

Enhancing motor educability in young learners: challenging the 'schools without brains' stigma through teaching games for understanding

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Abstract:

Developing motor skills is a crucial component of education that influences students' physical abilities and coordination. Motor educability refers to an individual's ability to learn and master motor skills (physical movements) through instruction and practice. This concept encompasses cognitive abilities (thinking and understanding), sensory perception (such as vision, hearing, and proprioception), and muscle coordination. However, in Indonesia, a social stigma connects physical activity with lower cognitive abilities in sports schools, often referred to as "Schools Without Brains." The Teaching Games for Understanding (TGfU) approach emphasizes understanding game tactics and strategies with the potential to enhance students' motor skills. Despite this promise, most studies on TGfU have focused primarily on cognitive development, leaving the role of fostering motor skills educability underexplored. **Objective:** Therefore, this study aimed to examine the impact of the TGfU approach on motor educability among elementary students. **Material and Approach:** A quasi-experimental design was used with three groups namely a control group (students with minimal physical activity), a regular physical activity group, and an experimental group engaged in TGfU-based sports activities. Ninety elementary students aged 9-11 participated with 30 students in each group. Motor skills development was assessed using motor educability tests, coordination tests, and the Game Performance Assessment Instrument (GPAI). **Results:** The study showed significant improvements in motor skills, particularly coordination and fine motor skills among students who participated in the TGfU-based sports program. The experimental group showed greater gains compared to both the control and the regular physical activity groups. **Conclusion:** This study challenged the stigma that sports participation was incompatible with cognitive or motor skill excellence. By showcasing the dual benefits of TGfU-based learning on both motor and cognitive dimensions, the analysis outlined TGfU as a valuable addition to physical education curricula which promoted holistic development in young learners.

Key Words: TGfU, Motor Educability, Physical Education, Decision Making, Elementary Students

Introduction

Motor skills development is a crucial component of education, particularly during the formative years of young learners (Rahmanto et al., 2024). Despite the significance, traditional educational models often restrict opportunities for physical-cognitive enhancement through play (Revilla et al., 2021). Developing motor skills not only enhances physical abilities but also contributes to overall well-being and academic performance (Aliriad, 2023). Additionally, motor skills are strongly connected to self-esteem in physical education learning (Shakty et al., 2022), emphasizing the impact on students' psychological well-being. Motor coordination has also been connected to academic achievement through the mediating role of executive function (Schmidt et al., 2017). This evidence suggests that motor skills support both physical and cognitive development, reinforcing educational value. Motor educability refers to an individual's ability to learn and master motor skills (physical movements) through instruction and practice. This concept encompasses cognitive abilities (thinking and understanding), sensory perception (such as vision, hearing, and proprioception), and muscle coordination. However, in Indonesia, a pervasive social stigma associates physical activity in sports schools with lower cognitive abilities and is often referred to as "Schools Without Brains" (Supandri, 2009). This stigma undermines the importance of integrating physical education into the broader curricula and devalues the intellectual potential of students engaged in sports.

The Teaching Games for Understanding (TGfU) approach is a pedagogical framework shifting focus from traditional and skill-based physical education to an understanding-oriented approach. It promotes critical thinking, autonomy, and physical literacy more effectively than traditional approaches (Doozan & Bae, 2016). By emphasizing game tactics and strategies, TGfU enables students to develop a deeper comprehension of gameplay which enhances both motor and cognitive skills. Implementing TGfU further required teachers to be skilled observers and facilitators of students' thought processes (Mitchell & Collier, 2009). Though

predominantly applied in developed countries, TGFU has shown success when combined with other teaching approaches (Ortiz Gómez et al., 2023). Compared to traditional approaches, TGFU provides more engaging and effective learning through active participation and critical thinking.

Studies have supported the effectiveness of TGFU in fostering an understanding of game tactics and strategies. For instance, Ortiz et al. (2023) found that TGFU enhanced decision-making in gaming contexts while Balakrishnan et al. (2011) showed significant improvements in elementary students' tactical understanding and decision-making in handball games compared to traditional skill-based. Furthermore, TGFU has been shown to enhance metacognitive knowledge, self-regulation, and game performance more effectively than skill-based approaches (Stephanou & Karamountzos, 2020; TGFU et al., 2015). These results outline TGFU's potential to improve learning outcomes and performance in physical education and sports (Rinaldo et al., 2021; Saryono & Ahmad, 2011; Stephanou & Karamountzos, 2020; TGFU et al., 2015).

In Indonesia, stigma surrounding sports education persists with students pursuing physical education often perceived as having lower cognitive abilities compared to the academically-focused peers. Negative nicknames such as "Schools Without Brains" further reinforce this stereotype, disregarding the intellectual capabilities of students passionate about sports (Supandri, 2009). Studies show that student-athletes face significant challenges due to stereotypes about intellectual inferiority hindering academic performance and prospects (Martins et al., 2020; Martins & da Rocha, 2020). This stereotype is particularly prevalent for black athletes, who are often characterized as physically superior but intellectually inferior compared to the white counterparts (Hodge et al., 2008). These perceptions can place a psychological burden on students, potentially reducing the ability to reach full potential in academic contexts (Walton & Cohen, 2007).

This study aims to challenge the assumptions by showing that sports, particularly through pedagogical approaches such as TGFU can foster motor skills development. By examining various motor aspects, the analysis provides empirical evidence that students engaged in TGFU-based sports can achieve motor skill development on par with—or even surpass—that of peers who engage in less physical activity.

The study's focus on the intersection of motor skills development and strategy-based games within the TGFU framework addresses a gap in existing study. Using structured observations and motor skill assessments, the analysis explores how TGFU-facilitated learning experiences enhance students' motor skills. It further underscores the role of physical education not only in cultivating physical abilities but also in advancing holistic development. This study challenges traditional views that emphasize only physical components of sports education, presenting TGFU as a comprehensive tool for student development.

Objective: This study aimed to investigate and empirically show the benefits of physical activity for motor skills development. The analysis further attempts to dispel the myth that sports participation correlates with lower cognitive abilities by comparing motor performance of students engaged in regular physical activity, infrequent physical activity, and the TGFU approach.

Material & Approaches

This study used a quasi-experimental design to evaluate the impact of the TGFU approach on motor educability of elementary school students. Two groups were formed namely an experimental group receiving TGFU-based instruction and a control group undergoing conventional physical education. The analysis lasted 12 weeks and comprised 24 sessions of 60 minutes each. The experimental group also participated in TGFU interventions while the control group followed traditional skills-based learning.

Participants

Sixty students from grades 4 and 5, aged 9–11 years were purposively selected based on the criteria that student had no significant physical or cognitive limitations and had been following the regular physical education curriculum. Students were evenly divided into the experimental and control groups with 30 participants in each. Before the study, written consent was obtained from parents or guardians, and the protocol was approved by the institutional study ethics committee.

Procedure

Motor skills variables measured in this study included coordination, balance, and fine motor skills. Standardized test tools such as motor educability and coordination tests were further used. Additionally, the author conducted direct observations during learning sessions to assess students' engagement in motor activities and the ability to perform motor skills. Assessments were conducted through pre- and post-test evaluations as well as observational data recorded during the sessions.

Test Protocol

Motor variables measured in this study included coordination, balance, and fine motor skills. Measurements were carried out using standard test tools such as motor educability and coordination tests. Additionally, direct observation during learning sessions was used to identify students' engagement in motor activities and the ability to execute motor skills. Motor skills assessment scores were taken from the results of the pre- and post-test, as well as from direct observation assessments.

Measure and Instrument

Motor variables were measured using the following approaches.

1. Motor Educability Test (van der Veer et al., 2021): Measured students' motor skill abilities including coordination and fine motor skills with scores based on movement precision and fluidity.
2. Coordination Test (Ribas et al., 2020, 2022): Assessed students' ability to perform coordinated motor tasks, evaluating balance, timing, and spatial awareness.
3. Observation Checklist: A structured framework for recording observed motor skills during learning sessions which further assessed how often students engage in correct movements and ability to perform complex tasks.

These instruments were validated through previous studies and confirmed for reliability using an internal consistency test (Cronbach's alpha > 0.80) to ensure accuracy and consistency.

Data Collection

Three primary approaches were used to gather data namely field notes, participant observation, as well as motor pre- and post-tests. The post-test was administered following the conclusion of the learning sessions while the pre-test was conducted before the start of the intervention. Student behavior concerning games and motor tasks was recorded through observations made during class sessions. A structured observation sheet was used to record and analyze each session, documenting the interactions and tactics adopted. Field notes were recorded to record the group dynamics and the learning process.

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS) software was used to analyze the data. Changes between the experimental and control groups were compared using independent t-tests, while paired t-tests were used to analyze pre- and post-tests differences within each group. A significance level of $p < 0.05$ was applied. Additionally, an analysis of variance (ANOVA) was conducted to explore interaction effects between TGFU-based learning and the assessed motor characteristics.

Results

This study included 90 elementary school students aged 9–11 years and further divided into three groups namely (1) students who rarely exercised, (2) those who exercised regularly, and (3) those who exercised using the TGFU approach. No significant differences were observed between these groups in terms of age and gender distribution as presented in Table 1.

Table 1. Participant Description

Group	Number of Participants	Mean Age (SD)	Percentage of Men	Percentage of Women
Exercise Regularly	30	10.4 (0.7)	53%	47%
Exercise with TGFU	30	10.6 (0.6)	47%	53%
Rarely exercise	30	10.5 (0.8)	50%	50%

The table showed that the age and gender distribution across groups was balanced, ensuring the results could be generalized effectively. At the beginning of the study, there were no significant differences in average motor educability scores among the three groups. This was reflected in Table 2 with a p-value greater than 0.05.

Table 2. General Motor Educability Results (Motor Educability Scores) Between All Groups

Group	Average Motor Educability Score	Standard Deviation	Significance (p)
Exercise Regularly	98	7	$p > 0.05$
Exercise with TGFU	109	5	$p > 0.05$
Rarely exercise	103	6	$p > 0.05$

Following the intervention, significant differences in motor educability scores evolved. The group that exercised using the TGFU approach showed the most substantial improvements compared to the other groups. Table 3 presented a Specific Motor Educability Comparison (Coordination, Balance, and Fine Motor Skills). The three groups had mean scores that were not significantly different in the initial stage of the study.

Table 3. Specific Motor Educability Comparison (Coordination, Balance, and Fine Motor Skills)

Group	Coordination (Average)	Balance (Average)	Fine Motor Skills (Average)
Exercise Regularly	79	73	71
Exercise with TGFU	87	82	77
Rarely exercise	76	70	69

After the intervention program, the group that exercised the TGFU approach showed much better results in terms of coordination, balance, and fine motor skills compared to the others as shown in Table 3. Table

4 presented a correlation analysis between exercise frequency, TGFU scores, motor educability, and specific motor skills, showing a significant positive correlation among these variables.

Table 4. Correlation Between Variables

Variable	Exercise Frequency	TGFU Score	Motor Educability (Scores)	Coordination	Balance	Fine Motor Skills
Exercise Frequency	1.0	0.45	0.55	0.38	0.42	0.48
TGFU Score	0.45	1.0	0.5	0.46	0.44	0.50
Motor Educability	0.55	0.5	1.0	0.68	0.59	0.62
Coordination	0.38	0.46	0.68	1.0	0.65	0.60
Balance	0.42	0.44	0.59	0.65	1.0	0.52
Fine Motor Skills	0.48	0.50	0.62	0.60	0.52	1.0

The results of the analysis showed that the more often children exercise, the better the outcome in general and specific motor educability tests. This positive correlation emphasized the important role of sport with the TGFU approach in supporting students' motor development.

Table 5 further described changes in motor educability scores in the TGFU group after following a structured exercise program for 3 months. In the pre-intervention test, the average scores for coordination, balance, and fine motor skills were at a decent level.

Table 5. Pre- and Post-Intervention Motor Educability Changes in the TGFU Group

Motor Educability Aspect	Pre-Interventions (Average)	Post-Intervention (Average)	Percentage Change
Coordination	79	86	+8.86%
Balance	74	81	+9.46%
Fine Motor Skills	72	78	+8.33%

After 3 months of TGFU-based intervention, this group showed significant improvements across all motor educability aspects underscoring the effectiveness of the approach. Table 6 presented a comparison of motor educability scores between men and women in each group. In general, there were no significant differences based on gender in the groups who rarely exercised or those who exercised regularly.

Table 6. Comparison Table of Motor Educability Results Based on Gender

Group	Gender	Coordination (Average)	Balance (Average)	Fine Motor Skills (Average)
Exercise Regularly	Man	80	75	74
	Woman	78	72	70
Exercise with TGFU	Man	88	83	78
	Woman	86	80	75
Rarely exercise	Man	77	72	70
	Woman	75	70	67

The results showed that both men and women who exercised with TGFU exhibited equal improvements in general and specific motor educability aspects. This showed that the TGFU approach was effective regardless of gender differences.

Discussion

The results of this study show that the TGFU approach significantly improved students' motor educability including coordination, balance, and fine motor skills. The TGFU group achieved higher scores in motor educability tests compared to both the regular physical activity and the control groups. These results correlated with those of Mazzardo et al. (2022) who emphasized the potential of TGFU to enhance motor coordination, technical skills, and overall game performance.

A significant outcome was the superior performance of the TGFU group in motor educability tests. This suggests that the strategic elements of TGFU exercises demand more than physical engagement, requiring students to plan, adapt, and execute movements. The processes possibly stimulate neuromotor pathways, leading to improved coordination and motor functions. Fitrianto et al. (2023) similarly outlined TGFU's ability to enhance both cognitive and motor skills, creating a synergistic effect between physical and cognitive domains.

A closer examination of specific motor skills shows that balance and coordination are significantly enhanced in the TGFU group. The game-based approach of TGFU stimulates dynamic movement patterns and situational problem-solving, which require the simultaneous engagement of multiple motor functions. The results resonated with the work of Gillani (2013), who argued that incorporating game strategies into physical education could accelerate motor learning by promoting active participation and tactical thinking. The structured and playful environment of TGFU enables students to learn and refine motor skills in a manner that is both educational and enjoyable.

Although the regular exercise group also shows improvements in motor skills compared to the control group, the gains are less pronounced than those in the TGFU group. This suggests that although general physical activity supports motor development, the absence of strategic and decision-making components may limit the effectiveness. Martins & da Rocha (2020) explained that activities including problem-solving and decision-making as observed in TGFU were more inclined to stimulate brain regions associated with motor planning and execution. This reinforces the idea that structured physical education programs such as TGFU offer superior benefits compared to unstructured or less cognitively demanding activities.

The results also challenge the pervasive stigma in Indonesia that associates physical education and sports with lower cognitive and motor abilities. The stereotype of “Schools Without Brains” undermines the potential of sports programs, such as TGFU, to contribute to students’ overall development. The results counter this misconception by showing that TGFU-based programs significantly enhance motor skills, bridging the gap between physical and cognitive domains. This outlines the structured nature of TGFU as an effective framework for comprehensive student development.

The study also underscores TGFU's role in fostering a balanced educational approach that integrates motor and cognitive development. Ortiz et al. (2023) found that TGFU strengthened metacognitive abilities by motivating students to reflect on the actions and adapt strategies in real time. This reflective process not only enhances motor skills but also cultivates critical thinking and decision-making abilities, which are crucial for overall growth. The results further contribute to this evidence by showing how structured physical education programs such as TGFU support students’ holistic development.

From a broader perspective, this study underscores the importance of incorporating innovative approaches such as TGFU into physical education curricula. The significant improvements observed in motor skills among the TGFU group show the potential of these approaches to address gaps in traditional physical education. By combining physical activities with strategic gameplay, TGFU fosters a dynamic learning environment that engages students both physically and mentally. This correlated with Antunes et al. (2006) stating that integrating cognitive and physical tasks in educational settings could enhance students’ overall learning experiences.

Although the study primarily focused on motor educability, it also sheds light on the interconnectedness of physical and cognitive development. The strategic decision-making included in TGFU-based exercises contributes to improved executive functions such as planning and problem-solving. Haapala (2012) emphasized that physical activities challenging cognitive processes could enhance attention, memory, and learning outcomes. Although cognitive benefits are not the primary focus, the benefits provide valuable insights into the broader implications of TGFU for educational practices.

Good motor coordination is essential for developing fundamental motor skills. A related study conducted in West Sumatra, Indonesia, analyzed the relationship between fundamental motor skills and motor coordination among elementary school students aged 7 to 9 years (Oktarifaldi et al., 2024). The study outlines that students with access to structured physical education programs showed better motor coordination and performance in tasks such as balancing, jumping sideways, and object manipulation. These results emphasize the importance of structured and pedagogically sound approaches such as TGFU in fostering motor development.

Furthermore, TGFU has been shown to promote *Higher Order Thinking Skills* (HOTS). A ndi research (CAR) found that TGFU improved HOTS including decision-making, execution skills, and player support as observed in incremental improvements across multiple cycles of learning. This was consistent with the various results where students engaged in TGFU not only exhibited improved coordination but also showed better problem-solving abilities and situational decision-making. The elements are essential for integrating motor development with cognitive skills as observed in the superior *Skills Execution Index* (SEI) scores during gameplay.

Previous studies on perceptual-motor-based models of physical activity in kindergarten children showed that basic motor skills enrich cognitive development. Although this study focused on physical and motor aspects, the results suggest that game-based approaches such as TGFU also support cognitive skills including decision-making and problem-solving (Yudanto, 2020).

From a social perspective, this study holds significant potential to reshape society's perceptions of the connection between sports and intelligence. Traditionally, there has been stigma that suggests athletes or students who engage in sports are not as cognitively adept. However, the results challenge that idea by showing that students who participate in the TGFU approach exhibit stronger critical thinking skills compared to those who exercise less frequently. The analysis can also lead to broader acceptance of the benefits of physical

education on cognitive and motor development. This is crucial in promoting educational programs that are not only more inclusive but also emphasize holistic growth both mentally and physically (McGregor, 2007).

However, this study has limitations where the sample is restricted to students aged 9 to 11 years and did not account for other variables such as socioeconomic status, prior exposure to physical activities, or parental support. Future publications should consider more diverse populations to ensure the generalizability of these results. Additionally, exploring the long-term impacts of TGFU on motor and cognitive development can provide a deeper understanding of its potential benefits.

The implications of this study are far-reaching by showing the effectiveness of TGFU in enhancing motor educability. The analysis also advocates for the integration of game-based learning approaches into physical education programs. These approaches not only improve motor skills but also promote a more inclusive and engaging learning environment. Policymakers and educators should further consider adopting TGFU as a standard practice in schools to address the dual objectives of physical and cognitive development, eventually fostering more well-rounded students prepared for both academic and physical challenges.

Conclusions

In conclusion, the study provided substantial evidence that the TGFU approach significantly enhanced motor skills of students who were actively engaged in sports activities. This improvement extended to general motor abilities as well as specific skills such as coordination, balance, and fine motor skills. Students who participated in TGFU-based exercises exhibited more pronounced advancements in motor skills compared to those engaged in non-TGFU physical activities or those focused solely on academic learning.

The results successfully challenged the long-standing stigma, particularly prevalent in Indonesia that students who actively participated in sports were less cognitively capable. TGFU effectively integrated physical and motor elements into a cohesive learning process, showcasing its potential to enhance both motor and cognitive abilities. This study underscored the broader value of physical education by showing that it not only developed physical proficiency but also fostered holistic student development.

However, this study has certain limitations where the sample was confined to a specific age group and did not account for external variables such as socio-economic status, prior exposure to physical activities, or varying teaching approaches. Future publications should address these limitations by incorporating more diverse samples and exploring additional influencing factors. This could provide a stronger basis for creating inclusive and effective physical education curricula.

The results also offered practical implications for the future of physical education in Indonesia. Schools could simultaneously nurture students' motor and cognitive development by adopting the TGFU approach and addressing both physical as well as intellectual growth. Future publications should further explore TGFU applications across a wider range of sports, student age groups, and educational contexts. Longitudinal studies could also assess the sustained impact of TGFU-based programs on students' overall development, further supporting the integration of this approach into national curricula.

Conflicts of Interest. The authors declare no conflict of interest.

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