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The Continuation of Tennis Careers and Teaching Dilemmas for Undergraduate Group A Tennis Players in Henan Province

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Abstract: *As the scale and influence of the Henan University Tennis Championship have gradually expanded, the career choices of Group A tennis players after graduation have become increasingly diversified. In order to understand the career continuation status and professional dilemmas of tennis Group A athletes after graduation, this study takes Group A tennis players from higher education institutions in Henan Province who graduated between 2013 and 2022 as the research subjects. A questionnaire survey method (N = 336) was employed to systematically track the current status of their tennis career continuity after graduation and to explore the core difficulties encountered in teaching practice after transitioning to coaching or teaching roles. The findings are as follows: (1) 27.1% (91 individuals) engaged in tennis-related work after graduation, of whom 62 (68.1%) had obtained provincial Group A competition top-eight certificates during their undergraduate studies. Among those pursuing tennis-related careers, the elite group was significantly higher than the non-elite group; (2) within the elite group (top-eight finishers), 46% engaged in coaching, club operations, tennis media and cultural publicity, etc., while 12% of elite Group A tennis players entered tennis teaching through cross-disciplinary pathways, subsequently gaining admission via postgraduate entrance examinations to specialise in tennis training and eventually working as tennis teachers in primary, secondary and tertiary educational institutions after graduation; (3) after transitioning to teaching positions, they primarily faced threefold pedagogical dilemmas: inadequacy in physical movement standardisation, deficiency in technical movement standardisation, and weakness in foundational theoretical knowledge of training. These three dimensions constitute constraining factors that impede the improvement of competitive performance and career development of Group A tennis players, and they are interrelated. On this basis, suggestions are proposed, including embedding teaching competency development modules within the Group A training system, integrating information technology teaching assistance, and refining career transition pathways.*

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1 Introduction

1.1 Background of the Study

Tennis, as a sport that combines both competitive and social attributes, occupies an important position in the higher education sports system in China. Since the joint issuance of the 'Notice on the Trial Recruitment of High-Level Athletes by General Institutions of Higher Education' by the State Education Commission and the State Physical Culture and Sports Commission in 1987, the construction of high-level sports teams in China's ordinary higher education institutions has undergone a development process of nearly forty years (Zhu, 2019). Henan Province, as a populous province and a major exporter of sports talent, has the scale and quality of training for Group A tennis players in its ordinary higher education institutions at the upper-middle level nationwide. However, for a long time, the high-level sports teams in universities have maintained a 'dual-track' training model, with insufficient investment in various resources such as funding, personnel and facilities, leading to a structural contradiction between athletes' academic studies and training.

In sports academia and sports policy research, the focus of the issue of 'athlete career transition' has long been concentrated on high-level athletes, professional athletes or sports special admissions – groups for whom competitive training is the core task, with relatively weak cultural education, and the difficulty of post-retirement transition is a classic topic of academic research (Lidor et al., 2009; Park et al., 2013). However, within China's university sports competition system, there exists a long-neglected group – Group A tennis player.

Group A tennis players are, first and foremost, ordinary students who gain university admission through academic examinations, and only secondarily are they athletes representing their schools in sports competitions. They take the same non-sports major courses as other students at their universities, utilise their spare time for training and competition, and have achieved considerable athletic results in provincial and even national Group A events – those who obtain the top eight places in provincial Group A competitions are awarded certificates by the event organising committee. However, when they attempt to translate their sporting expertise into coaching or teaching careers after graduation, the dilemmas they face are unique.

The establishment of the China University Tennis Association in 1994, and the commendable performance of Chinese professional tennis at the 2008 Beijing Olympics, have objectively

promoted the popularisation and dissemination of tennis among Chinese university students (Yan, 2017), The National University Tennis Championship marks a new phase in the development of college tennis in our country (Song, 2015), and the scale and influence of the Henan University Tennis Championship have gradually expanded, with the number of participants increasing (Li, 2022).

Henan Province, as a major province for university sports competitions, has Group A tennis players who are active in events such as the Henan University Tennis Championship and the Central China Regional Competition of the National University Tennis Championship. However, among these tennis enthusiasts – athletes – graduates who entered university through the ordinary college entrance examination, how many are still engaged in tennis careers after graduation? Can their competitive abilities be transformed into workplace competitiveness? When they pick up rackets to 'teach others', what unique difficulties do they face? These questions have not yet been answered by empirical research.

1.2 Research Objectives

1. To systematically depict the post-graduation career distribution landscape of Group A tennis players from ordinary higher education institutions in Henan Province, and to quantify their tennis career continuation rate.

2. To identify the key competitive performance variables affecting athletes' career continuation, and to analyse the differences in career choices between elite athletes and ordinary athletes.

3. To conduct an in-depth exploration of the core dilemmas encountered in teaching practice by athletes who have transitioned to coaches or teachers, so as to provide empirical evidence for optimising the university tennis talent cultivation system.

1.3 Significance of the Study

Theoretical development: The analytical perspective is shifted from the traditional narrative of "athletes' poor academic performance" to the "dual-identity tension of ordinary university student-athletes", thereby revealing the unique dilemmas faced by Group A athletes – as a special group characterised by "high competitive level plus zero formal education in sports theory" – during their career transition, and expanding the typological scope of research on athlete career transition.

Practical significance: The research findings can provide empirical evidence for the establishment of "teaching competency development modules" within the training system of university Group A sports teams, and offer a career development pathway reference for Group A athletes who intend to pursue tennis teaching careers. In addition, the teaching dilemmas uncovered by the study can serve as a demand-side basis for the design of continuing education programmes for in-service coaches and teachers.

1.4 Operational Definitions

Group A tennis players: Undergraduate students and non-sport-major postgraduate students who are formally admitted through the National Unified Entrance Examination for General Institutions of Higher Education (the ordinary college entrance examination), possess full-time student status at ordinary higher education institutions, and whose admission scores meet the prescribed cut-off points set by provincial admission authorities. They do not fall within the categories of high-level athlete admissions, sport-specific single-enrolment, or separate enrolment for sport training majors (CUSA, 2022).

Career continuation: Refers to engaging in work directly related to tennis after graduation, including tennis coaches, tennis teachers, club operation and management, tennis media and cultural publicity, and similar roles.

Teaching dilemmas: Refers to the perceived competency deficits or adaptive difficulties encountered in teaching design, classroom organisation, technical demonstration, theoretical instruction, and other aspects after transitioning to teaching positions.

2 Literature Review

Research on Athlete Career Transition

Athlete career transition is an important issue in the interdisciplinary field of sports sociology and vocational psychology. According to existing research, athletes' career transitions can be classified into three types: "developmental transition," "structural transition," and "unanticipated transition" (Stambulova et al, 2021). For university Group A athletes, career choices after graduation constitute a typical structural transition, that is, a shift from the dual role of "student-athlete" to a single occupational identity. A substantial body of research has shown that high-level athletes and professional athletes generally have low levels of educational attainment, and that this "educational deficit" serves as a core factor hindering their transition (Park et al., 2013; Sotiriadou et al., 2025).

Domestic scholars have conducted systematic research on the issue of retired athletes transitioning to school coaches. These studies indicate that the current career transition from retired athletes to school coaches faces prominent problems such as misalignment in competency cultivation, misalignment in talent selection, and misalignment in the target population of support (Yin et al, 2023). At the competency level, although retired athletes possess rich practical experience, they have notable deficiencies in teaching ability, educational philosophy, classroom management, and other areas, often resulting in the phenomenon of "being able to do but not being able to teach" (Zheng, 2024). Specifically, retired athletes generally lack theoretical knowledge of pedagogy, psychology, and the like, and are deficient in classroom organisation, teaching strategies, and other abilities required for classroom instruction, making it difficult for them to teach students in accordance with their aptitudes (Chen & Guo, 2025).

In the field of research on the employment of sports graduates in Henan Province, existing studies have pointed out that the number of sports graduates is continuously increasing; although the employment fields have expanded, the overall difficulty of finding employment has increased and competitive pressure has risen (Xu, 2024). Changes in the social environment have led to an increase in the rate of self-initiated interdisciplinary and cross-regional employment among sports graduates, with talent flows constrained by geographical factors and uneven distribution. Apart from a small number of outstanding graduates, the athletic abilities of other graduates vary greatly and develop in an extremely unbalanced manner, resulting in insufficient advantages and obvious shortcomings when applying for physical education teaching positions (Xu, 2024).

Cao et al (2026), from a competency-based perspective, constructed a core competency model for retired athletes transitioning to school coaches and found that "sports professional knowledge and teaching ability" exhibited the largest gap among all competency indicators. Liu (2025), drawing on organisational support theory and career adaptability theory, systematically analysed the practical difficulties faced by retired athletes in competing for school coaching positions, finding that "career development and training" had the greatest influence on success in such competitions (standardised regression coefficient 0.80), followed by "social support" (0.74) and "position availability" (0.69). Zhai et al (2026), from the perspective of the integration of sports and education policy, pointed out that institutional barriers to retired athletes' integration into school physical education teaching include the threshold of teacher qualification certificates, lack of teaching experience, and insufficient on-the-job training.

However, the overwhelming majority of participants in these studies are high-level athletes, physical education school graduates, or retired athletes from professional clubs, and their core assumption is that "athletes have a high level of professional training but poor academic performance." For Group A athletes, who have passed academic standards but have not received formal sports training, this assumption does not apply, and the explanatory power of the existing theoretical frameworks in previous research is also limited.

Research on the Teaching Competencies of Tennis Physical Education Teachers and Coaches.

Teaching competency is a core component of physical education teachers' professional quality. According to Shulman's (1986) classic theory, teacher knowledge can be divided into three dimensions: Subject-Matter Content Knowledge (SMCK), Pedagogical Content Knowledge (PCK), and Curriculum Knowledge. Werthner &Trudel (2006) further pointed out that the knowledge base that coaches need to develop should include coaching knowledge and sport-specific knowledge, among which Pedagogical Content Knowledge (PCK) refers to the "how to teach" knowledge required for coaches to effectively impart sport skills.

In the field of tennis teaching, researchers have paid particular attention to the balance between coaches' technical demonstration ability and their theoretical teaching ability. Studies have shown that tennis coaches in China mainly come from retired athletes and some graduates of physical education institutions who have professional or semi-professional training experience, and that the majority of coaches entered professional sports teams for training from an early age (State Physical Culture Administration, 2020).

Research on the difficulties of athletes transitioning to physical education teachers has pointed out that retired athletes face a role transition from "competitor" to "educator," during which they need long-term active adaptation (Yin et al, 2023). Empirical research on the professional competencies of tennis coaches has shown that Chinese tennis coaches' scores on the "theoretical literacy" dimension are generally lower than those on the "technical demonstration" dimension (Hsueh, 2019). However, for Group A athletes, this pattern may be even more extreme – because they have not received formal physical education training, their "theoretical literacy" is nearly zero, while long-term training has given them a relatively high level of technical demonstration ability; yet this demonstration ability, lacking theoretical support, cannot be effectively transformed into teaching ability.

Group A Athletes: A Research Gap

There is almost no research on the career development of Group A tennis players – a special group admitted through the ordinary college entrance examination. Existing studies either focus on the competitive improvement and retirement placement of high-level athletes, or on

the teacher training of physical education majors. In contrast, Group A athletes – who gain university admission through academic examinations, achieve competitive results through extracurricular training, and attempt to make a living through tennis after graduation – have remained at the periphery of academic attention. It is precisely this research gap that constitutes the academic entry point of the present study.

3 Methodology

3.1 Object of study

This study takes as its research subjects the Group A tennis players who graduated from ordinary higher education institutions in Henan Province (including Zhengzhou University, Zhongyuan University of Technology, Henan Normal University, Henan Polytechnic University, Zhengzhou University of Economics and Business, Sias University, Henan University of Economics and Law, and others) between 2013 and 2022. The inclusion criteria are as follows: during their enrolment, they had represented their university in provincial-level or above Group A tennis competitions; they graduated with a bachelor's or master's degree between January 2013 and December 2022; and they were willing to participate in the study and to complete the questionnaire in full.

3.2 Research Technique

3.2.1 Literature Review Method

A systematic search of the literature on athlete career transition, physical education teaching competency, integration of sports and education, and other related topics was conducted through academic databases including CNKI, Wanfang Data, Web of Science, ProQuest, ScienceDirect, etc., to provide theoretical support for this study.

3.2.2 Questionnaire Survey Method

This study employed a self-designed questionnaire, the Henan Province University Tennis Group A Players' Career Development Questionnaire, which comprised four sections:

Section One: Basic Information. This included gender, age, institution of graduation, year of graduation, academic major, and competitive performance during enrolment (whether they had obtained a provincial Group A competition top-eight placing).

Section Two: Current Career Status. This included current occupational category, engagement in tennis-related work, and years of work experience.

Section Three: Teaching Dilemmas Scale. For respondents who had taken up coaching or teaching positions, a 5-point Likert scale was used to measure their self-assessment across dimensions including physical movement standardisation, technical movement standardisation, foundational theoretical knowledge of training, classroom organisation ability, and ability to understand student psychology.

Section Four: Career Development Needs. This included needs for continuing education and suggestions for university training programmes.

Reliability and Validity Testing: The preliminary version of the questionnaire was evaluated for content validity by five domain experts (three leading coaches of university tennis Group A teams in Henan Province and two specialists in physical education measurement and evaluation). The content validity index was 0.89. The Cronbach's α coefficient for the Teaching Dilemmas Self-Assessment Scale was 0.87, indicating good reliability.

3.2.3 Mathematical Statistical Methods

Data were analysed using SPSS Statistics 27.0. The primary statistical methods employed included descriptive statistics, independent-samples t-tests, chi-square tests (χ^2), one-way analysis of variance (ANOVA), and Pearson correlation analysis. The significance level was set at $\alpha = 0.05$.

3.3 Data Collection

The research team distributed questionnaires through the following channels: (1) the alumni directory of previous Group A athletes provided by the Tennis Branch of the Henan Provincial Student Sports Federation; (2) contact with alumni through the physical education faculties/departments of participating universities; (3) the coach database of the Henan Provincial Tennis Association; and (4) snowball sampling (through referrals of other eligible graduates by respondents already contacted).

A total of 420 questionnaires were distributed via Questionnaire- Star, and 336 valid questionnaires were returned, yielding an effective response rate of 80.0%. The basic characteristics of the sample are shown in Table 1.

Table 1

Basic description of the sample (N=336)

Items	Category	Number	Percent (%)
Gender	Male	198	58.9
	Female	138	41.1
Time of graduation	2013-2015	89	26.5
	2016-2018	102	30.4
	2019-2022	145	43.2
Type of Institution	"Double First-Class" universities	68	20.2
	university	198	58.9
	Higher vocational and technical colleges	70	20.8
Rank	Group A top eight	135	40.2
	No- top eight	201	59.8
Major	Physical education/ Sports training	156	46.4
	Non-PE major	180	53.6

3.4 Research Ethics

This study adhered to the following ethical principles. The principle of informed consent: all participants voluntarily participated after fully understanding the research purpose and procedures. The principle of anonymity: the questionnaire was administered anonymously, and the data were used only for aggregate analysis. The principle of confidentiality: raw data were stored on encrypted devices and were accessible only to the research team. And the principle of non-maleficence: the research content did not involve sensitive personal information and caused no physical or psychological harm to the participants.

4 Finding

4.1 Overall Career Distribution After Graduation

4.1.1 Distribution of Career Categories

The survey results showed that, among the 336 respondents, 91 individuals (27.1%) were engaged in tennis-related work (career continuation) after graduation; 58 individuals (17.3%) were engaged in sports-related but non-tennis-specific work; and 187 individuals (55.7%) were engaged in non-sports-related work.

Table 2

Distribution of occupational categories after graduation (N=336)

Careerl categories	Number	Percent (%)
Tennis-related work	91	27.1
Tennis coach	42	12.5
Tennis teachers	24	7.1
Club operation and management	15	4.5
Tennis media/ Cultural promotion	10	3.0
Sports-related activities other than tennis	58	17.3
Coaches for other projects	22	6.5
Administration of sport	18	5.4
Sports marketing/ Event organization	18	5.4
Non- sports- related	187	55.7
Enterprise employee	98	29.2
Continue advanced studies	45	13.4
Self-employed entrepreneurship	28	8.3
Other	16	4.8

4.1.2 Analysis of Factors Influencing Career Continuation

To examine the effect of competitive performance on career continuation, the respondents were divided into an 'elite group' (those who had obtained a provincial Group A competition top-eight placing during their enrolment, n = 135) and an 'ordinary group' (those who had not obtained a top-eight placing, n = 201), and a chi-square test was conducted.

Table 3

Cross-analysis of Athletic Performance and Career Continuity

Career Continuity Status	Elite group (n=135)	Ordinary group (n=201)	Total	χ^2	p
Tennis-related work	62 (45.9%)	29 (14.4%)	91	37.42	<0.001***
Non-Tennis-related work	73 (54.1%)	172 (85.6%)	245		
Total	135	201	336		

***p<0.001

The results showed that the proportion of elite-group athletes engaged in tennis-related work after graduation (45.9%) was significantly higher than that of the ordinary group (14.4%), $\chi^2(1) = 37.42$, $p < 0.001$.

4.2 Professional Distribution of Elite Group A Tennis Players

Among the 62 elite athletes engaged in tennis-related professions, their specific Career distribution is shown in Table 4.

Table 4

Career distribution of personnel engaged in tennis-related work within the elite group (n=62)

Career Path	Number	Percent (%)
Tennis coach (Club/ Training institution)	22	35.5
Tennis teachers in primary, secondary, and university	15	24.2
Club operation and management	12	19.4
Tennis media/ Cultural promotion	8	12.9
Professional athletes/ Training partners	5	8.1
Total	62	100.0

It is worth noting that, among the 15 elite-group athletes who took up tennis teaching positions in primary, secondary and tertiary educational institutions, 7 (accounting for 11.3% of the total elite-group athletes and 46.7% of those in teaching positions) had achieved career transition through cross-disciplinary postgraduate entrance examinations. The specific pathway was as follows: during their undergraduate studies, they majored in non-sports disciplines such as business administration, English, journalism, etc.; while enrolled, they

participated in tennis competitions as Group A athletes; after graduation, they sat for postgraduate entrance examinations and were admitted to programmes in physical education or sports training with a tennis specialisation; upon obtaining a master's degree, they entered primary, secondary or tertiary institutions to engage in tennis teaching.

4.3 Analysis of Dilemmas in Transitioning to Teaching Positions

4.3.1 Overall Description of Dilemmas

Among the 39 respondents who had taken up coaching or teaching positions (including both elite-group and ordinary-group athletes), the teaching dilemmas were measured. The results showed that "weakness in foundational theoretical knowledge of training" scored the highest (M = 3.82, SD = 0.94), followed by "deficiency in technical movement standardisation" (M = 3.65, SD = 0.88) and "inadequacy in physical movement standardisation" (M = 3.51, SD = 0.91). The mean scores for all three dimensions were above the theoretical midpoint of 3, indicating that athletes who had transitioned to teaching positions generally faced moderate-to-high levels of teaching dilemmas.

Table 5

Descriptive statistics for various dimensions of teaching dilemmas (n=39)

Dimension of dilemmas	Minimum	Max	*M*	*SD*
Inadequacy in physical movement standardisation	1	5	3.51	0.91
Deficiency in technical movement standardisation	2	5	3.65	0.88
Weakness in foundational theoretical knowledge of training	2	5	3.82	0.94
Classroom organisation ability requires improvement	1	5	3.28	0.96
Insufficient capability in understanding student psychology	1	4	2.89	0.87

4.3.2 Differences in Dilemmas Across Different Groups

Further comparisons were made between the elite group and the ordinary group across each dimension of teaching dilemmas, with the results presented in Table 6.

Table 6

Comparison of teaching dilemma differences between groups of different competitive levels (n=39)

Dimension of dilemmas	Elite group (n=28)	Ordinary group (n=11)	*t*	*p*	Cohen's *d*
Inadequacy in physical movement standardisation	3.32	3.91	-1.89	0.067	-0.65
Deficiency in technical movement standardisation	3.43	4.09	-2.15	0.038*	-0.76
Weakness in foundational theoretical knowledge of training	3.61	4.27	-2.03	0.050*	-0.71
Classroom organisation ability requires improvement	3.14	3.55	-1.12	0.272	-0.43
Insufficient capability in understanding student psychology	2.75	3.18	-1.25	0.220	-0.50

*$p<0.05$

The results showed that the ordinary group experienced significantly greater levels of dilemma than the elite group on the dimensions of "deficiency in technical movement standardisation" (t = -2.15, p = 0.038) and "weakness in foundational theoretical knowledge of training" (t = -2.03, p = 0.05). Although the difference on the dimension of "inadequacy in physical movement standardisation" did not reach statistical significance (p = 0.067), the effect size (Cohen's d = -0.65) indicated a moderate practical difference.

4.3.3 Correlation Analysis of Dilemmas

Pearson correlation analysis showed that there were significant positive correlations among the three core dilemma dimensions ($p < 0.01$), with correlation coefficients ranging from 0.52 to 0.68, indicating that these three dilemmas do not exist in isolation but are interrelated and mutually reinforcing.

Table 7

Correlation Matrix of Teaching Dilemma Dimensions (n = 39)

	1	2	3
1. Inadequacy in physical movement standardisation	1.00		
2. Deficiency in technical movement standardisation	0.58**	1.00	
3. Weakness in foundational theoretical knowledge of training	0.52**	0.68**	1.00

**$p<0.01$

4.4 Analysis of the Characteristics of the Cross-disciplinary Transition Group

An in-depth analysis was conducted on the seven elite-group athletes who had transitioned to tennis teaching positions through cross-disciplinary postgraduate entrance examinations. The following characteristics were identified: their undergraduate majors were broadly distributed across disciplines including management, literature, and science; all of them chose physical education and training or physical education teaching (tennis specialisation) at the postgraduate level; their self-rating on the dimension of "weakness in foundational theoretical knowledge of training" (M = 3.29) was significantly lower than that of other individuals in the same teaching positions (M = 3.95, t = -2.34, p = 0.026), indicating that systematic study at the postgraduate level had a significant effect on improving their theoretical literacy.

5 Discussion and Suggestion

5.1 Discussion

The Relationship Between Career Continuation Rate and Competitive Performance

This study found that the tennis career continuation rate among Group A tennis players from higher education institutions in Henan Province was 27.1%, a figure that echoes Xu's (2024) conclusion that the employment situation for tennis graduates is less than optimistic. More importantly, the career continuation rate of the elite group (45.9%) was significantly higher than that of the non-elite group (14.4%), a finding that validates the effectiveness of competitive performance as a "signalling mechanism" in the sports labour market.

From the perspective of human capital theory, the provincial top-eight certificate serves as a "signal of ability," conveying to employers the athletes' technical proficiency and competitive potential. In the recruitment practices for tennis coaches and teachers, employers tend to use athletic performance as the primary screening criterion, which gives elite athletes a significant advantage in the job market. However, this "performance-only" hiring orientation

may also lead to an "illusion of competence" – that is, employers assume that a high level of competitive performance automatically equates to a high level of teaching ability, while overlooking the independent value of teaching competency itself.

The Formation Mechanism of the Threefold Teaching Dilemmas

The threefold teaching dilemmas identified in this study – inadequacy in physical movement standardisation, deficiency in technical movement standardisation, and weakness in foundational theoretical knowledge of training – can be explained from the following three aspects:

The conflict between training and teaching mindsets. The "training mindset" formed through long-term athletic training emphasises individual technical refinement and the pursuit of competitive results, whereas the "teaching mindset" emphasises technical decomposition, progressive sequencing, and differentiated instruction. The transformation between these two mindsets requires systematic educational intervention; however, the current university Group A training system primarily focuses on competitive performance enhancement and lacks institutional arrangements for cultivating teaching competencies (Zheng, 2024).

Difficulty in transforming tacit knowledge into explicit knowledge. The technical movements of elite athletes are often internalised through long-term training into "muscle memory" and "intuitive judgement." This type of tacit knowledge is difficult to express clearly and to transmit systematically through language. Shulman (1986) pointed out that the core of Pedagogical Content Knowledge (PCK) lies in the teacher's ability to transform subject-matter content knowledge into forms that students can understand. What athletes transitioning to teaching roles face is precisely the challenge of converting their personal tacit athletic knowledge into explicit pedagogical knowledge that can be taught, observed, and assessed.

Structural deficiency in theoretical knowledge systems. The training programmes for university Group A athletes are typically centred on skill development, with insufficient attention given to theoretical courses such as sports anatomy, sports physiology, sports psychology, and physical education pedagogy. Although retired athletes possess rich practical experience (Zheng, 2024), they generally lack theoretical knowledge of pedagogy, psychology, and the like, and are deficient in classroom organisation, teaching strategies, and other abilities required for classroom instruction (Chen & Guo, 2025). This "skill-heavy, theory-light" training model directly leads to a weakness in the ability to guide practice with theory after transition.

Implications of Cross-disciplinary Transition Pathways

The finding that 12% of elite-group athletes in this study achieved transition to teaching positions through cross-disciplinary postgraduate entrance examinations provides a new practical pathway for the integration of sports and education. The advantage of this pathway lies in the fact that non-sports major studies at the undergraduate stage broaden knowledge horizons and cultivate diverse thinking abilities. Moreover, systematic physical education training at the postgraduate stage compensates for the deficiency in theoretical knowledge, while advanced studies ensure continued tennis competition participation, further enhancing technical proficiency and industry connections. However, this pathway also has notable limitations, including high time costs, significant financial pressure, and uncertain success rates. Therefore, this pathway is more suitable for a small number of students with clear career plans and supportive family circumstances, and is difficult to promote as a large-scale model.

With regard to career transition difficulties, this study corroborates the problem of "misalignment in competency cultivation" faced by retired athletes transitioning to school coaches (Yin et al, 2023), and concretises it into the threefold teaching dilemmas. Regarding training models, this study supports the effectiveness of "dual-track" career planning approach (East China University of Science and Technology, 2023), while also pointing out the current lag in the development of similar mechanisms in Henan Province's higher education institutions.

5.2 Suggestion

Embedding Teaching Competency Development Modules in the Group A Training System

It is recommended that "teaching competency development modules" be systematically embedded in the tennis Group A training system of higher education institutions in Henan Province. A "teaching simulation" component should be added to routine training, requiring athletes to regularly perform decomposed demonstrations and verbal explanations of the technical movements they have learned, with feedback and evaluation provided by coaches and peers. Through "learning by doing," the transformation from tacit knowledge to explicit knowledge can be facilitated.

Partnerships should be established with surrounding primary and secondary schools to provide senior Group A athletes with tennis teaching internship opportunities 1-2 times per week. In authentic teaching contexts, athletes can experience the role transition from "being taught" to "teaching," accumulating classroom organisation and management experience.

Athletes participating in teaching practice should be required to write structured reflective journals, documenting successful experiences and areas of difficulty in their teaching, and to engage in regular discussions with supervising instructors. Reflective practice is a core mechanism for promoting teacher professional development (Schön, 2017).

Information Technology Teaching Assistance

The research on the application of information technology in tennis teaching mainly focuses on interventions through information technology, utilizing various information platforms (MOOC, Sakai online platform), app (Swingvision, Tennisace, All Tennis, Tennis Master (game-based)), technical methods (flipped classroom, BOPPPS teaching model, PBL blended teaching model, video feedback, virtual simulation technology), and technological devices (VR, AR, EMG, eye-tracking, EEG) to innovate and reform tennis teaching and training.There are three types of online teaching platforms: self-developed platforms by schools, commercial platforms, and open-source teaching platforms, to adapt to the trends of modern education (Ji, 2018). The research subjects mainly focus on college tennis general courses and sports major students.

In the application research of information technology-guided tennis teaching in higher education, numerous scholars have demonstrated relevant research findings. Wei (2021)'s BOPPPS teaching model, Guo & Zhang (2022)'s "MOOC" platform construction, Sun (2023)'s use of the PBL (Problem-Based Learning) combined with blended teaching model, Ji (2018)'s use of the Sakai online teaching platform, Ma (2022)'s use of VR technology, and Yang (2021)'s use of the "flipped classroom" teaching model mainly study the effects on tennis students' performance in tennis skills, theoretical knowledge of tennis, physical fitness, learning attitudes, thinking abilities, expression and communication skills, autonomous learning abilities, and students' recognition of tennis courses.

Input phase: An open-access digital platform should be established for Group A tennis players in Henan Province's higher education institutions, integrating high-quality domestic and international tennis teaching videos, 3D models of technical movements, training plan templates, and other resources. Athletes can engage in self-directed learning and review at any time and from any location.

Monitoring stage: Virtual reality (VR) technology should be utilised to create virtual teaching scenarios, allowing athletes to practise teaching organisation, technical explanation, and error correction guidance in an immersive environment. VR simulations can reduce the costs and risks associated with actual teaching internships, while providing repeatable and controllable training contexts.

Feedback stage: Smartphone applications or wearable devices should be employed to capture and analyse athletes' technical movements in real time, generating visualised feedback reports. This immediate feedback helps athletes gain a deeper understanding of the mechanical principles and standard requirements of technical movements, thereby laying a scientific foundation for future teaching demonstrations.

Improving the Career Transition Support System

Establishing "athlete–coach–teacher" career development profiles. A personal career development profile should be created for each athlete upon university enrolment, documenting their competitive performance, teaching internships, qualification certificates, continuing education, and other relevant information. This profile can serve as evidence of competence and a credibility endorsement for their career transition after graduation.

Establishing a career transition probationary period system. Drawing on the experience of Fujian Province's "intern coach" system (Fujian Provincial Sports Bureau, 2024), partnerships should be formed with primary and secondary schools or clubs to establish a 6- to 12-month career transition probationary period. During this period, basic living allowances and systematic training should be provided to help athletes achieve a smooth role transition.

Building an "alumni mentor" network. Alumni who have successfully transitioned to coaching or teaching roles should be invited to serve as career mentors. Through one-to-one guidance, experience-sharing sessions, teaching observations, and other formats, they can provide graduating athletes with personalised career development advice and psychological support.

5.3 Limitations of the Study

First, this study was conducted exclusively at undergraduate institutions in Henan Province, China, and may therefore not be fully representative of student populations in other regions. Given the diversity across China’s regions and educational systems, the findings may not be applicable elsewhere.

Second, this study employed a questionnaire survey method, with all data derived from participants' self-reports. On the one hand, respondents may consciously or unconsciously overstate their performance when completing the questionnaire, giving rise to a "social desirability effect"; on the other hand, as the questionnaire involved career information from several years after graduation, respondents may have had recall biases regarding details such as past training achievements and career choice motivations, thereby affecting the accuracy of the data.

Third, this study adopted a cross-sectional research design, collecting data at a single point in time. While this design can clearly describe the current status, it is difficult to establish causal relationships among variables or to dynamically capture the complete process of athletes' career development from university training to post-graduation employment. For example, although this study found that elite-group athletes were more inclined to engage in tennis-related work, it remains unclear whether this career choice is driven by the advantage of competitive performance itself, or by personal interest, social capital, or other mediating variables acting together.

Fourth, the assessment of teaching dilemmas in this study relied primarily on participants' subjective self-evaluations. Although the scale demonstrated good reliability and validity, there may be a gap between self-perception and actual teaching performance. For instance, respondents might overestimate or underestimate their own movement standardisation, theoretical mastery, and other aspects in self-ratings. Future research could attempt to introduce more objective assessment methods, such as video analysis of lessons delivered by transitioned coaches or teachers, inviting peer experts to conduct on-site observations and scoring, or collecting feedback evaluations from their students, so as to combine subjective self-assessment with external evaluation and thus form a more comprehensive and accurate judgement of teaching dilemmas.

Future research could adopt a mixed-methods approach, conducting in-depth interviews on the basis of quantitative surveys. Through qualitative inquiry, researchers could gain access to the real working contexts of participants, carefully uncovering the deeper dilemmas they face in teaching practice, their individual coping strategies, and the institutional and cultural factors behind them, thereby compensating for the limitations of quantitative data. In addition, with the rapid advancement of educational informatisation, digital transformation has become an important direction for physical education reform. Future research should pay attention to the pathways and mechanisms through which information technology intervenes in the cultivation of athletes' teaching competencies, particularly how it can assist athletes in enhancing their understanding of technical movements, self-correction abilities, and teaching expression skills during training and instruction.

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Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this study.

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