

Performance Assessment of Novice vs. Advanced Soccer Players in a Gamified Longitudinal Study

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Summary

We developed an immersive soccer drill to analyze movement patterns and quantify performance, revealing significant skill-level differences in positioning, reaction time, and scoring between Novice and Advanced soccer players. This approach offers a holistic and joint assessment of fitness and motor skills. Our findings demonstrate the potential of immersive technology to study player movement and develop specific training programs to enhance overall performance.

Introduction

Assessing soccer performance assessment is essential for talent identification and targeted training. Traditionally, cognitive, fitness, and motor skills are tested separately [1]. This work aimed to investigate whether a custom-designed immersive drill can holistically quantify these skills jointly and evaluate individual soccer performance individually.

Methods

Six Novices and four Advanced soccer players completed 12 sessions of a soccer drill in a circular 360° immersive environment. Each three-minute session required them to score as many dynamically timed goals as possible. The difficulty level was dependent on the current performance of the player.

Gamification elements, such as badges and leaderboards, were integrated into the game, and a personalized, weekly performance report. Performance metrics (e.g., scored goals, difficulty level) were logged, and overhead video recorded the player and ball movements. A custom trained YOLO model extracted the ball and player coordinates [2]. In total, 16 performance and movement features were extracted and statistically analyzed.

Normality for all features was tested (Shapiro–Wilk test). For parametric tests, two-tailed t-test, otherwise Mann–Whitney–U test was used to determine condition differences using the player grouping as between-variable. Bonferroni correction accounted for multiple comparisons. The significance level was set to 0.05 and effect sizes were reported as Hedges' g .

Results and Discussion

On average, Advanced players scored 7.86 more goals than Novice players ($p < .001$, $g = 2.20$) and showed significantly higher difficulty levels (minimum, maximum, mean) (each $p < .001$, $|g| > 0.62$) and more missed goals ($p < .001$, $g = 1.79$). Visual inspections also indicated a clear distinction between Novices and Advanced sessions (Figure 1).

Video analysis showed that Advanced players maintained a more centered position and moved less in peripheral areas ($p < 0.05$, $|g| > 0.80$). While trends indicated higher ball and player speeds, greater distances covered, and more gamification elements achieved by Advanced players, these differences were not significant. The immersive drill effectively highlighted skill-level differences. As expected, Advanced players demonstrated faster gameplay, greater ball control, and higher shot frequency compared to Novice players.

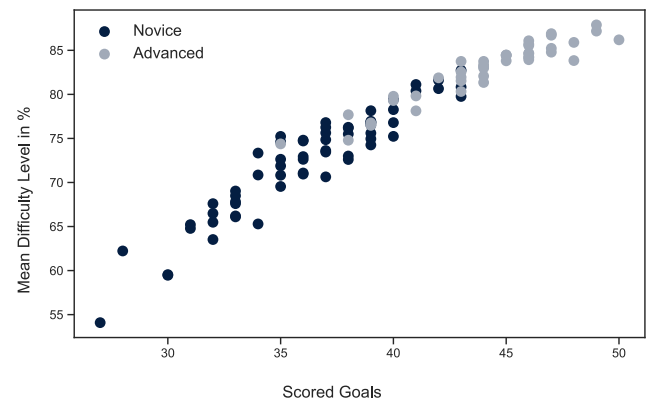


Figure 1: Scatter plot showing the relationship between mean difficulty level in percent and scored goals. The plot reveals a clear separation between Novice and Advanced Players.

Conclusions

An immersive soccer drill was proposed to assess performance jointly across various skills metrics. This analysis focused on scoring and movement patterns, revealing significant differences in score, difficulty levels, reaction times and positioning between Novice and Advanced players. Future analysis of the recorded data will examine finer movement details, such as head turns, while additional recorded electrocardiogram and eye-tracking data will investigate stress and cognitive demand. These features need to be analyzed collectively and in relation to the achieved points per session to get a more granular and holistic picture of soccer performance and the required skills

Acknowledgments

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References

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- [2] Redmon J et al. (2016). *CVPR* 77