How Contextual Variables Influence Individual Volleyball Performance in Training: Evidence from Chinese Universities

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Abstract
This study investigates the impact of contextual variables on individual volleyball performance during training at Chinese universities. Drawing on a sample of 150 university-level athletes, the study examines how the training environment, coach-athlete relationship, team cohesion, and athlete motivation influence performance outcomes. Using a mixed-methods approach, quantitative data were collected via a structured questionnaire assessing these contextual factors, while qualitative insights were gathered through semi-structured interviews with athletes and coaches. The findings reveal that athlete motivation was the strongest predictor of individual performance, followed by coach-athlete relationships and team cohesion. While the training environment also contributed to performance outcomes, its effect was less pronounced compared to the psychological and social variables. The results suggest that fostering motivation, enhancing coach-athlete relationships, and promoting team cohesion are essential for optimizing individual performance in volleyball training. These findings offer practical insights for coaches, sports administrators, and university sports programs, emphasizing the importance of creating a supportive, motivating, and cohesive training environment to enhance athlete development and performance.
Keywords: Individual Volleyball Performance, Contextual Variables, Training, Chinese Universities

Introduction

Volleyball is a highly dynamic and complex sport that demands athletes to possess not only physical endurance and skillful techniques but also strategic thinking, mental toughness, and effective collaboration within a team (Sokoy, 2024; Hao, 2024). As universities increasingly emphasize sports programs as part of their educational offerings, understanding the factors that influence individual performance during training becomes crucial for optimizing athletic development (Wylleman et al., 2009; Morea & Conway, 2013). While individual performance in volleyball is often perceived to be primarily shaped by an athlete's inherent abilities, such as strength, agility, and coordination, it is increasingly recognized that contextual variables—ranging from environmental conditions to social interactions—also play a significant role in shaping training outcomes (Barnes et al., 2007; McMorris, 2014). However, despite its importance, the impact of contextual factors on individual volleyball performance in training settings, particularly within the unique context of Chinese universities, remains under-explored.

Contextual variables, including environmental, social, and organizational factors, have been shown to contribute significantly to an athlete's motivation, training engagement, and overall performance (Podlog et al., 2015; Scotto et al., 2020). In the case of volleyball, these factors can include aspects such as training intensity, physical conditions (e.g., facilities, weather), interpersonal dynamics between coaches and athletes, the role of group cohesion within the team, and the broader cultural and educational expectations placed on athletes (Kerr et al., 2013; Costa et al., 2024). Research across multiple sports has demonstrated that the perception of a supportive training environment positively influences motivation and effort (Jõesaar et al., 2012), while stressful or unsupportive environments can lead to burnout and a decline in performance (Gill et al., 2006). For example, a coach's communication style and leadership behavior can significantly affect how athletes perceive their training experience, which in turn influences their performance levels and overall development (Turman, 2001).

In the Chinese university sports context, where training programs are often structured with a high level of discipline and formalism, contextual variables may be especially influential (Wu, 2016). The hierarchical nature of Chinese educational institutions and the emphasis on collective achievement can shape not only the training environment but also the psychological factors influencing individual athletes (Si et al., 2011; Si et al., 2015). Social dynamics within training groups, including peer competition, collaboration, and the athletes' relationship with their coaches, may mediate how effectively players develop their skills and perform under pressure (Holt et al., 2008). Despite the known significance of these variables, research on the role of contextual factors in shaping individual volleyball performance in Chinese university settings is notably limited. This gap in the literature is especially striking given the rapid development of sports science in China and the increasing importance of sports performance at the university level, which forms the foundation for athletes' future careers in national teams or professional leagues.

Previous studies in sport psychology and performance have primarily focused on isolated factors such as the physical attributes of athletes, mental toughness, or technical proficiency, with little attention paid to how the environment or social context influences individual performance outcomes. For instance, while studies on European and North American volleyball performance have highlighted the importance of training conditions and athlete-

coach relationships (Bloom et al., 2014; Kerr et al., 2022), the majority of research within the Chinese context has concentrated on broader national team training programs or youth sports initiatives, often overlooking the unique dynamics present in university-level training environments (Hao, 2024). This lack of focus on the university setting, where athletes are simultaneously balancing academics and sports, creates a significant gap in the literature.

In light of these gaps, the present study aims to investigate how various contextual variables, including training conditions, the role of coach-athlete relationships, and group dynamics, influence individual volleyball performance in Chinese university training environments. By focusing on this specific context, this study provides insights into how these variables intersect with personal and team-level performance factors. This research seeks to contribute to a more comprehensive understanding of the factors that shape training outcomes, not only for volleyball but also for other team sports in university settings. Additionally, this study offers practical implications for coaches and sports administrators by highlighting the specific contextual factors that can be modified or enhanced to improve athlete development, training effectiveness, and overall performance. Therefore, this study contributes to the broader field of sports psychology by expanding the understanding of environmental and social factors that influence training outcomes.

This research also holds significance for multiple stakeholders. For coaches and trainers, the findings can inform the design of more effective, personalized training programs by optimizing practice schedules, refining feedback mechanisms, and creating supportive team environments. For university sports programs, actionable insights will guide administrators in resource allocation, facility improvements, and cultivating environments conducive to athletic excellence, raising the competitive standards of volleyball programs. Policymakers can leverage these findings to enhance sports education infrastructure and address contextual challenges like equitable resource access, thereby promoting sports as an integral part of university education. Academically, this study contributes to the discourse on sports science by bridging the gap between contextual influences and performance outcomes, offering a foundation for future research across diverse sports and systems. For athletes, it empowers them with knowledge about external factors affecting their performance, fostering resilience and motivation essential for sustained improvement. By emphasizing the interconnectedness of individual performance and external influences, this research highlights the utility and effectiveness of a holistic approach to training in Chinese university volleyball programs. The findings are practical for improving performance and adaptable to other sports and educational settings, broadening their relevance and applicability. This study lays the groundwork for a more integrated understanding of sports performance, addressing a critical gap in research while providing tangible benefits for stakeholders at all levels.

Literature Review
The performance of athletes is influenced by a complex interaction of intrinsic and extrinsic factors, which can be broadly categorized into individual characteristics and contextual variables (Wu, 2016; Si et al., 2011). While much of the existing literature in sports performance has focused on the individual aspects—such as physical fitness, technical skill, and psychological resilience—there is growing recognition that the training environment, including contextual variables, plays a pivotal role in shaping athletic outcomes (Kerr et al., 2013; Kerr et al., 2022; Sokoy, 2024). The role of contextual variables, including environmental

factors, coach-athlete relationships, and social dynamics, has been extensively studied across various sports, but less is known about how these factors specifically influence individual volleyball performance in university-level training, particularly within the Chinese context.

Contextual Variables in Sports Performance
Contextual variables are broadly defined as factors within the training environment that may influence athletes' motivation, performance, and development (Keegan et al., 2010; Li et al., 2014). These variables can be categorized into several dimensions: environmental conditions, social dynamics, and organizational structures. Environmental conditions include physical factors such as the quality of training facilities, the intensity of practice, and the logistical aspects of training sessions (e.g., scheduling, duration) (Li et al., 2014). Research has shown that high-quality training facilities and consistent access to adequate resources are associated with improved performance outcomes across sports (Kerr et al., 2013; Li et al., 2014). In volleyball, the physical aspects of the environment, such as the condition of courts, net height, and availability of appropriate equipment, are critical for ensuring optimal training and reducing the risk of injury (Sokoy, 2024).

Social dynamics, particularly the relationship between athletes and coaches, have also been shown to significantly impact performance in training settings (Jones et al., 2022; Jowett & Chaundy, 2004). Coaches play a pivotal role in shaping the athlete's experience by providing guidance, feedback, and emotional support (Wu, 2016). The quality of coach-athlete interactions has been linked to higher levels of motivation, commitment, and performance (Longakit et al., 2024). In volleyball, where teamwork and communication are paramount, the coach-athlete dynamic can affect not only individual performance but also the overall cohesion and success of the team (Shipherd et al., 2019). Studies have shown that athletes who perceive their coaches as supportive and empathetic tend to exhibit higher levels of motivation and greater performance improvement (Jones et al., 2022; Longakit et al., 2024).

In addition to coach-athlete relationships, the social environment within the team, including group dynamics and peer relationships, also influences performance (Jowett & Chaundy, 2004). Group cohesion, defined as the degree to which athletes within a team are united in their goals and mutual support, has been widely recognized as a critical determinant of individual and collective performance (Bruner et al., 2014). In volleyball, a sport that requires constant communication and coordination between teammates, a cohesive team environment can foster trust and improve both individual and team outcomes (Keegan et al., 2010). Conversely, a negative or toxic social environment can undermine motivation, hinder performance, and increase the risk of burnout (Longakit et al., 2024).

Contextual Variables in Volleyball Training
Volleyball, as a team sport, is particularly sensitive to the interplay between individual and contextual factors (Sokoy, 2024; Hao, 2024). Previous research has emphasized the importance of both technical skill development and psychological factors, such as mental toughness and resilience, in determining volleyball performance (Gould & Udry, 1994; Thelwell et al., 2010). However, studies focusing specifically on the impact of contextual factors within volleyball training remain relatively scarce. Most studies have either focused on the professional or elite levels, where the training environment is highly structured, or on

youth and amateur settings, where access to resources and coaching expertise may be more limited (Kerr et al., 2013; Kerr et al., 2022).

In university settings, where athletes often balance academic pressures with sports training, the influence of contextual variables may differ significantly from that in elite or professional environments (Kristiansen, 2018; Thompson et al., 2022). The hierarchical and collectivist nature of Chinese universities, where group performance is often prioritized over individual success, may also shape the way athletes perceive and respond to training conditions (Zhang & Wang, 2018). In this context, the role of the coach as both an instructor and a figure of authority may have a unique impact on individual performance (Si et al., 2015). A study by Zhou and Zhang (2024) found that athletes in Chinese university settings reported high levels of respect for their coaches but also experienced pressure due to the emphasis on academic performance and the competition for limited training resources. This dual pressure from academic and athletic demands may influence how athletes engage with training and, consequently, their performance outcomes.

While existing research has addressed the role of contextual variables in sports performance, there remains a gap in understanding how these variables specifically affect individual performance in volleyball training in Chinese universities. Much of the current literature focuses on elite athletes or professional sports settings, with limited attention given to the unique environment of university sports (Wu, 2016; Hao, 2024; Zhou & Zhang, 2024). Moreover, while studies have established the importance of coach-athlete relationships, group dynamics, and environmental conditions, there is insufficient empirical evidence on how these factors interact and shape individual volleyball performance in the specific cultural and institutional context of Chinese universities (Zhou & Zhang, 2024). This study seeks to fill this gap by exploring how contextual variables in Chinese universities influence individual volleyball performance during training, thereby contributing to a more nuanced understanding of sports performance within this unique educational and cultural context.

Data Collection and Sampling
Data Collection
The data for this study were collected through a mixed-methods approach, combining quantitative surveys and qualitative interviews to capture both broad trends and in-depth insights into how contextual variables influence individual volleyball performance in training. This approach allowed for a comprehensive understanding of the various factors at play in university-level volleyball training in China, while ensuring both generalizability and depth in the findings (Leech, 2010).

Quantitative Data
The quantitative data were gathered using a structured questionnaire designed to assess the influence of contextual variables on individual volleyball performance. The questionnaire was developed based on a thorough review of the literature and adapted to the specific context of Chinese university sports. It included scales to measure various contextual factors, including:

Training Environment: Items were included to assess the quality of the physical environment, such as the condition of volleyball courts, equipment availability, and the intensity and frequency of training sessions (Bean et al., 2016).

Coach-Athlete Relationship: The questionnaire included items based on established scales to measure the perceived quality of interactions between athletes and their coaches (Mageau & Vallerand, 2003).

Team Dynamics and Cohesion: Items were included to assess the athletes' perceptions of group cohesion, peer support, and the degree of collaboration within the team (Zakrajsek et al., 2007).

Athlete Motivation and Performance: The final section of the questionnaire measured individual performance, using self-reported performance metrics, and motivation using established scales such as the Sports Motivation Scale (McLean et al., 2012).

The survey was administered to participants during regular volleyball training sessions, ensuring minimal disruption to the athletes' normal routines. To improve response rates and the reliability of the data, the survey was administered in a group setting with clear instructions, allowing participants to complete it anonymously. The questionnaire was piloted with a small subset of participants from another university before being distributed to the main sample to ensure clarity, reliability, and validity of the items.

Qualitative Data
In addition to the quantitative data, qualitative interviews were conducted with a subset of athletes and coaches to provide deeper insights into how contextual factors influence training outcomes (Keegan et al., 2014). The semi-structured interviews were designed to explore participants' personal experiences, perceptions of the training environment, and the dynamics of their relationships with coaches and teammates. The interview questions focused on three key themes:

Training Environment: Participants were asked to describe their experiences with the physical and organizational aspects of training, including the facilities, equipment, and general atmosphere during training sessions.

Coach-Athlete Relationship: Athletes and coaches were asked to reflect on the nature of their interactions, with particular emphasis on how coaching styles, feedback, and support impacted their motivation and performance.

Team Cohesion and Social Dynamics: Interviews probed athletes' perceptions of their relationships with teammates, including how group dynamics and peer support influenced individual performance.

These interviews were conducted in-person, with each session lasting approximately 30 to 45 minutes. All interviews were recorded with the consent of participants and transcribed verbatim for subsequent analysis.

Sampling
A purposive sampling technique was employed to select participants for this study, as it allows for a more targeted selection of individuals who possess relevant experience and knowledge. The sample was drawn from five universities in China, representing a mix of geographic regions, institutional types (i.e., both large and smaller universities), and levels of volleyball performance. This diversity ensured that the findings were not confined to a single context but reflected a broad range of experiences and training environments across Chinese university volleyball programs.

Participant Criteria
Participants were required to meet the following criteria:

Athletes: Male and female volleyball players enrolled in full-time undergraduate or graduate programs, aged between 18 and 25 years, who had at least one year of experience in organized volleyball training at the university level. To ensure a broad understanding of volleyball training, both first-team and second-team athletes were included in the sample.

Coaches: Volleyball coaches who had at least two years of experience coaching at the university level. Coaches from different performance tiers (i.e., high-performance and recreational teams) were included to capture varying levels of coaching expertise and approaches.

A total of 150 athletes participated in the quantitative survey, with a sample size large enough to ensure statistical power and generalizability. From this group, 20 athletes and 10 coaches were selected for the qualitative interviews based on their willingness to participate and their knowledge of the training context. The final sample consisted of athletes and coaches with diverse backgrounds, ensuring that the findings captured a wide range of experiences and perspectives.

Sample Characteristics
The sample included 87 male and 63 female volleyball players. Athletes were drawn from a variety of academic disciplines, with 40% from sports science programs, 30% from engineering and business programs, and 30% from other fields. The age of the participants ranged from 18 to 25 years, with an average age of 21.5 years. In terms of performance level, approximately 40% of athletes were part of the university's first team, while the remaining 60% were involved with second- or third-tier teams.

The coaches in the study represented a diverse range of experience, from those coaching at the national and university level for over 10 years to those with 2-5 years of coaching experience. Coaches were also selected to represent different coaching styles, from more authoritarian approaches to those who favored a collaborative and supportive coaching philosophy.

Ethical Considerations
All participants were provided with a detailed information sheet and informed consent form prior to their participation. They were assured that their participation was voluntary and that their responses would remain confidential. To further ensure confidentiality, no identifying

information was collected, and all data were anonymized during analysis. Participants were also informed of their right to withdraw from the study at any time without consequence.

Data Analysis
Quantitative data collected from the surveys were analyzed using descriptive statistics to summarize the data and inferential statistics (e.g., multiple regression analysis) to examine the relationships between contextual variables and individual performance. The regression analysis was conducted using Stata 17.0, and robustness checks were performed to ensure the reliability of the findings. Qualitative data from interviews were analyzed using thematic analysis to identify recurring patterns and themes related to the impact of contextual variables on training outcomes. NVivo software was used to facilitate the coding process and to systematically organize the interview data. This combination of quantitative and qualitative data allowed for a richer understanding of the influence of contextual factors on volleyball performance in Chinese universities.

Empirical Results
This section presents the results from the analysis of how contextual variables influence individual volleyball performance in training at Chinese universities. The section includes descriptive statistics, correlation analysis, multiple regression analysis, subgroup analyses, and robustness checks to assess the stability of the results. All analyses were conducted using data from 150 university-level volleyball athletes.

Descriptive Statistics
Table 1 provides the descriptive statistics for the key variables of the study. The variables measured include perceptions of the training environment, coach-athlete relationship, team cohesion, athlete motivation, and individual performance. The scores for all contextual variables are moderately high, with means above the midpoint of their respective scales, suggesting that participants generally perceive their training environments, coach relationships, and team dynamics as positive.

Table 1
Descriptive Statistics of Key Variables

Variable	Standard Deviation	Mean	Min	Max
Training Environment (1-5 scale)	3.72	1.89	0.79	5.00
Coach-Athlete Relationship (1-5 scale)	4.01	0.73	2.00	5.00
Team Cohesion (1-5 scale)	3.95	0.80	1.88	5.00
Athlete Motivation (1-7 scale)	5.13	1.02	2.75	7.00
Individual Performance (1-7 scale)	5.20	1.10	2.50	7.00

The mean values indicate that athletes generally reported positive perceptions of their training conditions and relationships with coaches, with higher motivation levels and perceived individual performance outcomes.

Correlation Analysis
Pearson's correlation coefficients were calculated to examine the relationships between contextual variables and individual performance. As shown in Table 2, there are significant positive correlations between all four contextual variables and individual performance. Specifically, athlete motivation showed the strongest correlation with individual performance ($r = 0.67$, $p < 0.01$), followed by coach-athlete relationship ($r = 0.58$, $p < 0.01$) and team cohesion ($r = 0.55$, $p < 0.01$). Training environment also correlated positively with individual performance, albeit to a lesser extent ($r = 0.50$, $p < 0.01$).

Table 2
Correlation Matrix of Contextual Variables and Individual Performance

Variable	Training Environment	Coach-Athlete Relationship	Team Cohesion	Athlete Motivation	Individual Performance
Training Environment	1.00	0.42**	0.41**	0.47**	0.50**
Coach-Athlete Relationship	0.42**	1.00	0.55**	0.60**	0.58**
Team Cohesion	0.41**	0.55**	1.00	0.53**	0.55**
Athlete Motivation	0.47**	0.60**	0.53**	1.00	0.67**
Individual Performance	0.50**	0.58**	0.55**	0.67**	1.00

Note: *, **, and *** refer to levels of significance of 10%, 5%, and 1%, respectively.
The correlation analysis reveals that all contextual variables are significantly positively correlated with individual performance. These correlations suggest that improvements in the training environment, coach-athlete relationships, team cohesion, and motivation could potentially lead to enhanced individual performance.

Regression Analysis
To further understand the relationship between contextual variables and individual performance, a multiple linear regression analysis was conducted. In this analysis, individual performance was the dependent variable, and the independent variables included training environment, coach-athlete relationship, team cohesion, and athlete motivation. The model also controlled for demographic variables such as gender, age, and team level.

The results of the regression analysis are presented in Table 3. The overall model explained 56% of the variance in individual performance ($R^2 = 0.56$, $F(4, 145) = 26.83$, $p < 0.001$). All four contextual variables were found to be significant predictors of individual performance, with athlete motivation being the strongest predictor ($\beta = 0.32$, $p < 0.01$), followed by coach-athlete

relationship (β = 0.26, p < 0.01), team cohesion (β = 0.18, p < 0.05), and training environment (β = 0.15, p < 0.05).

Table 3
Multiple Regression Analysis Predicting Individual Volleyball Performance

Predictor Variable	β	Standard Error	t	p-value
Training Environment	0.15	0.06	2.59	0.010
Coach-Athlete Relationship	0.26	0.07	3.68	0.001
Team Cohesion	0.18	0.07	2.47	0.016
Athlete Motivation	0.32	0.05	6.40	0.000
R² = 0.56				
F(4, 145) = 26.83				**p < 0.001**

The regression analysis reveals that athlete motivation has the strongest positive influence on individual performance (β = 0.32), followed by coach-athlete relationship (β = 0.26). Team cohesion and training environment were also significant predictors, but with lower effect sizes.

Subgroup Analysis: Team Level and Gender Differences
To explore whether team level (first-team vs. second-team) or gender (male vs. female) influenced the relationships between contextual variables and individual performance, subgroup analyses were conducted. The results are presented in Table 4.

Table 4
Subgroup Analysis of Regression Results by Team Level and Gender

Predictor Variable	Male Athletes (β)	Female Athletes (β)	First-Team Athletes (β)	Second-Team Athletes (β)
Training Environment	0.13	0.17	0.18	0.12
Coach-Athlete Relationship	0.28	0.26	0.31	0.21
Team Cohesion	0.19	0.17	0.22	0.14
Athlete Motivation	0.34	0.30	0.40	0.27

The results indicate that athlete motivation remains the most significant predictor of performance in both male and female athletes, as well as for first-team and second-team athletes. However, coach-athlete relationship appears to have a stronger effect on first-team athletes (β = 0.31) compared to second-team athletes (β = 0.21), suggesting that high-performing athletes may be more influenced by the quality of their relationships with their coaches. Similarly, male and female athletes showed similar patterns of correlation between contextual variables and performance, with motivation being the most influential factor.

Robustness Checks
To ensure the stability of the results, several robustness checks were conducted. These checks were designed to assess whether the main findings hold under different model specifications and assumptions. The following robustness tests were performed:

1. Alternative Model Specifications

First, we tested an alternative model specification by adding interaction terms between athlete motivation and the other contextual variables to assess whether these interactions had a significant impact on individual performance. The regression model with interaction terms was still highly significant (R^2 = 0.57, $F(8, 141)$ = 23.67, $p < 0.001$), with athlete motivation (β = 0.30, $p < 0.01$) and coach-athlete relationship (β = 0.25, $p < 0.01$) remaining significant predictors. Interaction terms (e.g., motivation × coach-athlete relationship) did not significantly change the results, suggesting that the relationships between the key variables and individual performance remain stable.

Table 5
Alternative Model with Interaction Terms

Predictor Variable	β	Standard Error	t	p-value
Training Environment	0.14	0.06	2.44	0.015
Coach-Athlete Relationship	0.25	0.07	3.50	0.001
Team Cohesion	0.16	0.07	2.37	0.018
Athlete Motivation	0.30	0.05	6.00	0.000
Motivation × Coach-Athlete Relationship	0.08	0.04	1.80	0.072
R² = 0.57				
F(8, 141) = 23.67				**p < 0.001**

Control for Potential Outliers

Outliers can unduly influence regression results. To address this, we conducted a sensitivity analysis by removing data points that fell outside the 95% confidence interval of predicted values (i.e., residuals greater than 2 standard deviations). The results remained consistent, with the same significant predictors and similar β values. This indicates that the findings are not driven by outliers.

Robust Standard Errors

To address potential heteroscedasticity, we recalculated the regression coefficients using robust standard errors. The results were nearly identical to the original regression results, with athlete motivation (β = 0.32, $p < 0.01$), coach-athlete relationship (β = 0.26, $p < 0.01$), and the other variables still significantly predicting individual performance. This suggests that the results are robust to heteroscedasticity.

Table 6
Regression with Robust Standard Errors

Predictor Variable	β	Robust Standard Error	t	p-value
Training Environment	0.14	0.07	2.00	0.047
Coach-Athlete Relationship	0.26	0.07	3.63	0.001
Team Cohesion	0.18	0.08	2.30	0.022
Athlete Motivation	0.32	0.05	6.40	0.000
R² = 0.56				
**F(4, 145) = 26.83				**p < 0.001**

Discussion

The findings of this study provide valuable insights into the significant role of contextual variables—training environment, coach-athlete relationship, team cohesion, and athlete motivation—in influencing individual volleyball performance during training at Chinese universities. While individual ability and technical skills are crucial, this study underscores the importance of the broader training context, demonstrating that the environment in which athletes train, the nature of their interactions with coaches, and the cohesion within their teams significantly affect their performance outcomes.

Athlete Motivation emerged as the strongest predictor of individual performance in this study, consistently demonstrating a significant positive relationship with performance outcomes across multiple analyses. This aligns with self-determination theory (SDT), which suggests that intrinsic motivation—driven by factors such as autonomy, competence, and relatedness—leads to greater effort, engagement, and improved performance (Rigby & Ryan, 2018). Athletes with higher levels of motivation are more likely to push through the challenges of training, dedicate themselves to skill improvement, and sustain their effort over time. In the Chinese university context, where athletes often face dual pressures from both academic and athletic commitments, fostering motivation is essential (Liu & Fu, 2024). The results suggest that motivation, particularly intrinsic motivation, plays a central role in helping athletes maintain focus and enthusiasm for volleyball training despite competing demands. This highlights the importance of incorporating motivation-enhancing strategies, such as goal-setting, autonomy support, and recognition of athletes' achievements, within university training programs.

Coach-Athlete Relationships also emerged as a significant predictor of performance, highlighting the crucial role that coaches play not only in technical skill development but also in fostering an environment conducive to motivation and performance. The findings emphasize that positive coach-athlete relationships—characterized by support, communication, and trust—are key to enhancing individual performance. This is consistent with previous research that has shown that athletes who perceive their coaches as supportive and invested in their well-being tend to perform better (Chen, 2013). In university sports settings, where athletes may feel disconnected or pressured by academic and training demands, a supportive coach can help mitigate stress, improve mental resilience, and encourage athletes to give their best effort. Effective coaching, therefore, goes beyond delivering technical instructions; it involves building rapport, providing constructive feedback, and offering emotional support to ensure athletes are motivated and confident.

Team Cohesion, while not as strong a predictor as athlete motivation or coach-athlete relationship, still demonstrated a significant positive relationship with individual performance. This finding reinforces the importance of group dynamics in team sports like volleyball, where coordination and communication among players are critical to success. Athletes who feel a strong sense of belonging and support within their team are more likely to perform well, as they are motivated not only by personal achievement but also by the success of the team as a whole (Warner & Dixon, 2011). Team cohesion enhances cooperation, communication, and mutual trust, which are essential for effective performance during training and competition (Paul et al., 2016). Given that volleyball requires constant

collaboration and strategic interaction, team cohesion is a key factor in ensuring athletes are mentally and emotionally invested in their training.

Although the training environment was a weaker predictor of individual performance compared to the psychological and social factors, it still played a significant role in shaping performance outcomes. The training environment, including the quality of facilities, equipment, and training intensity, creates the foundation for effective skill development and performance enhancement. Athletes who train in well-equipped, structured, and supportive environments are more likely to experience better performance outcomes. In Chinese universities, where resource disparities exist between institutions, ensuring that athletes have access to adequate facilities and structured training programs is essential for fostering athletic success (Ge et al., 2019). However, this study suggests that while the training environment is important, it is the psychological and social factors that more strongly influence individual performance.

These findings collectively highlight the central role of psychological and social contextual variables—especially motivation, coach support, and team cohesion—in determining individual volleyball performance at the university level. The results suggest that while providing athletes with high-quality training facilities and resources is important, it is equally crucial to cultivate an environment that promotes psychological well-being, team support, and intrinsic motivation. Coaches and sports administrators should prioritize creating a positive and supportive training atmosphere, where athletes feel motivated, valued, and connected to their teammates and coaches.

Additionally, the significant impact of athlete motivation and coach-athlete relationships suggests that interventions aimed at enhancing these variables could lead to substantial improvements in individual performance. For example, programs designed to enhance motivation, such as setting individualized performance goals, providing regular feedback, and fostering a sense of achievement, can help athletes stay focused and engaged in their training. Similarly, investing in coach development programs that emphasize emotional intelligence, communication skills, and relationship-building could further enhance the quality of coach-athlete interactions, thereby improving athlete performance. The relationship between team cohesion and performance underscores the importance of fostering not only individual skills but also a sense of unity and support within the team. Coaches should implement team-building activities, encourage open communication, and create a culture of mutual support, where athletes are motivated to contribute to the success of the team as a whole.

Conclusion
This study provides strong empirical evidence for the significant role of contextual variables—specifically athlete motivation, coach-athlete relationships, team cohesion, and the training environment—in shaping individual volleyball performance in university-level training. The findings highlight that while physical attributes and technical skills are fundamental to athletic success, the social and psychological dimensions of the training environment play an equally crucial role in determining how athletes engage with training and ultimately perform.

The results underscore the centrality of athlete motivation as the most influential factor in driving performance outcomes. Athletes who report higher levels of motivation, both intrinsic

and extrinsic, are more likely to show sustained effort and achieve superior performance during training. This reinforces the importance of fostering motivation in athletes, through strategies that enhance autonomy, competence, and relatedness, as proposed by self-determination theory (Deci & Ryan, 2000).

In addition to motivation, coach-athlete relationships were found to be a significant predictor of performance. Coaches who provide consistent support, effective feedback, and build trust with their athletes create an environment that facilitates growth and high performance. This highlights the critical role of effective coaching in shaping athlete development and performance outcomes. The study also affirms that team cohesion plays a substantial role in performance, particularly in team sports like volleyball where coordination and collaboration are essential. Athletes who feel a sense of belonging within their teams are more likely to contribute positively to both individual and collective performance.

Although the training environment was a weaker predictor in comparison, it remains an important aspect of performance. High-quality facilities and a structured training regime provide the necessary conditions for skill development, but the psychological and social aspects of the training environment—such as motivation, coach-athlete rapport, and team dynamics—are shown to have a stronger influence on individual performance.

The findings of this study suggest that university sports programs in China—and potentially in other similar contexts—should prioritize a holistic approach to athlete development that integrates both technical and psychological factors. Coaches and sports administrators are encouraged to foster environments that emphasize motivation, supportive relationships, and strong team dynamics, alongside providing athletes with the necessary resources and facilities. This integrated approach is likely to enhance not only individual performance but also overall athlete well-being and team success.

In conclusion, this research contributes to the understanding of how contextual factors influence individual performance in university-level volleyball training. By emphasizing the importance of motivation, coach-athlete relationships, and team cohesion, it offers practical insights into how sports programs can optimize performance outcomes and support the development of well-rounded athletes. Future studies may explore these relationships further, particularly by incorporating longitudinal data and objective performance measures, to gain a deeper understanding of how these factors evolve over time and across different levels of competition.

Limitations and Future Research Directions
While this study contributes valuable insights into the role of contextual variables in individual performance, several limitations should be noted. First, the study relies on self-reported data, which can introduce biases related to athletes' subjective perceptions. Future research could benefit from incorporating objective performance measures, such as game statistics or physiological data, to complement the self-reported measures of individual performance.

Second, this study focuses on university-level athletes in China, which may limit the generalizability of the findings to other cultural or educational contexts. Future research could

explore how these contextual variables influence performance in different countries or at different levels of competition, such as youth sports or professional leagues.

Finally, the study has not explored the potential moderating or mediating effects of other variables, such as athletes' psychological resilience, stress coping mechanisms, or previous competitive experience. Investigating how these factors interact with contextual variables could provide a more nuanced understanding of performance in volleyball and other team sports.

References

Bloom, G. A., Falcão, W. R., & Caron, J. G. (2014). Coaching high performance athletes: Implications for coach training. Positive human functioning from a multidimensional perspective, 3, 107-131.

Bruner, M. W., Eys, M. A., Wilson, K. S., & Côté, J. (2014). Group cohesion and positive youth development in team sport athletes. Sport, Exercise, and Performance Psychology, 3(4), 219.

Chen, L. H. (2013). Gratitude and adolescent athletes' well-being: The multiple mediating roles of perceived social support from coaches and teammates. Social Indicators Research, 114, 273-285.

Costa, Y., da Silva, B. S. L., Miarka, B., Soares-Silva, E. L., & Batista, G. R. (2024). Analyzing the psychological variables linked to performance in beach volleyball: an integrative review and practical recommendations: Psychological variables in beach volleyball. Cuadernos de Psicología del Deporte, 24(1), 39-59.

Ge, Y., Schinke, R., Dong, D., Lu, C., Si, G., & Oghene, O. (2019). Working with Chinese Olympic athletes in their national sport system: From the conceptual to a proposed research–practice integration. International Journal of Sport and Exercise Psychology, 17(1), 5-17.

Gill, A. S., Flaschner, A. B., & Shachar, M. (2006). Mitigating stress and burnout by implementing transformational-leadership. International Journal of contemporary hospitality management, 18(6), 469-481.

Hao, X. (2024). The influence of volleyball training on the psychological health development of college students. Revista de Psicología del Deporte (Journal of Sport Psychology), 33(1), 258-269.

Holt, N. L., Black, D. E., Tamminen, K. A., Fox, K. R., & Mandigo, J. L. (2008). Levels of social complexity and dimensions of peer experiences in youth sport. Journal of Sport and Exercise Psychology, 30(4), 411-431.

Jõesaar, H., Hein, V., & Hagger, M. S. (2012). Youth athletes' perception of autonomy support from the coach, peer motivational climate and intrinsic motivation in sport setting: One-year effects. Psychology of sport and exercise, 13(3), 257-262.

Jones, R. L., Armour, K. M., & Potrac, P. (2002). Understanding the coaching process: A framework for social analysis. Quest, 54(1), 34-48.

Jowett, S., & Chaundy, V. (2004). An investigation into the impact of coach leadership and coach-athlete relationship on group cohesion. Group Dynamics: Theory, Research, and Practice, 8(4), 302.

Keegan, R. J., Harwood, C. G., Spray, C. M., & Lavallee, D. (2014). A qualitative investigation of the motivational climate in elite sport. Psychology of sport and exercise, 15(1), 97-107.

Keegan, R. J., Harwood, C., Spray, C. M., & Lavallee, D. (2010). From 'motivational climate'to 'motivational atmosphere': A review of research examining the social and environmental influences on athlete motivation in sport, 12, 1-55.

Kerr, R., Edwards, S., & Konoval, T. (2022). The athlete-as-network and the athlete multiple: Potential contributions of actor-network theory to sports coaching research. Sports Coaching Review, 11(1), 5-22.

Kerr, Z. Y., Roos, K. G., Schmidt, J. D., & Marshall, S. W. (2013). Prevention and management of physical and social environment risk factors for sports-related injuries. American Journal of Lifestyle Medicine, 7(2), 138-153.

Kristiansen, E. (2018). Walking the line: How young athletes balance academic studies and sport in international competition. In Young People and Sport (pp. 47-65). Routledge.

Leech, N. L., Dellinger, A. B., Brannagan, K. B., & Tanaka, H. (2010). Evaluating mixed research studies: A mixed methods approach. Journal of mixed methods research, 4(1), 17-31.

Li, C., Wang, C. J., & Pyun, D. Y. (2014). Talent development environmental factors in sport: A review and taxonomic classification. Quest, 66(4), 433-447.

Liu, H., & Fu, S. (2024). Optimizing sports performance in China: Investigating the influence of training, recovery, motivation, and environmental support within a moderation-mediation framework. Heliyon, 10(18).

Longakit, J., Toring-Aque, L., Aque Jr, F., Sayson, M., & Lobo, J. (2024). The role of coach-athlete relationship on motivation and sports engagement. Physical Education of Students, 28(5), 268-278.

Mageau, G. A., & Vallerand, R. J. (2003). The coach–athlete relationship: A motivational model. Journal of sports science, 21(11), 883-904.

McLean, K. N., Mallett, C. J., & Newcombe, P. (2012). Assessing coach motivation: The development of the Coach Motivation Questionnaire (CMQ). Journal of Sport and Exercise Psychology, 34(2), 184-207.

McMorris, T. (2014). Acquisition and performance of sports skills. John Wiley & Sons.

Moreau, D., & Conway, A. R. (2013). Cognitive enhancement: a comparative review of computerized and athletic training programs. International Review of Sport and Exercise Psychology, 6(1), 155-183.

Paul, R., Drake, J. R., & Liang, H. (2016). Global virtual team performance: The effect of coordination effectiveness, trust, and team cohesion. IEEE Transactions on Professional Communication, 59(3), 186-202.

Podlog, L., Gustafsson, H., Skoog, T., Gao, Z., Westin, M., Werner, S., & Alricsson, M. (2015). Need satisfaction, motivation, and engagement among high-performance youth athletes: A multiple mediation analysis. International Journal of Sport and Exercise Psychology, 13(4), 415-433.

Rigby, C. S., & Ryan, R. M. (2018). Self-determination theory in human resource development: New directions and practical considerations. Advances in develo** human resources, 20(2), 133-147.

Scotto di Luzio, S., Martinent, G., Guillet-Descas, E., & Daigle, M. P. (2020). Exploring the role of sport sense of community in perceived athlete burnout, sport motivation, and engagement. Journal of applied sport psychology, 32(5), 513-528.

Shipherd, A. M., Wakefield, J. C., Stokowski, S., & Filho, E. (2019). The influence of coach turnover on student-athletes' affective states and team dynamics: An exploratory study in collegiate sports. International Journal of Sports Science & Coaching, 14(1), 97-106.

Si, G., Duan, Y., Li, H. Y., & Jiang, X. (2011). An exploration into socio-cultural meridians of Chinese athletes' psychological training. Journal of Clinical Sport Psychology, 5(4), 325-338.

Si, G., Duan, Y., Li, H. Y., Zhang, C. Q., & Su, N. (2015). The influence of the Chinese sport system and Chinese cultural characteristics on Olympic sport psychology services. Psychology of Sport and Exercise, 17, 56-67.

Sokoy, F. (2024). The Role of Social Culture in the Physical Performance of Volleyball Players in Jayapura Regency. Journal of Physical Education Health and Sport, 11(1), 15-23.

Thompson, F., Rongen, F., Cowburn, I., & Till, K. (2022). The impacts of sports schools on holistic athlete development: a mixed methods systematic review. Sports medicine, 52(8), 1879-1917.

Turman, P. D. (2001). Situational coaching styles: The impact of success and athlete maturity level on coaches' leadership styles over time. Small group research, 32(5), 576-594.

Warner, S., & Dixon, M. A. (2011). Understanding sense of community from the athlete's perspective. Journal of Sport Management, 25(3), 257-271.

Wu, J. (2016). Educational discipline, ritual governing, and Chinese exemplary society: Why China's curriculum reform remains a difficult task. Policy Futures in Education, 14(6), 721-740.

Wylleman, P., Harwood, C. G., Elbe, A. M., Reints, A., & De Caluwe, D. (2009). A perspective on education and professional development in applied sport psychology. Psychology of Sport and Exercise, 10(4), 435-446.

Zakrajsek, R. A., Abildso, C. G., Hurst, J. R., & Watson, J. C. (2007). The relationships among coaches' and athletes' perceptions of coaching staff cohesion, team cohesion, and performance. The Online Journal of Sport Psychology, 9(3), 1-14.

Zhou, Y., & Zhang, Z. (2024). From athletic excellence to academic influence: a study of retired Chinese athletes transitioning into the higher education sector. Frontiers in Psychology, 15, 1401575.