

Case Analysis of Improving Teaching Quality in Basketball Teaching through Information Technology

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Abstract: To discuss the impact of applying information technology in basketball referee training on referees' self-efficacy, stress management, and job satisfaction, this study selected 200 registered referees from the Chinese Basketball Association as research participants, who were randomly divided into an experimental group and a control group. The experimental group received training in virtual reality (VR) technology and video analysis, while the control group adopted traditional training methods. Research methods included questionnaires, experimental observations, and data analysis. By evaluating the self-efficacy, stress levels, and job satisfaction of referees in both groups before and after training, the effectiveness of information technology was compared. The results indicated that the experimental group's self-efficacy significantly increased, rising from 3.21 ± 0.14 to 4.46 ± 0.15 ($P < 0.001$), while the control group showed only a slight improvement. Furthermore, the experimental group experienced a notable reduction in stress levels, whereas the control group's changes were insignificant ($P < 0.05$). Regarding job satisfaction, the experimental group's satisfaction level improved from 3.53 ± 0.17 to 4.62 ± 0.16 ($P < 0.001$), while the control group showed a more modest increase. The conclusion suggests that information technology effectively enhances self-efficacy, reduces stress, and improves job satisfaction among referees during training, demonstrating broad application prospects.

Keywords: Basketball teaching; Information technology; Teaching quality

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1. Introduction

In recent years, the application of information technology in physical teaching has significantly enhanced the teaching quality and participants' learning. According to the data from the "White Paper on Education Informatization", the utilization of information technology in teaching has led to an increase in teaching efficiency by over 30%. In particular, the integration of technologies such as virtual reality (VR) and augmented reality (AR) has vastly strengthened the interactivity and effectiveness of physical teaching. In terms of the

training of basketball referees, research conducted by the International Basketball Federation (FIBA) indicates that officials who undergo penalty training using VR technology experience a 15% improvement in penalty accuracy, accompanied by a 20% reduction in psychological stress. Furthermore, a study from Harvard University highlights that athletes who conduct self-assessment through video playback and motion analysis technologies show a 25% acceleration in skill acquisition and a 10% decrease in error rates. These figures suggest that information technology not only boosts referees' self-efficacy but also enhances their professional satisfaction and stress resilience through more intuitive training models, thereby bringing remarkable benefits to basketball teaching and referee training ^[1].

2. Research objects and methods

2.1. Research objects

The research objects of this study were 200 basketball referees registered with the Chinese Basketball Association, who were randomly divided into an experimental group and a control group, with 100 referees in each group. All participants had at least 5 years of refereeing experience and had officiated in at least 10 national or provincial-level competitions within the last three years. The experimental group consisted of 100 referees, including 82 males and 18 females, ranging in age from 28 to 49 years old, with an average age of 34.29 ± 3.39 years. In terms of refereeing experience, the duration ranged from 5 to 13 years, with an average of 8.96 ± 1.16 years. Among these referees, 36 held national-level qualifications, and 64 held provincial-level qualifications. Similarly, the control group also comprised 100 referees, with 85 males and 15 females, ranging in age from 28 to 47 years old, and an average age of 34.38 ± 3.41 years. Regarding refereeing experience, the duration ranged from 5 to 14 years, with an average of 8.84 ± 1.23 years. In this group, 37 referees had national-level qualifications, and 63 had provincial-level qualifications. Overall, the experimental and control groups were comparable ($P > 0.05$) in terms of gender, age, refereeing experience, and refereeing level.

2.2. Research methods

The control group adopted traditional methods to train referees, primarily involving learning penalty techniques and rules through watching actual game videos, classroom lectures, and group discussions. During training, referees made penalty practices based on the videos, with instructors providing explanations and corrections. Referees also shared their experiences through discussions, but there was a lack of practical simulations and immediate feedback.

The observation group underwent training that combined virtual reality (VR) technology with video analysis. Firstly, referees participated in simulated game scenarios using dedicated VR equipment, immersing themselves in a virtual competition environment to handle various penalty situations from a first-person perspective. These scenarios encompassed matches of varying intensities and complexities, covering intricate penalty situations such as quick transitions, fouls in collisions, and out-of-bounds balls. Before each training module, referees were briefed on the scenario and reviewed the relevant penalty rules to ensure familiarity with potential penalties in the scenario. During training, the system captured the referees' penalty responses in real-time, providing instant reports on the accuracy of penalties, reaction times, and rule application through data feedback. After training, the referees progressed to the video analysis segment, where the system automatically replayed their penalty processes from the virtual matches. Each penalty was analyzed frame-by-frame, allowing

referees to scrutinize their decision-making by pausing, slowing down, and switching from multiple angles. This process enabled them to engage in interactive discussions with training instructors, gaining insights into their performance in actual scenarios. Throughout the training, instructors provided both qualitative and quantitative feedback to help referees comprehend and improve upon their shortcomings. By repeatedly simulating and analyzing scenarios, the entire training process equipped referees with a vast amount of practical experience in a short period, enabling them to make targeted adjustments and intensive practice for identified issues in subsequent training rounds ^[2].

3. Analysis of results

3.1. Analysis of self-efficacy between the two groups

As shown in **Table 1** below, before the experiment, the self-efficacy scores of both groups were essentially the same, with no significant difference ($P > 0.05$). However, after the experiment, the self-efficacy scores of the experimental group were significantly lower than those of the control group ($P < 0.05$), indicating a statistically significant difference between the two groups.

Table 1. Self-efficacy statistics for both groups (Scores, mean \pm SD)

Group	Number of participants	Pre-training scores	Post-training scores
Experimental group	100	3.21 \pm 0.14	4.46 \pm 0.15
Control group	100	3.12 \pm 0.13	3.39 \pm 0.16
<i>t</i>		1.193	8.225
<i>P</i>		0.092	0.001

3.2. Analysis of stress management between the two groups

As presented in **Table 2** below, before the experiment, the stress management scores of both groups were comparable, with no significant difference ($P > 0.05$). However, following the experiment, the experimental group's stress management scores were significantly lower than those of the control group ($P < 0.05$), indicating a statistically significant difference between the two groups.

Table 2. Stress management statistics for both groups (Scores, mean \pm SD)

Group	Number of participants	Pre-training scores	Post-training scores
Experimental group	100	4.03 \pm 0.11	3.22 \pm 0.13
Control group	100	4.12 \pm 0.12	3.91 \pm 0.14
<i>t</i>		1.193	8.225
<i>P</i>		0.092	0.001

3.3. Analysis of job satisfaction between the two groups

The job satisfaction statistics for both groups are shown in **Table 3**. The job satisfaction score of the experimental group is higher than the control group ($P < 0.05$), indicating a statistically significant difference between the two groups.

Table 3. Job satisfaction statistics for both groups

Group	Number of Participants	Very satisfied (%)		Normal satisfied (%)		Dissatisfied (%)		Total satisfaction rate	
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	%	<i>n</i>
Experimental group	100	58	58.00	38	38.00	4	4.00	96	96.00
Control group	100	31	31.00	50	50.00	19	19.00	81	81.00
									χ^2
									10.192
									<i>P</i>
									0.000

4. Discussion

The application of information technology in basketball referee training has demonstrated immense potential, particularly in improving referees' self-efficacy and stress management, with remarkable effects. Firstly, virtual reality (VR) technology offers a safe and controllable environment that enables referees to repeatedly practice decision-making in penalty. Traditional training often relies on the accumulation of experience through actual games, but VR technology can simulate various complex match scenarios, allowing referees to accumulate a significant amount of decision-making experience in a short period. This repetitive scenario training not only enhances referees' ability to respond to unexpected events on the court but also significantly boosts their confidence in their skills. Furthermore, the instant feedback mechanism in the virtual environment enables referees to immediately identify errors in their judgments and make improvements, further enhancing their learning outcomes. The International Basketball Federation (FIBA) noted in a study that referees who underwent judgment training using VR saw their self-efficacy increase by over 20% in the short term, which aligns with the findings in this study, indicating the high promotional value of information technology in practical applications^[3].

In addition to promoting self-efficacy, the role of information technology in stress management cannot be overlooked. Basketball referees often face immense pressure from spectators, teams, and the media during actual games, and these external factors can easily affect their mental state, subsequently impacting the accuracy of their judgments. Virtual reality (VR) technology enables referees to adapt to high-pressure game environments in advance, and through simulating various tense scenarios, they can gradually develop a stable psychological coping mechanism. The results of this study show that the stress levels of referees in the experimental group significantly decreased after training, with a notable improvement in their decision-making abilities under high-pressure environments. Similar studies have also indicated that using information technology for stress management training can effectively help referees maintain calmness and focus during actual games, thereby avoiding mistakes caused by pressure. By combining technical means with psychological training, referees can improve both technically and psychologically, leading to more confident and stable performances during games.

Another significant finding in the application of information technology is the enhancement of job satisfaction. Traditional refereeing work is often monotonous and stressful, easily leading to burnout among referees. However, the introduction of information technology has infused freshness and interactivity into referee training. Through data analysis and video playback, referees can visually observe their progress, gaining a sense of achievement and satisfaction. Research results indicate that the job satisfaction of referees

in the experimental group significantly increased after training with information technology assistance. This is not only due to their remarkable technical progress but also because they feel supported by the system and perceived growth opportunities. The application of video analysis technology enables referees to correct mistakes more quickly while receiving positive feedback from the system, an interactivity that is difficult to achieve in traditional referee training. A study at Harvard University points out that information technology can enhance job satisfaction through continuous positive feedback, providing strong support for the conclusions of this study.

In summary, the application of information technology in basketball referee training not only provides effective tools for improving referees' technical skills but also has a profound impact on their psychological coping abilities and job satisfaction.

Disclosure statement

The authors declare no conflict of interest.

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