Developing tackling technique in youth soccerThrough AI motion capture and visual feedback

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Résumé

Introduction

The development of human intelligence and motor skills relies on various theoretical frameworks and methodological approaches (Newell, 2020). The use of artificial intelligence (AI) in this process has the potential to enhance outcomes significantly (Baidoo-anu & Ansah, 2023; Robert et al., 2024). Innovations in physical education (PE) facilitate the incorporation of AI into teaching methodologies, providing educators with adaptive tools that create engaging learning experiences for students (Cust et al., 2021; Harry & Sayudin, 2023). Feedback mechanisms correct information and support student learning (Zhou et al., 2021). When utilized in physical education, they enhance motor skills and encourage educators and researchers to explore new models and tools (Treschman et al., 2024).

Methods

Twenty-three male soccer players were recruited from a local soccer team (Age 16.10±0.40 years, body mass 60.70±4.50 kg, stature 181.30±6.00 cm, BMI: 18.61±0.60 kg·m-2). The participants were divided into two groups: an experimental group composed of 12 players having received video feedback of their actions in the form of an animated 3D video, and a control group composed of 11 players having received only verbal feedback. Over a six-week period, participants engaged in a standardized training program consisting of two sessions per week with 90 minutes for each. The program training is taken from the English Football Federation website and aimed to enhance tackling techniques in football, specifically targeting the effective interception of the ball.

Each participant in both groups was required to repeat the tackling action four times. On the fifth repetition, they awaited the coach's signal, which served as a trigger for the camera to capture their performance for subsequent analysis. Participants in the experimental group watched videos of their own tackling actions alongside animated 3D models of those actions on the same screen with the DEEPMOTION software. In contrast, participants in the control group had their actions recorded by the coach but did not see any video footage; instead, they received only verbal feedback from the coach. To assess motivation, both groups completed the Situational Motivation Scale (SIMS) questionnaire (Guay et al., 2000), at the beginning and at the end of the training unit.

*Intervenant

Results

The development of the trunk-leg angle for each player between first (Lesson 1) and last lesson (Lesson 12) was assessed with the one-way analysis of variance (ANOVA). The experimental group showed significant improvements after Lesson 12 with reflecting differences (18.94%; P= 0.01; ES= 0.61) compared to Lesson 1. In contrast, the control group exhibited a smaller improvement in the last lesson of (8.31% P= 0.01, ES=0.61) compared to Lesson 1. In the psychometric dimension of motivation, two-factor ANOVA test established a significant increase in intrinsic motivation for the experimental group compared to the control group. Furthermore, the amotivation dimension decreased for both groups, with a notable difference as (F=9.028, $P < 0.05$).

Discussion

Through a six-week training program consisting of twelve sessions, the study evaluated the effectiveness of a novel pedagogical approach by assessing both the leg-trunk angle during execution and the participants' level of motivation. The immersive nature of these feedback environments promotes early skill optimization and accelerates motor learning. Previous research has highlighted the significance of artificial intelligence (AI) and machine learning algorithms in soccer, particularly in areas such as tactical knowledge (Herold et al., 2019), technical skill development (Rico-González et al., 2022), and adaptation to individual learning styles (Chaeroni et al., 2024). However, few studies have explored the application of AI tools for motor learning, specifically through the use of 3D animated visualization integrated with real movement data. In the present study, AI-driven insights enabled players to view their actions from a 360-degree perspective, providing a detailed and comprehensive understanding of body positioning and movement patterns.

Conclusion

By utilizing innovative AI tools that facilitate the video feedback process, players are encouraged to adopt a proactive approach to technical challenges. Future research should explore the long-term effects of AI-driven feedback systems on athletic development, retention of motor skills, and overall performance in competitive environments.