognitive flexibility (Bruijn et al., 2022). Artistic gymnastics, in particular, encourages children to think creatively by designing routines and solving movement-related challenges (Baumgarten & Pagnano-Richardson, 2010).

While TGfU also promotes creativity through tactical problem-solving and decision-making (Chow et al., 2009), its focus is more on strategic thinking than on physical or artistic creativity. This difference in emphasis might explain why gymnastics training showed a stronger effect on creativity. However, studies by Aryanti et al. (2022) and Pratama (2023) illustrate that TGfU remains a valuable model for promoting creative thinking within game contexts, suggesting that combining TGfU with other creative activities could further enhance outcomes.

These findings are consistent with existing literature demonstrating the complementary benefits of TGfU and gymnastics training. For instance, López-Lemus (2023) suggested that hybridizing TGfU with other pedagogical models can enhance multiple domains, including creativity and motivation (López-Lemus, 2023). Similarly, Arias et al. (2020) showed that TGfU integrated with Sport Education

led to increased self-determined motivation, supporting the idea of combining models for holistic development (Arias, Diloy-Peña, et al., 2020).

This study had several limitations. First, the sample size was limited to 60 participants, which may restrict the generalizability of the findings. Larger, more diverse samples are necessary to confirm these results across different populations and settings. Second, the study focused on short-term effects of the interventions, with no follow-up assessments to determine their long-term impact on motivation and creativity. Future studies should incorporate longitudinal designs to explore sustained effects. Finally, the study relied on self-reported and observational measures of motivation and creativity, which may introduce bias. Including objective measures or triangulating data sources could enhance reliability.

Future research should explore the integration of TGfU and gymnastics training into hybrid models to maximize their respective benefits on motivation and creativity. Investigating the effects of these interventions across various age groups and skill levels could provide deeper insights into their applicability. Furthermore, studies examining the underlying mechanisms, such as neural or cognitive processes, could elucidate how these pedagogical models influence creativity and motivation. Researchers should also evaluate the impact of these interventions in diverse cultural and educational contexts to determine their universal relevance.

Educators and policymakers should consider incorporating both TGfU and gymnastics training into school physical education curricula to leverage their complementary strengths. TGfU's emphasis on engagement and decision-making can make physical education classes more enjoyable and motivating, while gymnastics training can enhance physical skills and foster creativity through movement exploration. To achieve this, schools could implement hybrid programs that integrate the tactical and strategic elements of TGfU with the artistic and motor development aspects of gymnastics. Additionally, providing professional development for teachers to effectively deliver these models is crucial for ensuring their success in practice.

Authors' Contributions

Authors contributed equally to this article.

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.

Acknowledgments

We would like to express our gratitude to all individuals helped us to do the project.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethical 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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