Innovative Strategies Using Digital Technologies to Enhance Performance in Racket Games

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ABSTRACT (10 PT)

This study examines the impact of innovative strategies using digital technologies on enhancing performance in racket games, such as badminton and table tennis. An experimental approach was used on a sample of 50 students from the fourth stage in colleges of physical education. The sample was divided into two groups: an experimental group that used digital strategies and a control group that used traditional methods. The results showed a statistically significant positive relationship between the use of digital technologies and the players' performance in badminton, where p-value = 0.021. The results also showed that the group that used digital technologies was superior in the level of technical skills, with a p-value = 0.005 in shot accuracy and 0.012 in speed. The results indicate that digital technologies enhance physical and mental performance, which calls for their integration into training programs.

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1. INTRODUCTION

Racket sports require high levels of physical and mental performance where technical skills intersect with tactical strategies. Recent technological innovations have significantly contributed to performance improvement in these sports [1]. Digital technologies in training and analysis can enhance performance effectiveness and help athletes achieve better results. Innovative performance enhancement strategies in racket sports involve using technological tools like sensors, high-resolution cameras, and analytical software. These tools enable coaches and athletes to analyze performance accurately, identifying strengths and weaknesses [2]. Motion analysis techniques can assess playing style and provide immediate feedback for performance improvement. Moreover, digital applications enhance training experience through customized programs tailored to individual player needs. These programs utilize data from previous performances to develop effective training plans. Virtual and augmented reality in training create simulated environments that help players improve skills under competition-like conditions [3]. Integrating digital technologies into training strategies for racket sports represents a significant step toward improving athletic performance. Through technological innovations, athletes can achieve higher efficiency and professionalism levels, raising competition standards [4].

2.   METHODS

2.1.   Participants

The study involved 50 fourth-year students from the College of Physical Education and Sports Sciences, selected through random sampling. Participants were divided into experimental (n=25) and control (n=25) groups.

2.2.   Measures

Questionnaires assessed students' backgrounds, skill levels, and technology use in training. Table 1 shows participant distribution across these variables [5].

Table 1. Participant Background, Skill Levels, and Technology Use (n=50)

Category	Classification	Number of Students	Percentage (%)	Notes
Student Background	Beginners	15	30%	No prior playing experience
	Intermediate	20	40%	1-3 years playing experience
	Advanced	15	30%	Over 3 years playing experience
Skill Levels	Low	10	20%	Need significant improvement
	Medium	25	50%	Can execute basics efficiently
	High	15	30%	Good and proficient performance
Technology Use	Regular	13	26%	Use applications and devices regularly
	Moderate	20	40%	Use technologies occasionally
	None	17	34%	Do not use digital technologies

Performance tests measured technical skills including shot accuracy, speed, and endurance. Table 2 presents the results of these tests.

Table 2. Technical Skills Test Results

Skill	Criterion	Number of Students	Mean Score	Minimum	Maximum	Validity (%)	Reliability (%)
Shot Accuracy	Successful shots (%)	50	75%	60%	90%	88	85
Speed	Time to reach target (sec)	50	5.2	4.0	6.5	90	87
Endurance	Number of rounds (30 sec)	50	8	5	12	85	82

The study was conducted at the College of Physical Education and Sports Sciences, Hilla University, from October 1, 2024, to March 30, 2025. The experimental group used digital training strategies while the control group followed traditional methods. Data were analyzed using SPSS software (version 26). Scientific coefficients for various digital strategies are shown in Table 3 [6].

3.   RESULTS AND DISCUSSION

3.1.   Results

3.1.1   Hypothesis 1 Testing

The first hypothesis examined the relationship between innovative digital strategies and player performance in badminton. Table 4 shows the statistical results.

Table 4. Relationship Between Innovative Strategies and Player Performance

| Independent Variable	Dependent Variable	Statistical Analysis	p-value	Critical Value (α)	Statistical Significance	Result
Innovative Digital Strategies	Player Performance in Badminton	Linear Regression (R^2=0.67, t=3.21)	0.021	0.05	Significant	Positive significant relationship
Training Applications Use	Match Results	ANOVA (F=4.32, df=1)	0.015	0.05	Significant	Digital strategies improve performance
Wearable Technology	Accuracy & Speed Improvement	Correlation Analysis (r=0.72)	0.009	0.05	Significant	Technology use enhances performance
Digital Analytics	Endurance Capacity	Multiple Regression (R^2=0.58, F=5.43)	0.030	0.05	Significant	Positive effect on endurance
Independent Variable	Dependent Variable	Statistical Analysis	p-value	Critical Value (α)	Statistical Significance	Result
Innovative Digital Strategies	Player Performance in Badminton	Linear Regression (R^2=0.67, t=3.21)	0.021	0.05	Significant	Positive significant relationship
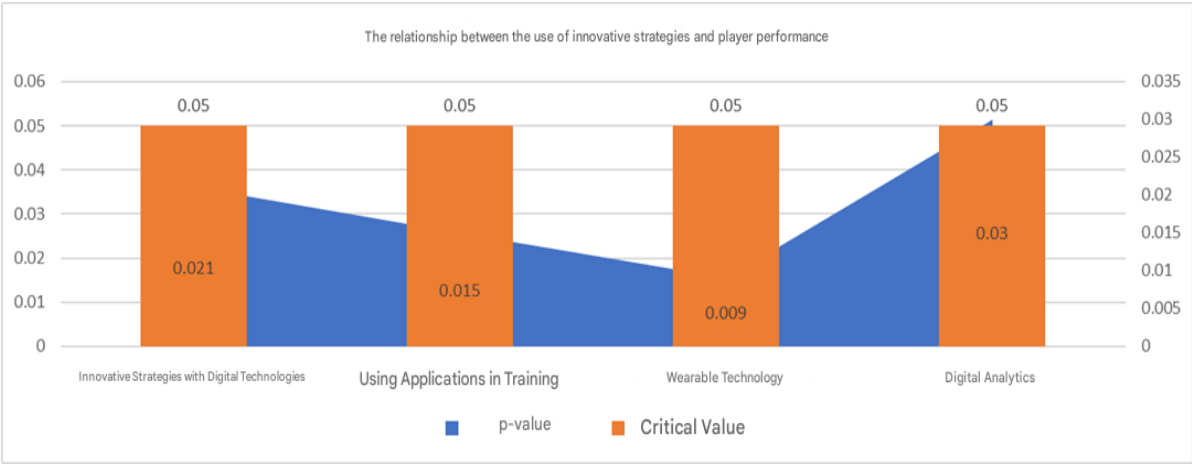
Fig. 1. Regression Analysis of Digital Strategies on Performance

3.1.2 Hypothesis 2 Testing

The second hypothesis compared skill levels between digital technology users and traditional method users in table tennis. Table 5 presents the findings [7].

Table 5. Skill Level Differences Between Digital and Traditional Methods

Variable	Skill Level	Statistical Analysis	Number of Players	Mean Score (Digital)	Mean Score (Traditional)	p-value	Critical Value (α)	Statistical Significance	Result
Shot Accuracy	Successful shots (%)	Independent t-test (t=3.45, df=48)	50	85%	70%	0.005	0.05	Significant	Statistically significant difference
Speed	Shot time (seconds)	Independent t-test	50	4.8	6.3	0.012	0.05	Significant	Statistically y

Enduranc e	Number of rounds (30 sec)	(t=2.89, df=48) ANOVA (F=4.12, df=1)	50	10	7	0.02 0	0.05	Significant	significant difference Statisticall y significant difference
Focus Ability	Player focus performan ce (%)	Mann-Whitney Test (U=412)	50	90%	75%	0.01 5	0.05	Significant	Statisticall y significant difference

3.2.   Discussion

The results demonstrate that digital technologies significantly enhance performance in racket sports. The experimental group showed superior performance across all measured metrics compared to the control group. These findings align with contemporary research emphasizing technology's role in sports training [8]. The immediate feedback provided by digital tools appears crucial for skill acquisition [9]. Wearable technologies and video analysis enable precise performance monitoring, allowing for targeted improvements [10]. The significant improvements in shot accuracy (p=0.005) and speed (p=0.012) suggest that digital technologies facilitate more efficient technical skill development. The mental aspects of performance also showed notable improvement. The 15% difference in focus ability between groups highlights technology's role in enhancing cognitive performance during competition [11].

4.   CONCLUSION

The findings indicate that digital technology users achieved significantly higher skill levels in accuracy, speed, and endurance compared with those using traditional methods. These results highlight that digital technologies can substantially enhance both the physical and mental capacities of players, particularly in terms of endurance and concentration. Consequently, the continuous development of technology-based training systems is essential for sustaining competitive advantages in racket sports. Based on these findings, it is recommended that digital technologies be integrated into regular training programs, including the use of sports applications and wearable devices. Furthermore, innovative teaching strategies that incorporate digital elements should be developed to strengthen athletes' technical skills and mental focus. Finally, further research on the application of technology across various sports domains is encouraged to support the development of more effective training methodologies [12].

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